Simple Poverty Scorecard® Tool
Sierra Leone

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Dis pepa ɛn wan **ap fɔ gɛda data** de fɔ Krio na **scorocs.com**
This document and a **data-collection app** are in English at **scorocs.com**

The Scorocs Simple Poverty Scorecard-brand poverty-assessment tool is a low-cost, transparent way for pro-poor programs in Sierra Leone to get to know their participants better so as to prove and improve their social performance. Responses to the scorecard's nine questions can be used to:

- Assess poverty rates and numbers of poor people among in-coming participants
- Track changes in poverty among on-going participants
- Segment participants for differentiated treatment based on poverty

Version note

This new scorecard is based on data from **2018**. It replaces an old scorecard based on data from **2003/4**. Because Sierra Leone changed its definition of *poverty* in 2018, it is not possible to estimate changes with a baseline from the old scorecard and a follow-up from the new scorecard.

Acknowledgement

Data are from **Statistics Sierra Leone**.

Scorocs® Simple Poverty Scorecard® Poverty Assessment Tool

			Full name	Identifier
Interview ID:				
Interview date:		Participant of record:		
Country:	SLE	Service agent:		
Scorecard:	002	Service point:		
Sampling weight:		Number of household members:		

Question	Response	Points
1. In which district does the household live? (*record without asking*)	A. Kenema, or Pujehun	0
	B. Tonkolili, or Bombali	5
	C. Freetown (western area, rural), Port Loko, Bo, Moyamba, Karene, Falaba, or Koinadugu	9
	D. Kono, or Bonthe	13
	E. Freetown	15
	F. Kailahun, or Kambia	18
2. How many members does the household have? (*from **Back-page Worksheet***)	A. Nine or more	0
	B. Eight	5
	C. Seven	8
	D. Six	12
	E. Five	19
	F. Four	26
	G. Three	30
	H. One or two	41
3. What is the main construction material of the outside walls of the household's dwelling? (*By observation; ask if in doubt*)	A. Wattle and mud, or mud bricks	0
	B. Mud bricks plastered with cement, or other	3
	C. Cement blocks, wooden boards, or corrugated iron/zinc sheets	7
4. Does the household cook mostly with charcoal, cooking gas, or electricity?	A. No	0
	B. Yes	2
5. What kind of toilet does the household use?	A. None (bush, field, waterside), hanging toilet/hanging latrine, or composting toilet	0
	B. Pit latrine without slab (open pit) or with slab, ventilated improved pit latrine (VIP), flush (to pit latrine, septic tank, or piped sewer system)	3
6. How many mattresses does the household have?	A. None	0
	B. One	1
	C. Two	3
	D. Three or more	5
7. Does the household have a television?	A. No	0
	B. Yes	9
8. How many mobile phones does the household have?	A. None	0
	B. One	7
	C. Two or more	11
9. In the past 12 months, did the household grow rice or cassava for its own consumption?	A. Yes	0
	B. No	4

Score:

Back-page Worksheet

Fill out the scorecard header first. Include the interview's unique identifier (if known), the interview date, and the sampling weight of the participating household (if known). Then record the full name and unique identification number for the participant of record (who may differ from the respondent), for the service agent of the participant of record (who may differ from you the enumerator), and for the service point that the participant of record uses (if any and if known). Without asking the respondent, circle the response to the first scorecard question based on the district where the household lives.

Then read to the respondent: *Please tell me the first name (or nickname) of each household member, starting with the head and his/her spouse/conjugal partner (if there is one). A* household *is one person or a group of people (regardless of blood or marital relationship) who usually live, sleep, and eat in the same dwelling (even if they are temporarily absent on the day of the interview) and who recognize one member of the household as their head. A household may occupy a whole building, part of a building, or many buildings.*

Write down the name (or nickname) of each member, first for the head and then for his/her spouse (if there is one). Record the sex of the head and of his/her spouse (if there is one).

After recording all household members, write down the exact number of members in the scorecard header next to "Number of household members". Then circle the response to the second scorecard question.

If you can, record the response to the third question about the main construction material of the outside walls of the dwelling based on your own observation. If you are not completely certain, then ask the question of the respondent.

Read aloud the remaining six questions. Always apply the instructions in the **Interview Guide**.

First name or nickname?	Head or spouse of head?
1.	Head (male) Head (female)
2.	Wife (eldest) of male head Husband of female head Other member
3.	Other
4.	Other
5.	Other
6.	Other
7.	Other
8.	Other
9.	Other
10.	Other
11.	Other
12.	Other
13.	Other
14.	Other
15.	Other
# Household members:	—

Figure 1: Conversion of scores to poverty likelihoods

	Poverty likelihood (%)														
	National lines				Intl. 2011 PPP lines				Percentile-based lines						
Score	Food	100%	150%	200%	$1.90	$3.20	$5.50	$21.70	10th	20th	40th	50th	60th	80th	90th
0–13	55.3	96.4	99.9	99.9	92.4	99.9	99.9	100.0	47.2	71.8	91.2	95.4	99.3	99.9	99.9
14–18	42.9	96.1	99.5	99.7	89.2	99.2	99.9	100.0	34.5	57.4	87.4	92.5	96.4	99.5	99.8
19–22	31.4	95.5	99.4	99.7	85.1	99.1	99.9	100.0	25.7	50.2	82.7	91.5	95.8	99.5	99.8
23–25	26.7	94.9	99.4	99.7	85.1	99.1	99.9	100.0	22.1	47.7	82.7	91.5	95.8	99.5	99.8
26–28	17.3	89.7	99.4	99.7	70.9	98.6	99.9	100.0	13.5	31.6	66.4	84.6	91.0	99.5	99.8
29–30	13.6	82.8	98.9	99.7	62.4	97.3	99.9	100.0	10.6	24.9	57.1	75.4	85.1	98.6	99.7
31–32	11.5	79.5	98.2	99.7	61.7	96.7	99.9	100.0	9.1	20.0	56.4	73.2	82.5	97.9	99.7
33–35	8.5	73.7	95.7	99.1	50.6	94.9	99.9	100.0	5.1	15.6	47.7	62.0	79.1	95.8	99.6
36–38	6.0	65.6	92.3	98.0	41.6	89.9	99.9	100.0	3.7	11.9	38.3	55.5	72.0	92.3	99.3
39–40	3.6	63.0	90.9	95.9	36.2	87.5	98.5	100.0	2.6	7.3	31.3	51.9	69.4	92.3	96.2
41–43	3.6	49.5	88.6	95.4	30.8	83.1	97.5	100.0	2.6	7.3	24.0	44.1	59.1	88.4	96.1
44–46	2.7	44.1	84.5	95.1	21.0	79.5	97.0	100.0	1.7	4.4	17.1	29.6	49.9	86.6	95.9
47–49	1.9	33.3	79.8	94.8	16.5	72.8	96.8	100.0	1.7	2.3	13.6	22.5	40.8	80.9	95.6
50–52	1.9	27.4	70.3	90.9	11.9	61.2	96.5	100.0	1.7	2.3	9.3	16.0	26.8	74.7	91.5
53–55	1.9	21.0	62.5	84.4	7.5	52.3	91.4	100.0	1.7	2.3	5.1	11.8	23.7	61.9	84.3
56–58	0.6	14.5	57.4	80.4	5.2	43.8	89.3	100.0	0.5	0.6	2.5	7.4	16.7	53.8	80.8
59–64	0.1	5.2	40.4	71.2	1.0	28.7	81.5	100.0	0.0	0.1	0.8	2.0	5.5	37.7	71.9
65–74	0.0	2.3	20.0	45.8	0.2	10.4	58.2	99.6	0.0	0.0	0.2	0.3	2.0	14.8	47.7
75–100	0.0	0.1	7.4	18.3	0.0	0.9	23.3	94.7	0.0	0.0	0.0	0.0	0.0	2.9	16.2

Figure 2: Estimation errors in head-count poverty rates in a time period, along with margins of error and the α factor for finding margins of error and sample sizes

	Poverty lines														
	National lines				Intl. 2011 PPP lines				Percentile-based lines						
	Food	100%	150%	200%	$1.90	$3.20	$5.50	$21.70	10th	20th	40th	50th	60th	80th	90th
Estimation error	+1.2	−3.1	−2.7	−0.5	−6.3	−2.8	−0.6	0.0	+1.3	+1.3	−6.8	−4.1	−3.0	−2.3	−0.4
Margin of error	1.8	3.1	1.6	1.1	3.7	1.9	0.7	0.1	1.6	2.1	3.7	3.4	2.8	1.5	1.1
α factor	1.10	1.21	0.60	0.50	3.38	1.22	0.34	0.04	1.06	1.05	1.45	1.30	1.10	0.74	0.72

Estimation errors from the scorecard with 1,000 bootstrap samples of n = 16,384 households from the validation sample.
Estimation errors are average differences between estimates and observed values, in percentage points.
Margins of error are ± percentage points with 90-percent confidence for samples of n = 1,024.
The α factor is used to calculate margins of error and sample sizes.
α is an average across 1,000 bootstrap samples of n = 256, 512, 1,024, 2,048, 4,096, 8,192, and 16,384.

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Scorocs® Simple Poverty Scorecard® Tool
Sierra Leone

1. Introduction

The Scorocs Simple Poverty Scorecard-brand poverty-assessment tool for Sierra Leone is a low-cost, transparent way for pro-poor programs to get know their participants better so as to prove and improve their social performance.

1.1 Questions addressed by the scorecard

To address the question of "How many poor people does our program attract?", the scorecard can take a snapshot in a single time period with a census or a sample of in-coming households to estimate both head-count poverty rates as well as the number of poor people.

To address the question of "How has poverty changed for on-going participants?", the scorecard can be applied across two time periods with samples from a given cohort of on-going participants to estimate both net annual changes in head-count poverty rates as well as net annual changes in the number of poor people.

The scorecard can also be used for targeting, that is, to segment participants for differentiated treatment based on poverty.

It is difficult and costly for pro-poor programs to address these questions with the traditional direct approach to poverty assessment via consumption-expenditure surveys. A case in point is Sierra Leone's 2018 Integrated Household Survey (IHS) by Statistics Sierra Leone (SSL). The 2018 IHS has more than 100 pages and asks about 800 top-level questions, most of which have several follow-up questions or are repeated (for example, for each household member, each consumer durable, or each expenditure item). An IHS enumerator completed 10 interviews per month, and an interviewed household kept a log of each food item purchased or consumed for 20 days.

1.2 How the scorecard works

The scorecard has nine factual questions that are drawn from the exhaustive 2018 IHS. Examples include: "What is the main construction material of the outside walls of the household's dwelling?" and "Does the household have a television?".

The nine questions are selected to be:

- Inexpensive to collect, easy to answer quickly, and straightforward to verify
- Strongly and intuitively linked with poverty
- Liable to change over time as poverty changes
- Applicable in all districts of Sierra Leone

Each question has multiple-choice response options, with points assigned to each response. The points are zeroes or positive whole numbers. The points are derived from the statistical links between responses and consumption-expenditure-based poverty in the 2018 IHS.

Adding up the points for a given household gives a *score* that ranges from 0 to 100. The lower the score, the poorer the household.

A trained enumerator can interview a household, record its responses on paper or **on a device**, and add up the household's score (if needed for on-the-spot segmentation) in about ten minutes.[1]

Back at the office or in the cloud, a household's score is converted into an estimated probability (the *poverty likelihood*) that the household is poor for a given poverty line. The links between scores and poverty likelihoods are based on IHS data.

The average of poverty likelihoods across the members of sampled households is an estimate of the head-count poverty rate among people in the sampled population.

This estimated poverty rate may be used to estimate:

- The number of poor people in in-coming households in a single time period
- The change in the net number of poor people in households of on-going participants across two time periods

[1] Responses on paper are entered in a spreadsheet or database later at an office.

1.3 Targeting

The scorecard can also be used to segment participating households for differentiated services. Unlike some other targeting tools—such as the World Bank's "proxy-means tests"[2]—the scorecard is transparent, freely available,[3] and tailored to the capabilities and purposes not of national governments but rather of local pro-poor programs. The feasible poverty-assessment tools available to such programs are typically blunt (such as rules based on land ownership or housing quality) or subjective and relative (such as community-based, participatory wealth ranking facilitated by skilled field workers). Poverty assessments based on these approaches may be costly, their accuracy is unknown, and they are not comparable across places, programs, nor time.

1.4 Consumption-expenditure-based poverty

Sierra Leone's scorecard is a quantitative way to assess whether a program's participants have consumption expenditure below any of 15 poverty lines. The most-relevant line is Sierra Leone's national line (called here "100% of the national line") of SLL10.71 per adult equivalent per day, giving a country-wide head-count poverty rate in 2018 of 56.8 percent.

A program uses only the poverty line(s) that fit its context and mission. For example, a program may report poverty estimates to funders based a national line while internally using a percentile-based line.

1.5 Transparency

The scorecard's design aims to make its workings clear to program managers. The tool's adoption stems from the low cost of its short interviews and from the fact that managers can see for themselves how the scorecard works and that its approach makes sense. Similar tools have been around for decades, but pro-poor programs have rarely used them. This is not because these tools are inaccurate, but because *how* they work is unclear or hidden.

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[2] **Coady, Grosh, and Hoddinott**, 2004.

[3] Sierra Leone's scorecard is not in the public domain; it is copyright © 2022 Scorocs.

When scorecard projects fail, the cause is not usually inaccuracy but rather a program's failure to commit to the work-a-day project management needed to integrate the scorecard in the program's processes and to train and convince employees to use the tool properly.[4] For tool-based estimates of social outcomes such as poverty, data scientists have long known that there is almost no trade-off in accuracy between the straightforward and transparent versus the complex and opaque.[5] Project risk is less technical and more human, not statistics but organizational-change management.

1.6 Assumptions and estimation errors

Like all predictive tools, the scorecard makes two fundamental assumptions:

- The scored sample is representative of the same population as that whose data was used to construct the scorecard
- The links between responses and poverty are the same in the scored sample as in the population whose data was used to construct the scorecard

Of course, these assumptions do not hold to some unknown degree.[6] In particular:

- A given program's participants are not representative of Sierra Leone overall
- Over time, the links between responses and poverty drift or shift

Scorecard estimates have errors because the scorecard incorrectly acts as if the links between responses and poverty in all scored samples and in all time periods are the same as in the construction sample from the 2018 IHS. Reality diverges further from assumptions as:

- More time passes since the collection of construction data
- A program's participants differ from the country's general population
- Attrition has changed the composition of a cohort of on-going participants
- Change has been rapid (say, due to war, plague, or changes in the program itself)[7]

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[4] **Schreiner**, 2002.
[5] **Dupriez**, 2018; **Caire and Schreiner**, 2012; **Schreiner**, 2012; **Hand**, 2006; **Lovie and Lovie**, 1986; **Kolesar and Showers**, 1985; **Stillwell, Barron, and Edwards**, 1983; **Dawes**, 1979; **Wainer**, 1976; **Myers and Forgy**, 1963.
[6] **Diamond *et al.***, 2016; **Tarozzi and Deaton**, 2009.
[7] For example, the 2020−22 economic upheaval due to COVID−19 changed the links between poverty and questions, but the Sierra Leone scorecard still uses 2018 links.

For any particular scorecard and scored sample, the estimation error due to migration away from the assumptions is unknown. It is known, however, that the scorecard's targeting is robust. That is, the extent to which assumptions diverge from reality is not strongly linked with the extent to which the scorecard gives lower scores to more-poor households and higher scores to less-poor households. It is also known that the scorecard's estimation errors are larger when estimating changes in poverty across two periods (or across two scorecards) than when estimating poverty in one period or across two periods with a single scorecard.

There are no rules nor formulas that automatically signal when estimation error is too large for estimates to be useful. Program managers must make their own judgments based on common sense and on what they know about their context and their participants from non-scorecard sources.

In practice, scorecard estimates often serve as a basic check on whether a pro-poor program is indeed *pro-poor*. The estimates address existential questions such as:

- "How many in-coming participants are below the national poverty line?"
- "Are in-coming participants poorer than the average person in our work area?"
- "Are our participants more likely to rise above a poverty line than the average poor person in our work area?"

For such existential checks on whether a program lives out its purported social mission, estimation errors will often be small enough to be immaterial.

1.7 Estimation errors when assumptions hold

If the scorecard's assumptions do hold, then the scorecard estimators are statistically *unbiased*. That is, the true value in the population matches the average of scorecard estimates from repeated samples.

The assumptions do hold when the scorecard is tested against households in the validation sample from the 2018 IHS that are not used to construct the scorecard. Smaller errors in this ideal case imply smaller-than-otherwise errors in real-world use.

Even so, there are estimation errors on average in the validation sample because there is only one scorecard, and it is derived from one construction sample and applied to a single validation sample. **Figure 2** documents the estimation error for estimates of poverty rates in one time period, allowing scorecard users to adjust for it.

1.8 What is next?

Section 2: **How to convert responses to poverty likelihoods**

Section 3: **How to calculate scorecard estimates**

- **Poverty in a single time period**:
  - **Head-count poverty rate**
  - **Number of poor people**
- **Annual net changes in poverty across two time periods for on-going participants**:
  - **Poverty rate with one sample scored twice**
  - **Number of poor people with one sample scored twice**
  - **Poverty rate with two independent samples**
  - **Number of poor people with two independent samples**

Section 4: **How to design scorecard surveys and samples**

Section 5: **How to use scores for targeting**

After Section 5, the **Interview Guide** tells how to ask questions—and how to interpret responses—so as to mimic practice in Sierra Leone's 2018 IHS as closely as possible. The **Interview Guide** and the **Back-page Worksheet** are integral parts of the scorecard. Do not ignore them.

The annexes provide details for advanced users:

Annex 1: **Data used for construction and validation**

Annex 2: **Definition of poverty**

Annex 3: **Scorecard construction**

Annex 4: **Estimates of poverty likelihoods**

Annex 5: **Error and margins of error**

Annex 6: **Formulas for sample size**

Details on cited **References** appear at the end.

2. How to convert responses to poverty likelihoods

This section tells how to:

- Collect a household's responses to scorecard questions
- Convert responses to points
- Add up points to get scores
- Convert scores to poverty likelihoods

The next section tells how to combine poverty likelihoods from a sample of households to estimate poverty.

2.1 Instructions for enumerators

An *enumerator* asks a scorecard's questions to a respondent and then records the responses. An enumerator may or may not be same as the program's service agent (if any) who is associated with a participating household.

Enumerators should interview a sampled household at the household's dwelling using a **mobile device** or a paper scorecard along with the **Back-page Worksheet**. Following the **Interview Guide**, enumerators should:

- Record administrative information in the scorecard header:
  - Interview identifier (if known)
  - Interview date (required)
  - Country code ("SLE", pre-filled)
  - Scorecard code ("002", pre-filled)
  - Sampling weight assigned to the household by the survey design (if any and if known)
- Record names and identifiers (if known) in the scorecard header:
  - *Participant of record*. This is the member of the household whose identifying information is recorded on-file with the pro-poor program. Often, the participant of record is the adult member of the household who interacts directly with the program. He/she may or may not be the same as the respondent who responds to the scorecard questions. For example, a participant of record for a microfinance program is often a borrower or a saver, and a participant of record with a child-health program might be a child or a child's parent or guardian

- — *Service agent* (if there is one and if known). This is the participant of record's main, on-going point of contact with the program. The service agent may or may not be the same as the enumerator. For example, the service agent in a microfinance program is often a loan officer or savings collector, and the service agent in a child-health program might be a community health-care worker or a nurse practitioner
- — *Service point* (if there is one). This is the program office that is relevant to the participant of record. The service point is usually the base of operations for the service agent who serves the participant of record or where the participant of record usually does program business. For example, the service point for a microfinance program is often a branch, and the service point for a child-health program might be a community health post

- Mark the response to the first scorecard question ("In what district does the household live?"). If the enumerator already knows the district (as is almost always the case), then the question does not need to be asked directly of the respondent
- Complete the **Back-page Worksheet** with each household member's first name (or nickname)
- If using a paper scorecard, then use the **Back-page Worksheet** to record:
  - — The number of household members in the header next to "Number of household members"
  - — The response to the second scorecard question ("How many members does the household have?")
- Record the response to the third question ("What is the main construction material of the outside walls of the household's dwelling?") based on your own observation. Ask the question directly of the respondent only if you are not completely certain of the appropriate response
- Read aloud the remaining six questions one-by-one and in order, marking the responses given by the respondent
- Do not read the response options for any scorecard question to the respondent
- When marking a response on paper, write each point value in the far right-hand column. Then make single circle around the pre-printed response, the pre-printed points, and the hand-written points. This helps to reduce later data-entry mistakes
- Add up the points to get the score (if needed on-the-spot and if using a paper scorecard)
- Implement targeting policy (if any) based on the score

2.2 Header, Back-page Worksheet, Interview Guide, and audits

Fill out the scorecard header as best you can; do not skip it. Scorecard estimates are more useful if they can be linked—via names or identifiers—to a program's existing data on the participant of record, service agent, and service point. Record the types of identifiers that are used in the program's databases, be they program-specific or government-issued. Be sure to record the number of household members not only indirectly via the scorecard's second question but also directly in the scorecard's header.

Do not leave fields in the header blank. If the data is unknown, does not exist, or is not applicable, then write "UNKNOWN", "NONE" or "NOT APPLICABLE".

Likewise, do not skip the **Back-page Worksheet**. Take the time to read the definition of *household* to the respondent and to fill out the roster member-by-member. If you cut corners, many respondents will miscount or apply the wrong definition of *household*. Completing the **Back-page Worksheet** improves data quality because it mimics SSL's practice in the 2018 IHS. The accuracy of the scorecard's estimates depends on the quality of recorded responses and especially strongly on an accurate count of household members. Working through the **Back-page Worksheet** provides the best data.

Throughout the interview, apply the instructions in the **Interview Guide**. Enumerators must be thoroughly trained on the **Interview Guide** before they do any interviews, and they should carry a copy of the **Interview Guide** with them to each interview.[8] Even though the scorecard is less difficult than other poverty-assessment tools, training and explicit definitions of the scorecard's terms and concepts are still essential.[9] Enumerators must study the **Interview Guide** and scrupulously follow it.

[8] The **Interview Guide** is the only source of guidance for enumerators. All other issues of interpretation should be left to the judgment of enumerators and respondents, as this seems to be what SSL did in the 2018 IHS.

[9] Merely reading through the scorecard with enumerators is not adequate training.

Finally, on-going quality-control audits are wise if a program or its service agents collect their own data and if they believe that they have an incentive to exaggerate poverty estimates (for example, if they expect to be rewarded for higher poverty rates).[10]

[10] **Matul and Kline**, 2003. If a program does not want enumerators or respondents to know the scorecard's points, then it can use a **data-collection app** or a paper version of the scorecard that omits the points, with scores computed later at an office. Even if points are hidden, however, enumerators and respondents can use common sense to guess how responses are linked with poverty.

Figure 3: First example household, filled-in scorecard

			Full name	Identifier
Interview ID:	A123			
Interview date:	13JUN2022	Participant of record:	ANNA JACKSON	1V0276FZ7
Country:	SLE	Service agent:	UNKNOWN	UNKNOWN
Scorecard:	002	Service point:	EAST CLINIC	NONE
Sampling weight:	UNKNOWN	Number of household members:		FIVE

Question	Response	Points	
1. In which district does the household live? (*record without asking*)	A. Kenema, or Pujehun	0	**0**
	B. Tonkolili, or Bombali	5	
	C. Freetown (western area, rural), Port Loko, Bo, Moyamba, Karene, Falaba, or Koinadugu	9	
	D. Kono, or Bonthe	13	
	E. Freetown	15	
	F. Kailahun, or Kambia	18	
2. How many members does the household have? (*from* ***Back-page*** Worksheet)	A. Nine or more	0	
	B. Eight	5	
	C. Seven	8	
	D. Six	12	
	E. Five	19	**19**
	F. Four	26	
	G. Three	30	
	H. One or two	41	
3. What is the main construction material of the outside walls of the household's dwelling? (*by observation; ask if in doubt*)	A. Wattle and mud, or mud bricks	0	**0**
	B. Mud bricks plastered with cement, or other	3	
	C. Cement blocks, wooden boards, or corrugated iron/zinc sheets	7	
4. Does the household cook mostly with charcoal, cooking gas, or electricity?	A. No	0	**0**
	B. Yes	2	
5. What kind of toilet does the household use?	A. None (bush, field, waterside), hanging toilet/hanging latrine, or composting toilet	0	**0**
	B. Pit latrine without slab (open pit) or with slab, ventilated improved pit latrine (VIP), flush (to pit latrine, septic tank, piped sewer system)	3	
6. How many mattresses does the household have?	A. None	0	
	B. One	1	**1**
	C. Two	3	
	D. Three or more	5	
7. Does the household have a television?	A. No	0	**0**
	B. Yes	9	
8. How many mobile phones does the household have?	A. None	0	
	B. One	7	**7**
	C. Two or more	11	
9. In the past 12 months, did the household grow rice or cassava for its own consumption?	A. Yes	0	**0**
	B. No	4	

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Score: 0 + 19 + 0 + 0 + 0 + 1 + 0 + 7 + 0 = 27

Figure 4: First example household, filled-in Back-page Worksheet

First name or nickname?	Head or spouse of head?
1. **ANNA**	Head (male) Head (female)
2. **BILLY**	Wife (eldest) head Husband of female head Other member
3. **CHARLES**	Other
4. **DARLA**	Other
5. **EUGENE**	Other
6.	Other
7.	Other
8.	Other
9.	Other
10.	Other
# Household members: **FIVE**	—

2.3 First example household

The points for the first example household's responses add up to a score of 27 (**Figure 3** and **Figure 4**).

For all supported poverty lines, **Figure 1** lists poverty likelihoods by score range. A score of 27 falls in the fifth range of 26−28. For 100% of the national poverty line, the poverty likelihood for scores of 26−28 is 89.7 percent. That is, the scorecard estimates that 89.7 percent of households in Sierra Leone with a score of 26−28 have consumption expenditure below 100% of the national line.

Figure 5: The first example household's score of 27 corresponds with a poverty likelihood of 89.7 percent for 100% of the national line (excerpted from Figure 1)

	Poverty likelihood (%)			
		National lines		
Score	Food	100%	150%	200%
0–13	55.3	96.4	99.9	99.9
14–18	42.9	96.1	99.5	99.7
19–22	31.4	95.5	99.4	99.7
23–25	26.7	94.9	99.4	99.7
26–28	17.3	89.7	99.4	99.7
29–30	13.6	82.8	98.9	99.7
31–32	11.5	79.5	98.2	99.7
33–35	8.5	73.7	95.7	99.1
36–38	6.0	65.6	92.3	98.0
. . .	. . .	. . .	. . .	. . .

Figure 6: Second example household, filled-in scorecard

			Full name	Identifier
Interview ID:	B456			
Interview date:	30JUN2022	Participant of record:	JOHN BROWN	2W3120ZG8
Country:	SLE	Service agent:	UNKNOWN	UNKNOWN
Scorecard:	002	Service point:	EAST CLINIC	NONE
Sampling weight:	UNKNOWN	Number of household members:		SEVEN

Question	Response	Points	
1. In which district does the household live? (*record without asking*)	A. Kenema, or Pujehun	0	**0**
	B. Tonkolili, or Bombali	5	
	C. Freetown (western area, rural), Port Loko, Bo, Moyamba, Karene, Falaba, or Koinadugu	9	
	D. Kono, or Bonthe	13	
	E. Freetown	15	
	F. Kailahun, or Kambia	18	
2. How many members does the household have? (*from* ***Back-page*** Worksheet)	A. Nine or more	0	
	B. Eight	5	
	C. Seven	8	**8**
	D. Six	12	
	E. Five	19	
	F. Four	26	
	G. Three	30	
	H. One or two	41	
3. What is the main construction material of the outside walls of the household's dwelling? (*by observation; ask if in doubt*)	A. Wattle and mud, or mud bricks	0	
	B. Mud bricks plastered with cement, or other	3	**3**
	C. Cement blocks, wooden boards, or corrugated iron/zinc sheets	7	
4. Does the household cook mostly with charcoal, cooking gas, or electricity?	A. No	0	
	B. Yes	2	**2**
5. What kind of toilet does the household use?	A. None (bush, field, waterside), hanging toilet/hanging latrine, or composting toilet	0	**0**
	B. Pit latrine without slab (open pit) or with slab, ventilated improved pit latrine (VIP), flush (to pit latrine, septic tank, or piped sewer system)	3	
6. How many mattresses does the household have?	A. None	0	
	B. One	1	
	C. Two	3	**3**
	D. Three or more	5	
7. Does the household have a television?	A. No	0	**0**
	B. Yes	9	
8. How many mobile phones does the household have?	A. None	0	
	B. One	7	
	C. Two or more	11	**11**
9. In the past 12 months, did the household grow rice or cassava for its own consumption?	A. Yes	0	
	B. No	4	**4**

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Score: 0 + 8 + 3 + 2 + 0 + 3 + 0 + 11 + 4 = 31

Figure 7: Second example household, filled-in Back-page Worksheet

First name or nickname?	Head or spouse of head?
1. **ALBERT**	Head (male) Head (female)
2. **BERNITA**	Wife (eldest) male head Husband of female head Other member
3. **CARLOS**	Other
4. **DARLENE**	Other
5. **EVELYN**	Other
6. **FRANCINE**	Other
7. **GEORGE**	Other
8.	Other
9.	Other
10.	Other
# Household members: **SEVEN**	—

2.4 Second example household

The points for the second example household's responses add up to a score of 31 (**Figure 6** and **Figure 7**).

For all supported poverty lines, **Figure 1** lists poverty likelihoods by score range. A score of 31 falls in the seventh range of 31−32. For 100% of the national poverty line, the poverty likelihood for scores of 31−32 is 79.5 percent. That is, the scorecard estimates that 79.5 percent of households in Sierra Leone with a score of 31−32 have consumption expenditure below 100% of the national line.

Figure 8: The second example household's score of 31 corresponds with a poverty likelihood of 79.5 percent for 100% of the national line (excerpted from Figure 1)

	Poverty likelihood (%)			
		National lines		
Score	Food	100%	150%	200%
0–13	55.3	96.4	99.9	99.9
14–18	42.9	96.1	99.5	99.7
19–22	31.4	95.5	99.4	99.7
23–25	26.7	94.9	99.4	99.7
26–28	17.3	89.7	99.4	99.7
29–30	13.6	82.8	98.9	99.7
31–32	11.5	79.5	98.2	99.7
33–35	8.5	73.7	95.7	99.1
36–38	6.0	65.6	92.3	98.0
. . .	. . .	. . .	. . .	. . .

3. How to calculate scorecard estimates

This section tells how to estimate:

- Head-count poverty rates for a single time period for in-coming participants
- Net changes in poverty rates across two time periods for on-going participants

It also tells how to use these estimated poverty rates to estimate:

- Number of poor people in the households of in-coming participants
- Net change in the number of poor people in the households of on-going participants

3.1 Poverty in a single time period

3.1.1 Head-count poverty rate

The *head-count poverty rate* is the share of people in participating households in which total household consumption expenditure (divided by the number of adult equivalents in the household or by the number of members in the household) is below a given poverty line.

An estimate of the head-count poverty rate is the household-size-weighted average of poverty likelihoods from a scored sample, adjusted for the scorecard's known estimation error.

To illustrate the calculation, suppose that in a pro-poor program that operates throughout Sierra Leone enrolls 1,000 in-coming households in calendar-year 2022, from which it scores a simple random sample[11] of two households.[12]

The program judges that 100% of the national poverty line is the most-relevant line for its purposes. For that line and for estimates of poverty rates in one period, the scorecard's known estimation error is −3.1 percentage points (**Figure 2**).

[11] In a *simple random sample*, all households in the population have the same selection probability. This paper does not discuss samples in which different households have different selection probabilities.

[12] Of course, estimates based on such an unrealistically small sample have wide margins of error, but a small sample facilitates the arithmetic in the examples here.

The first example household has five members and is interviewed on June 13, 2022 (**Figure 3** and **Figure 4**). Its score of 27 corresponds with a poverty likelihood of 89.7 percent.

The second example household has seven members and is interviewed on June 30, 2022 (**Figure 6** and **Figure 7**). Its score of 31 corresponds with a poverty likelihood of 79.5 percent.

The estimated head-count poverty rate for the population of in-coming households in the 2022 calendar-year cohort is the household-size-weighted average of the estimated poverty likelihoods of the sampled households, less the known estimation error. Expressing poverty likelihoods and the estimation error as proportions between 0 and 1 rather than percentages between 0 and 100, this is:

$$\frac{5 \cdot 0.897 + 7 \cdot 0.795}{5 + 7} - (-0.031) \approx \frac{10.05}{12} + 0.031 \approx 0.869 = 86.9 \text{ percent.}$$

The five in the "$5 \cdot 0.897$" term is the number of members (household size) in the first household, and the 0.897 is the first household's estimated poverty likelihood as a proportion.

In the same way, the seven in "$7 \cdot 0.795$" is the number of members in the second household, and the 0.795 is the second household's estimated poverty likelihood.

The "5 + 7" is the sum of the weights—that is, the number of household members—across the two sampled households.

The "−0.031" is the scorecard's estimation error for this poverty line (**Figure 2**). Because unadjusted estimates tend to be too low by 3.1 percentage points, they are adjusted upwards by subtracting −3.1 (that is, adding +3.1). This is akin to how an archer whose arrows tend to miss a little to the left of the bulls-eye will adjust his/her aim to be a little to the right of the bulls-eye.

The estimated head-count poverty rate for the population is 86.9 percent. Again, this is the household-size-weighted average of the two sampled households' poverty likelihoods, adjusted for the known estimation error.[13]

With hundreds or thousands of interviewed households, the calculations are done with the **ProveIt™-brand reporting and analysis tool** or in a spreadsheet, as modeled in **Figure 9** below.

[13] Be careful; the estimated poverty rate is *not* the single poverty likelihood associated with the household-size-weighted average score, which here is $(5 \cdot 27 + 7 \cdot 31) \div (5 + 7) \approx 29$. This average score of 29 corresponds to a poverty likelihood for 100% of the national poverty line of 82.8 percent (**Figure 1**), giving an error-adjusted poverty rate of $82.8 - (-3.1) = 85.9$ percent. This differs from the 86.9 percent found as the household-size-weighted average of the two individual likelihoods associated with each of the two scores. Unlike likelihoods, scores are ordinal symbols, like colors in the spectrum or syllables in a solfège scale. Because scores are ordinal, they cannot be added up nor averaged. Only three operations are valid for scores: conversion to likelihoods, analysis of distributions, or comparison with a cut-off for segmentation (**Schreiner**, 2012). In general, programs should analyze likelihoods, not scores.

Figure 9: Spreadsheet calculation to estimate the head-count poverty rate and number of poor people in a population of in-coming participants in a period

	A	B	C	D	E	F	G
1	**Survey**	**Interview date**	**ID participant of record**	**Number of household members**	**Score**	**Poverty likelihood (%)**	**Estimated number of poor household members**
2	Baseline	13-Jun-22	1V0276FZ7	5	27	89.7	4.49 = (D2*F2)/100
3	Baseline	30-Jun-22	2W3120ZG8	7	31	79.5	5.57 = (D3*F3)/100
4			**Sum:**	12 = SUM(D2:D3)			10.05 = SUM(G2:G3)
5			**Average:**	6.0 = AVERAGE(D2:D3)			
6							
7	**Estimated scorecard error for this poverty line (percentage points):**						−3.1
8							
9				**Estimated head-count poverty rate (%):**			86.9 = (G4/D4)*100-G7
10							
11				**Households in the population:**			1,000
12							
13				**People in households in the population:**			6,000 = G11*D5
14							
15				**Number of poor people in population:**			5,211 = (G9/100)*G13
16	Rows of data are sorted by Survey, then by Interview date, then by the ID of the participant of record.						

This estimate in a single time period tends to be more relevant for in-coming participants who joined a program in the current period than for on-going participants who joined in past periods. This is because fulfilling a pro-poor mission implies that some share of new participants be poor by some definition of *poverty*.[14] To be pro-poor, a bare-minimum standard is that the poverty rate of in-coming participants exceed that of the country as a whole or that of the program's work area.

To help with benchmarking poverty-rate estimates, **Figure 10** reports head-count poverty rates from the 2018 IHS for all 15 supported poverty lines by urban/rural/all for Sierra Leone overall and for each of its 16 districts.

For Sierra Leone overall, the head-count poverty rate for 100% of the national line is 56.8 percent. Thus, the example program is pro-poor in the sense that its in-coming participants have an above-average estimated poverty rate (86.9 percent).

The text that illustrates the calculation of the scorecard estimate of the number of poor people in a single time period follows after **Figure 10**, which stretches across the next six pages.

The areas in **Figure 10** begin with Sierra Leone overall, followed by the 16 districts in alphabetical order.

[14] The scorecard for Sierra Leone uses a definition of *poverty* based on consumption expenditure. Other common definitions of *poverty* include: being rural, agricultural, landless, or unemployed; living in a given area; having a head who is illiterate, female, or an ethnic minority; or having a member who is pregnant, handicapped, elderly, or young.

Figure 10: (Sierra Leone overall, Bo, and Bombali): Poverty lines and head-count poverty rates by urban/rural/all in 2018

District/ Area	Line or Rate	*n*	Poverty lines (SLL) and poverty rates (%)														
			National lines				Intl. 2011 PPP lines				Percentile-based lines						
			Food	100%	150%	200%	$1.90	$3.20	$5.50	$21.70	10th	20th	40th	50th	60th	80th	90th
Sierra Leone	Urban	Line	6.16	11.36	17.04	22.72	7.01	11.80	20.28	80.01	4.16	5.07	6.77	7.73	8.88	12.91	17.94
		Rate	3.8	34.8	63.8	79.4	21.5	56.6	85.2	99.7	2.5	5.9	18.7	26.9	36.8	62.8	80.0
		n	3,378														
	Rural	Line	5.53	10.21	15.31	20.41	6.29	10.60	18.22	71.87	3.74	4.55	6.08	6.94	7.98	11.60	16.11
		Rate	19.9	73.9	93.3	97.5	59.7	91.0	98.5	100.0	15.8	30.9	56.5	67.8	77.9	93.3	97.8
		n	3,432														
	All	Line	5.80	10.71	16.06	21.42	6.60	11.12	19.12	75.42	3.93	4.78	6.38	7.29	8.37	12.17	16.91
		Rate	12.9	56.8	80.4	89.6	43.0	76.0	92.7	99.8	10.0	20.0	40.0	50.0	60.0	80.0	90.0
		n	6,810														
Bo	Urban	Line	6.04	11.15	16.73	22.30	6.88	11.58	19.90	78.53	4.09	4.98	6.64	7.59	8.72	12.67	17.61
		Rate	1.2	36.8	70.9	83.5	18.7	64.6	89.6	99.4	1.2	1.6	13.8	27.6	35.8	69.3	84.4
		n	319														
	Rural	Line	5.32	9.82	14.73	19.63	6.05	10.20	17.52	69.14	3.60	4.38	5.85	6.68	7.68	11.15	15.50
		Rate	18.3	70.7	91.7	97.3	59.9	89.3	98.1	100.0	15.4	28.8	57.6	64.9	76.5	91.2	97.5
		n	350														
	All	Line	5.54	10.23	15.34	20.46	6.31	10.62	18.26	72.05	3.75	4.56	6.09	6.96	8.00	11.62	16.15
		Rate	13.0	60.2	85.2	93.1	47.2	81.6	95.5	99.8	11.0	20.4	44.0	53.3	63.9	84.4	93.4
		n	669														
Bombali	Urban	Line	5.72	10.56	15.85	21.13	6.51	10.97	18.86	74.40	3.87	4.71	6.29	7.19	8.26	12.00	16.68
		Rate	3.8	38.6	79.0	90.2	26.9	68.3	95.2	99.9	2.7	8.3	23.5	33.9	43.5	77.1	91.4
		n	280														
	Rural	Line	5.62	10.38	15.56	20.75	6.40	10.78	18.52	73.08	3.80	4.63	6.18	7.06	8.11	11.79	16.38
		Rate	24.6	82.5	97.5	98.7	71.2	96.4	98.9	100.0	21.7	38.0	66.4	76.2	85.6	97.2	98.4
		n	278														
	All	Line	5.67	10.45	15.68	20.91	6.45	10.86	18.66	73.63	3.83	4.66	6.23	7.11	8.17	11.88	16.51
		Rate	15.9	64.1	89.8	95.1	52.6	84.7	97.4	100.0	13.7	25.6	48.4	58.5	67.9	88.8	95.4
		n	558														

Source: 2018 IHS

Poverty rates are percentages.

National poverty lines are SLL per-adult-equivalent and per-day in average prices in Sierra Leone overall during the 2018 IHS fieldwork.

International 2011 PPP lines and percentile-based lines are SLL per-person and per-day in average prices in Sierra Leone during the 2018 IHS fieldwork.

Figure 10: (Bonthe, Falaba, and Freetown [western area, rural]): Poverty lines and head-count poverty rates by urban/rural/all in 2018

District/ Area		Line or Rate	*n*	Poverty lines (SLL) and poverty rates (%)														
				National lines				Intl. 2011 PPP lines				Percentile-based lines						
				Food	100%	150%	200%	$1.90	$3.20	$5.50	$21.70	10th	20th	40th	50th	60th	80th	90th
Bonthe	Urban	Line	60	6.38	11.77	17.66	23.55	7.26	12.23	21.01	82.91	4.32	5.25	7.01	8.01	9.20	13.38	18.59
		Rate		3.0	31.4	52.1	72.5	21.8	47.9	80.5	100.0	3.0	10.2	21.8	23.3	34.4	54.6	76.7
	Rural	Line	240	5.35	9.87	14.81	19.74	6.09	10.25	17.62	69.52	3.62	4.40	5.88	6.71	7.72	11.22	15.59
		Rate		7.4	56.7	82.8	93.1	42.7	78.9	96.8	100.0	3.7	12.8	41.0	49.9	60.6	84.8	93.8
	All	Line	300	5.54	10.23	15.34	20.46	6.31	10.62	18.26	72.03	3.75	4.56	6.09	6.96	8.00	11.62	16.15
		Rate		6.6	51.9	77.1	89.2	38.7	73.1	93.7	100.0	3.6	12.3	37.4	44.9	55.7	79.2	90.6
Falaba	Urban	Line	20	5.93	10.95	16.43	21.90	6.75	11.37	19.55	77.13	4.01	4.89	6.52	7.45	8.56	12.44	17.29
		Rate		9.3	89.2	100.0	100.0	69.0	100.0	100.0	100.0	9.3	23.7	60.8	81.5	92.7	100.0	100.0
	Rural	Line	160	5.66	10.44	15.67	20.89	6.44	10.85	18.64	73.56	3.83	4.66	6.22	7.11	8.17	11.87	16.49
		Rate		12.2	80.0	96.5	99.1	62.8	94.6	99.6	100.0	13.0	27.5	59.3	77.0	84.6	97.4	99.6
	All	Line	180	5.70	10.52	15.77	21.03	6.48	10.92	18.77	74.06	3.86	4.69	6.26	7.15	8.22	11.95	16.61
		Rate		11.8	81.3	97.0	99.2	63.7	95.4	99.7	100.0	12.5	26.9	59.5	77.6	85.8	97.8	99.7
Freetown (west, rural)	Urban	Line	269	6.39	11.78	17.67	23.57	7.27	12.24	21.03	82.99	4.32	5.26	7.02	8.02	9.21	13.39	18.61
		Rate		3.7	37.9	65.5	79.4	23.5	58.4	86.3	99.9	1.4	4.9	19.8	29.4	39.9	66.9	79.9
	Rural	Line	30	6.38	11.78	17.67	23.56	7.26	12.23	21.03	82.97	4.32	5.26	7.02	8.01	9.21	13.39	18.60
		Rate		17.7	36.7	75.5	84.9	36.7	71.1	84.9	100.0	7.3	28.7	36.7	36.7	39.6	75.9	84.9
	All	Line	299	6.39	11.78	17.67	23.57	7.27	12.24	21.03	82.98	4.32	5.26	7.02	8.02	9.21	13.39	18.61
		Rate		5.1	37.7	66.5	79.9	24.8	59.7	86.1	99.9	2.0	7.2	21.4	30.1	39.9	67.8	80.4

Source: 2018 IHS

Poverty rates are percentages.

National poverty lines are SLL per-adult-equivalent and per-day in average prices in Sierra Leone overall during the 2018 IHS fieldwork.

International 2011 PPP lines and percentile-based lines are SLL per-person and per-day in average prices in Sierra Leone during the 2018 IHS fieldwork.

Figure 10: (Freetown, Kailahun, and Kambia): Poverty lines and head-count poverty rates by urban/rural/all in 2018

District/ Area	Line or Rate	*n*	Poverty lines (SLL) and poverty rates (%)														
			National lines				Intl. 2011 PPP lines				Percentile-based lines						
			Food	100%	150%	200%	$1.90	$3.20	$5.50	$21.70	10th	20th	40th	50th	60th	80th	90th
Freetown	Urban	Line	6.43	11.87	17.81	23.74	7.32	12.33	21.19	83.60	4.35	5.30	7.07	8.08	9.28	13.49	18.74
		Rate	1.4	16.3	43.2	65.5	7.7	35.4	73.7	99.4	1.2	1.4	5.7	10.1	17.1	41.9	66.1
		n	1,333														
	Rural	Line	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		n	—														
	All	Line	6.43	11.87	17.81	23.74	7.32	12.33	21.19	83.60	4.35	5.30	7.07	8.08	9.28	13.49	18.74
		Rate	1.4	16.3	43.2	65.5	7.7	35.4	73.7	99.4	1.2	1.4	5.7	10.1	17.1	41.9	66.1
		n	1,333														
Kailahun	Urban	Line	5.84	10.78	16.17	21.56	6.65	11.20	19.25	75.93	3.95	4.81	6.42	7.33	8.43	12.25	17.03
		Rate	3.3	39.0	75.3	91.3	31.1	68.6	94.7	100.0	3.3	7.8	28.2	35.9	45.9	74.6	90.3
		n	150														
	Rural	Line	5.63	10.40	15.59	20.79	6.41	10.80	18.56	73.22	3.81	4.64	6.19	7.07	8.13	11.81	16.42
		Rate	25.9	63.4	83.8	94.3	51.8	79.8	96.9	100.0	20.0	33.7	50.4	57.8	67.5	84.4	94.1
		n	230														
	All	Line	5.69	10.50	15.75	21.01	6.48	10.91	18.75	73.97	3.85	4.69	6.26	7.14	8.21	11.93	16.58
		Rate	19.6	56.7	81.5	93.4	46.1	76.7	96.3	100.0	15.4	26.5	44.3	51.7	61.6	81.7	93.1
		n	380														
Kambia	Urban	Line	5.81	10.71	16.07	21.43	6.61	11.13	19.13	75.46	3.93	4.78	6.38	7.29	8.38	12.17	16.92
		Rate	6.5	49.0	86.0	96.2	32.8	81.9	98.0	100.0	6.5	15.6	30.3	37.9	51.9	83.4	98.0
		n	59														
	Rural	Line	5.44	10.04	15.06	20.08	6.19	10.43	17.92	70.70	3.68	4.48	5.98	6.83	7.85	11.41	15.85
		Rate	2.2	44.8	88.6	96.1	29.6	84.3	99.0	100.0	2.2	10.4	26.2	35.5	57.6	87.8	97.9
		n	150														
	All	Line	5.52	10.19	15.29	20.38	6.28	10.59	18.19	71.78	3.74	4.55	6.07	6.93	7.97	11.58	16.09
		Rate	3.2	45.8	88.0	96.1	30.3	83.7	98.8	100.0	3.2	11.6	27.1	36.0	56.3	86.8	97.9
		n	209														

Source: 2018 IHS

Poverty rates are percentages.

National poverty lines are SLL per-adult-equivalent and per-day in average prices in Sierra Leone overall during the 2018 IHS fieldwork.

International 2011 PPP lines and percentile-based lines are SLL per-person and per-day in average prices in Sierra Leone during the 2018 IHS fieldwork.

Figure 10: (Karene, Kenema, and Kono): Poverty lines and head-count poverty rates by urban/rural/all in 2018

District/ Area		Line or Rate	*n*	Poverty lines (SLL) and poverty rates (%)														
				National lines				Intl. 2011 PPP lines				Percentile-based lines						
				Food	100%	150%	200%	$1.90	$3.20	$5.50	$21.70	10th	20th	40th	50th	60th	80th	90th
Karene	Urban	Line	30	5.94	10.95	16.43	21.91	6.76	11.38	19.55	77.15	4.02	4.89	6.53	7.45	8.56	12.45	17.30
		Rate		9.5	74.3	92.6	99.2	52.6	86.5	100.0	100.0	4.4	20.2	52.6	65.9	73.0	97.0	97.0
	Rural	Line	229	5.49	10.13	15.20	20.27	6.25	10.52	18.09	71.37	3.72	4.52	6.04	6.89	7.92	11.51	16.00
		Rate		15.5	77.5	96.4	99.2	59.9	94.3	99.7	100.0	12.1	27.0	57.9	72.2	81.8	96.4	99.2
	All	Line	259	5.52	10.18	15.27	20.37	6.28	10.58	18.18	71.72	3.73	4.54	6.07	6.93	7.96	11.57	16.08
		Rate		15.1	77.3	96.2	99.2	59.4	93.8	99.7	100.0	11.6	26.6	57.5	71.8	81.2	96.4	99.0
Kenema	Urban	Line	289	5.85	10.80	16.20	21.60	6.66	11.22	19.28	76.07	3.96	4.82	6.43	7.35	8.44	12.27	17.06
		Rate		7.2	61.1	86.5	94.6	39.5	81.0	96.7	100.0	5.1	11.9	37.4	48.3	64.2	84.2	95.2
	Rural	Line	270	5.65	10.42	15.63	20.85	6.43	10.83	18.61	73.41	3.82	4.65	6.21	7.09	8.15	11.84	16.46
		Rate		38.5	92.2	99.1	99.3	80.2	97.5	99.7	100.0	31.2	53.6	78.7	87.5	93.6	98.7	99.7
	All	Line	559	5.74	10.60	15.89	21.19	6.53	11.01	18.92	74.63	3.88	4.73	6.31	7.21	8.29	12.04	16.73
		Rate		24.2	78.0	93.3	97.2	61.5	89.9	98.3	100.0	19.2	34.4	59.8	69.5	80.1	92.0	97.7
Kono	Urban	Line	150	5.72	10.55	15.83	21.10	6.51	10.96	18.84	74.32	3.87	4.71	6.29	7.18	8.25	11.99	16.66
		Rate		9.3	39.5	71.8	84.4	26.5	63.4	90.6	99.4	2.9	14.5	24.9	31.1	43.6	68.7	87.4
	Rural	Line	238	5.58	10.30	15.45	20.60	6.35	10.70	18.39	72.54	3.78	4.60	6.14	7.01	8.05	11.70	16.26
		Rate		6.1	58.7	84.3	95.0	40.6	79.7	97.3	100.0	4.8	15.2	34.6	48.7	60.9	83.1	95.8
	All	Line	388	5.63	10.38	15.57	20.76	6.40	10.78	18.53	73.12	3.81	4.63	6.19	7.06	8.12	11.80	16.39
		Rate		7.1	52.4	80.2	91.5	36.0	74.4	95.1	99.8	4.2	14.9	31.5	43.0	55.2	78.4	93.1

Source: 2018 IHS

Poverty rates are percentages.

National poverty lines are SLL per-adult-equivalent and per-day in average prices in Sierra Leone overall during the 2018 IHS fieldwork.

International 2011 PPP lines and percentile-based lines are SLL per-person and per-day in average prices in Sierra Leone during the 2018 IHS fieldwork.

Figure 10: (Koinadugu, Moyamba, and Port Loko): Poverty lines and head count poverty rates by urban/rural/all in 2018

District/ Area	Line or Rate	*n*	Poverty lines (SLL) and poverty rates (%)														
			National lines				Intl. 2011 PPP lines				Percentile-based lines						
			Food	100%	150%	200%	$1.90	$3.20	$5.50	$21.70	10th	20th	40th	50th	60th	80th	90th
Koinadugu	Urban	Line	80	5.67	10.46	15.69	20.92	6.45	10.86	18.67	73.67	3.83	4.67	6.23	7.12	8.18	11.89	16.52
		Rate		4.7	54.8	77.3	87.9	33.5	70.0	89.0	100.0	4.7	6.3	32.5	41.9	54.2	77.0	87.2
	Rural	Line	120	5.58	10.29	15.44	20.58	6.35	10.69	18.37	72.48	3.77	4.59	6.13	7.00	8.05	11.69	16.25
		Rate		21.9	84.3	96.4	99.0	65.1	96.4	99.4	100.0	14.2	33.9	62.0	75.5	87.3	97.6	99.2
	All	Line	200	5.60	10.34	15.50	20.67	6.37	10.73	18.45	72.80	3.79	4.61	6.16	7.03	8.08	11.74	16.32
		Rate		17.4	76.6	91.4	96.1	56.8	89.5	96.7	100.0	11.7	26.7	54.2	66.7	78.6	92.2	96.1
Moyamba	Urban	Line	19	5.80	10.70	16.05	21.39	6.60	11.11	19.09	75.34	3.92	4.77	6.37	7.28	8.36	12.15	16.89
		Rate		0.0	27.2	81.4	97.7	21.7	71.9	97.7	99.5	0.0	0.0	21.7	21.7	27.2	81.4	97.7
	Rural	Line	198	5.44	10.05	15.07	20.09	6.20	10.43	17.93	70.75	3.68	4.48	5.99	6.83	7.85	11.42	15.86
		Rate		18.6	76.8	95.0	98.1	58.8	92.9	98.7	100.0	13.5	23.5	53.5	69.5	79.2	94.4	98.1
	All	Line	217	5.47	10.09	15.13	20.18	6.22	10.48	18.01	71.06	3.70	4.50	6.01	6.86	7.89	11.46	15.93
		Rate		17.4	73.5	94.1	98.0	56.4	91.5	98.6	100.0	12.6	22.0	51.4	66.4	75.8	93.5	98.0
Port Loko	Urban	Line	190	5.90	10.89	16.33	21.78	6.71	11.31	19.44	76.68	3.99	4.86	6.49	7.41	8.51	12.37	17.19
		Rate		1.5	50.7	82.9	92.8	29.1	75.2	95.6	99.9	0.0	1.9	23.5	38.7	52.1	82.7	93.1
	Rural	Line	250	5.56	10.27	15.40	20.54	6.33	10.66	18.33	72.32	3.76	4.58	6.12	6.99	8.03	11.67	16.22
		Rate		11.9	69.5	94.5	98.0	53.0	91.8	98.8	100.0	8.3	22.2	47.8	63.0	75.3	95.3	98.6
	All	Line	440	5.66	10.44	15.66	20.88	6.44	10.84	18.64	73.53	3.83	4.66	6.22	7.10	8.16	11.86	16.49
		Rate		9.0	64.3	91.3	96.5	46.4	87.2	98.0	100.0	6.0	16.6	41.0	56.2	68.9	91.8	97.1

Source: 2018 IHS

Poverty rates are percentages.

National poverty lines are SLL per-adult-equivalent and per-day in average prices in Sierra Leone overall during the 2018 IHS fieldwork.

International 2011 PPP lines and percentile-based lines are SLL per-person and per-day in average prices in Sierra Leone during the 2018 IHS fieldwork.

Figure 10: (Pujehun, and Tonkolili): Poverty lines and head count poverty rates by urban/rural/all in 2018

District/ Area	Line or Rate	*n*	Poverty lines (SLL) and poverty rates (%)														
			National lines				Intl. 2011 PPP lines				Percentile-based lines						
			Food	100%	150%	200%	$1.90	$3.20	$5.50	$21.70	10th	20th	40th	50th	60th	80th	90th
Pujehun	Urban	Line	5.94	10.96	16.44	21.92	6.76	11.38	19.56	77.19	4.02	4.89	6.53	7.46	8.57	12.45	17.31
		Rate	25.2	73.1	92.0	98.0	53.7	92.0	99.3	100.0	15.3	40.5	47.1	58.1	66.8	94.7	96.7
	Rural	Line	5.38	9.92	14.88	19.84	6.12	10.30	17.71	69.86	3.64	4.43	5.91	6.75	7.76	11.27	15.66
		Rate	28.1	85.3	97.4	99.4	72.8	96.9	99.5	100.0	24.7	43.5	70.3	81.1	89.0	97.2	98.8
	All	Line	5.41	9.99	14.98	19.97	6.16	10.37	17.83	70.33	3.66	4.46	5.95	6.79	7.81	11.35	15.77
		Rate	27.9	84.6	97.1	99.3	71.5	96.6	99.5	100.0	24.1	43.3	68.8	79.6	87.6	97.1	98.7
Tonkolili	Urban	Line	5.68	10.48	15.73	20.97	6.46	10.89	18.71	73.84	3.84	4.68	6.25	7.13	8.20	11.91	16.56
		Rate	14.1	70.1	91.9	96.3	47.1	87.6	97.8	100.0	12.4	20.9	46.0	60.6	75.8	88.9	96.3
	Rural	Line	5.53	10.20	15.30	20.39	6.29	10.59	18.20	71.81	3.74	4.55	6.07	6.94	7.97	11.59	16.10
		Rate	30.6	88.3	99.2	99.3	75.3	98.2	99.3	99.8	24.3	44.9	73.4	84.4	89.7	99.2	99.3
	All	Line	5.56	10.25	15.38	20.50	6.32	10.65	18.30	72.20	3.76	4.57	6.11	6.97	8.02	11.65	16.19
		Rate	27.4	84.8	97.8	98.8	69.9	96.2	99.0	99.8	22.0	40.3	68.1	79.8	87.0	97.2	98.8

Source: 2018 IHS

Poverty rates are percentages.

National poverty lines are SLL per-adult-equivalent and per-day in average prices in Sierra Leone overall during the 2018 IHS fieldwork.

International 2011 PPP lines and percentile-based lines are SLL per-person and per-day in average prices in Sierra Leone during the 2018 IHS fieldwork.

3.1.2 Number of poor people

Fulfilling a pro-poor mission depends not only on the *poverty rate* of in-coming participants but also on the *number* of poor in-coming participants. After all, a smaller program whose few participants have a higher poverty rate may serve fewer poor people than a larger program whose many participants have a lower poverty rate.[15]

The first step in estimating the number of poor people in one period is to estimate the number of household members in the population of in-coming households. In the two-household example with simple random sampling, this is the equal-weighted average of the number of people in the sampled households:

$$\frac{5+7}{1+1} = \frac{12}{2} = 6.0 \text{ people.}$$

The second step is to estimate the total number of people in the population of in-coming households. The example program has 1,000 in-coming households in its first calendar-year, with an estimated average of 6.0 members per household. The estimated number of people in the households of in-coming participants is then 1,000 · 6.0 = 6,000.

The third and final step is to multiply the estimated poverty rate (here, 86.9 percent, or 0.869) by the estimated number of people in in-coming households (here, 6,000). This gives 6,000 · 0.869 ≈ 5,211 poor people (**Figure 9**).

All else constant, the *number* of in-coming participants who are poor is more important than the *share* of in-coming participants who are poor. Both estimates are useful,[16] but increasing the share who are poor is only a means to the end of increasing the number who are poor.

In turn, increasing the number of in-coming participants who are poor is only a means to the end of increasing the net reduction in the number of on-going participants who are poor.

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[15] **Navajas *et al***., 2000.

[16] **Schreiner** (2014) tells how to report and analyze estimates from a scorecard.

3.2 Annual net changes in poverty across two time periods for on-going participants

The estimated net change in a population's poverty rate is the difference between the two estimated poverty rates at follow-up versus baseline.

Two sampling approaches are possible for the follow-up round after baseline:

- *One sample scored twice*: Score the same sample at follow-up that was scored at baseline
- *Two independent samples*: Score a new sample at follow-up from the same population cohort that was scored at baseline

Given the scorecard's assumptions, both approaches are unbiased, although with all else held constant, scoring one sample twice has smaller margins of error than does scoring two independent samples.

3.2.1 Poverty rate with one sample scored twice

When the follow-up sample is made up of the same households as the baseline sample,[17] then the estimated annual net change in the poverty rate of the population of on-going participants is the average-household-size-weighted average of the change in each scored household's poverty likelihood, divided by the household-size-weighted average of the years between each household's interviews.[18]

Continuing the earlier example, suppose that the first household has six members when re-interviewed at follow-up (rather than five as at baseline) and is scored a second time on August 13, 2025, which is 1,157 days (about 3.17 years) after its first interview on June 13, 2022. Its score is now 29 (rather than 27), so its poverty likelihood for 100% of the national line is now 82.8 percent (**Figure 1**).

Suppose that the second household now has eight members (rather than seven as at baseline) and is re-interviewed on May 15, 2025, which is 1,050 days (about 2.88 years) after its first interview on June 30, 2022. Its score is now 33 (rather than 31), so its poverty likelihood has decreased from 79.5 to 73.7 percent.

[17] Or when the follow-up sample is a random sample of the baseline sample.
[18] Estimates of change do not need to directly adjust for the estimation error in estimates in a single period because—given the scorecard's assumptions—this error washes out when comparing follow-up with baseline. The remaining error (due to divergence from assumptions) is unknown, and there is no direct way to adjust for it.

With poverty likelihoods expressed as proportions between 0 and 1, the average-household-size-weighted average of the change in each scored household's poverty likelihood is −6.3 percentage points:

$$\frac{\left(\frac{5+6}{2}\right)\cdot(0.828-0.897)+\left(\frac{7+8}{2}\right)\cdot(0.737-0.795)}{\left(\frac{5+6}{2}\right)+\left(\frac{7+8}{2}\right)}\approx\frac{-0.380+-0.435}{13.0}\approx-0.063.$$

The estimated head-count poverty rate decreased (improved) by 6.3 *percentage points* (not by 6.3 *percent*) between baseline and follow-up.

For clarity—and because the time between interviews varies across scored households—this estimate should be annualized by dividing it by the average-household-size-weighted average of years between the two interviews:

$$\frac{\left(\frac{5+6}{2}\right)\cdot 3.17+\left(\frac{7+8}{2}\right)\cdot 2.88}{\left(\frac{8+7}{2}\right)+\left(\frac{5+6}{2}\right)}\approx\frac{17.44+21.60}{13}\approx 3.00 \text{ years}.$$

The annual, non-compounded rate of net change is then the percentage-point change in the poverty rate, divided by the average years between interviews:
−6.3 ÷ 3.00 ≈ −2.1 percentage points per year.[19] The negative change means that poverty decreased (improved).[20]

In practice, the calculations are done with the **ProveIt™-brand reporting and analysis tool** or a spreadsheet modelled on **Figure 11**.

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[19] *Percentage points* are distinct from *percentages*. On the one hand, if the baseline poverty rate is 50.0 percent, and if there is a 10.0-*percent* annual reduction in the poverty rate, then the poverty rate after one year is
0.50 · (1 − 0.10) = 0.450 = 45.0 percent, and the poverty rate after two years is
0.45 · (1 − 0.10) = 0.405 = 40.5 percent. On the other hand, if there is a 10.0-*percentage-point* annual reduction in poverty, then the rate after one year is
0.50 − 0.10 = 0.40 = 40 percent, and the rate after two years is
0.40 − 0.10 = 0.30 = 30 percent.

[20] Of course, such a large annual reduction in poverty is unrealistic, but this is just an example to show how the scorecard can be used to estimate change.

Figure 11: Spreadsheet calculation of estimated annual net change in the head-count poverty rate and in the annual net number of poor people who rose above a poverty line with one sample scored twice

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	ID	Interview date			Number of household members			Member-years	Score		Poverty likelihood (%)		Estimated net change in
2	participant of record	Baseline	Follow-up	Years between interviews	Baseline	Follow-up	Average:	between interviews	Baseline	Follow-up	Baseline	Follow-up	number of poor household members
3	1V0276FZ7	13-Jun-2022	13-Aug-2025	3.17 = (C3-B3)/365	5	6	5.50 = (E3+F3)/2	17.43 = D3*G3	27	29	89.7	82.8	−0.380 = G3*(L3-K3)/100
4	2W3120ZG8	30-Jun-2022	15-May-2025	2.88 = (C4-B4)/365	7	8	7.50 = (E4+F4)/2	21.58 = D4*G4	31	33	79.5	73.7	−0.435 = G4*(L4-K4)/100
5				**Average:**	6.0 = AVERAGE(E3:E4)	7.0 = AVERAGE(F3:F4)	**Sum:**	39.01 = SUM(H3:H4)					−0.815 = SUM(M3:M4)
6													
7						**Estimated net change in head-count poverty rate (percentage points), follow-up versus baseline:**								−6.3 = M5/(E5+F5)*100
8													
9								**Household-size-weighted average years between interviews:**					3.00 = H6/(E5+F5)
10													
11							**Estimated annual net change in head-count poverty rate (percentage points):**						−2.1 = M7/M9*100
12													
13									**Participating households at baseline:**				1,000
14									**Participating households at follow-up:**				700
15													
16								**Estimated average number of on-going participating people:**					5,450 = (E5*M13+F5*M14)/2
17													
18								**Estimated annual net change in the number of poor people:**					−114 = M16*M11/100
19	Rows of data are sorted by the ID of the participant of record.												

3.2.2 Number of poor people with one sample scored twice

For a pro-poor program, the bottom line is *not* the annual net change in the *poverty rate*. Rather, the bottom line is the annual net change in the *number of poor participants*.

To calculate this, the first step is to estimate the average number of household members in the population of on-going participants from baseline to follow-up, accounting for drop-out. In the example here, the population in 2022 of in-coming households in the calendar-year 2022 cohort was 1,000. By the end of the follow-up period of calendar-year 2025, 300 had dropped out, leaving 700 households from the 2022 cohort. If drop-out took place at a constant pace and was unrelated to changes in poverty,[21] then an estimate of the average number of on-going participating people is the equal-weighted average of the number of participating people among households interviewed at baseline and follow-up. In a given round,

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[21] This assumption rarely holds. On the one hand, the households that benefit most from a program—and thus those for whom participation is most likely to cause a faster-than-otherwise decrease in poverty—may also be the least-likely to drop out, leading to too-high estimates of the change in poverty due to participation. On the other hand, households whose poverty decreases may be more likely to drop out if the benefits of continued participation fall as poverty decreases, leading to too-low estimates of change. Unfortunately, there is no general way to adjust scorecard estimates to account for drop out that is related to changes in poverty. As in all decision-making, managers must use their experience and judgment to detect deviations from assumptions and then to account for them as best they can. This is true even though scorecard estimates are based on data and math. "Hard numbers" may not represent reality as accurately as they may seem to, and only a manager's knowledge of context can detect and account for this. Managers should discount unreliable estimates when they have reasoned, explicit arguments to do so (**Schreiner**, 2016a). Of course, discretion also opens the door to abuse; faced with unexpectedly low estimates of poverty reduction, managers might quietly sweep them under the rug or blame them on a slow economy (even though they would not attribute high estimates of poverty reduction to a roaring economy). Ironically and sadly, such attempts to make a program look good by hiding or excusing undesired results destroys the results' value as feedback, harming the program's ability to fulfill its mission. If a program's funders fail to act like owners, then its employees—not its participants—commonly become its *de facto* beneficiaries (**Schreiner**, 1997).

the number of participating people is the average household size for that round's interviewed households (in the example, 6.0 at baseline and 7.0 at follow-up), multiplied by the number of participating households in the population in the given round (1,000 at baseline and 700 at follow-up), divided by the number of survey rounds (two). In the example, this is $\frac{6.0 \cdot 1{,}000 + 7.0 \cdot 700}{1+1} = 5{,}450$ people.

The second and last step is to multiply the estimated annual change in the poverty rate (here, about −2.1 percentage points, or −0.021) by the estimated average number of on-going participants (here, 5,450). This gives an estimate of the annual net change in the number of poor people by 100% of the national line of $-0.021 \cdot 5{,}450 \approx -114$ people.[22] This negative change is a decrease (improvement) in poverty; there are about 114 fewer poor people in participating households in this cohort each year.

3.2.3 Estimating a program's impact

Estimating *change* is not the same as an estimating a program's *impact*. It stands to reason that program participation is a real force that does cause some change (be it an increase or decrease) in the poverty of participants. At the same time, it is equally logical to expect that a large share of any change in participants' poverty is caused by the many non-program forces that also affect participants. On its own, the scorecard is like a bathroom scale; it can tell whether you lost weight in the past year, but not how much of the loss is due to eating right and exercising versus removing your coat and shoes.

This point is often forgotten, confused, or ignored, so it bears repeating: the scorecard estimates change, but it does not—on its own—identify the causes of change. In particular, estimating the impact of program participation requires knowledge or assumptions about what would have happened to participants if they had not been participants. This must come from beyond the scorecard.

What is a program manager to do? After all, decision-making hinges on forecasts of the expected impacts of possible choices; a manager cannot pretend that merely estimating change is helpful without also inferring some cause-and-effect relationship. Yet there are diminishing returns to improving inferences of impact.

At a minimum, a program should compare its estimated annual net change in the poverty rate of its on-going participants to third-party estimates for the country overall or for its work area.

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[22] This is a net figure; some start above the line and end below it, and vice versa.

A program can also look for signs that participants value (or expect to value) its services. Is the number of in-coming participants high or increasing? Is the drop-out rate low or decreasing? Are drop-outs mostly due to dissatisfaction or graduation? Is participation voluntary, without being a condition for some other linked benefit? Is the program the sole provider in its niche and area?

In short, decision-makers in pro-poor programs are called to do what good decision-makers must always do: weigh data and knowledge from a number of perspectives and sources—including scorecard estimates, but not *only* scorecard estimates—to inform reasoned guesses as to more or less what share of observed changes are due to program participation. Of course, the inevitable need for human wisdom/art may be disingenuously invoked as a cover for decision processes that do not take a program's pro-poor mission to heart. This is why the "scientific method" —that is, being transparent about inputs and reasoning so as to facilitate productive review and debate—makes sense even (or perhaps especially) for business decisions.[23]

3.2.4 Poverty rate with two independent samples

Instead of interviewing the same sample of households at both baseline and follow-up, a program could draw a second, independent sample of households from the same population cohort as that from which the baseline sample was drawn.[24] The head-count poverty rate for on-going participants in this new follow-up sample is estimated in the same way as for the baseline sample.

Continuing the example, suppose that a third household and a fourth household are sampled at follow-up. The third household is interviewed on March 3, 2025. It has four members, a score of 28, and a poverty likelihood by 100% of the national line of 89.7 percent (**Figure 1**).

The fourth household is interviewed on April 4, 2025. It has three members, a score of 36, and a poverty likelihood of 65.6 percent.

At follow-up, the estimated head-count poverty rate is calculated in the same way as at baseline, that is, as the household-size-weighted average of the poverty likelihoods of the sampled households:

$$\frac{4 \cdot 0.897 + 3 \cdot 0.656}{4+3} \approx \frac{3.59 + 1.97}{7} \approx 0.794 = 79.4 \text{ percent.}$$

[23] Schreiner (**2016a** and **2014**).
[24] By chance, some households may end up in both samples, and that is fine.

The estimated annual net change in the head-count poverty rate of on-going participants is then the difference between the (unadjusted) poverty-rate estimates at follow-up (79.4 percent) versus at baseline (83.8 percent),[25] divided by the difference (in years) between the household-size-weighted average of follow-up interview dates (March 16, 2025) versus the household-size-weighted average of baseline interview dates (June 22, 2022). These two average dates differ by about 998 days or about 2.73 years.

The estimated annual net change in the head-count poverty rate is the difference between the poverty-rate estimates at follow-up versus baseline, divided by the difference in the average years between interviews in the two rounds. For 100% percent of the national line, this is about (79.4 − 83.8) ÷ 2.73 ≈ −1.6 percentage points per year.

In practice, the calculations are done with the **ProveIt™-brand reporting and analysis tool** or a spreadsheet modelled on **Figure 12**.

[25] With two independent samples, the estimation error in each of the two single-period estimates washes out, so it is not explicitly included in the calculation. Thus, the figure here is 83.8 percent, not 83.8 − (−3.1) = 86.9 percent.

Figure 12: Spreadsheet calculation of estimated annual net change in a head-count poverty rate and in the annual net number of poor people who rise above a poverty line with two independent samples

	A	B	C	D	E	F	G	H
1	**Survey**	**ID participant of record**	**Interview date**	**Number of household members**	**Interview date x Number of household members**	**Score**	**Poverty likelihood (%)**	**Estimated number of poor household members**
2	Baseline	1V0276FZ7	13-Jun-2022	5	05-Apr-2512 = C2*D2	27	89.7	4.49 = D2*G2/100
3	Baseline	2W3120ZG8	30-Jun-2022	7	29-Jun-2757 = C2*D2	31	79.5	5.57 = D3*G3/100
4	Follow-up	3XA76T21L	3-Mar-2025	4	10-Sep-2400 = C2*D2	28	89.7	3.59 = D4*G4/100
5	Follow-up	4Y8Y3EQS9	4-Apr-2025	3	13-Oct-2275 = C2*D2	36	65.6	1.97 = D5*G5/100
6		**Sum baseline:**		12 = SUM(D2:D3)				10.05 = SUM(H2:H3)
7		**Sum follow-up:**		7 = SUM(D4:D5)				5.56 = SUM(H4:H5)
8		**Average baseline:**		6.0 = AVERAGE(D2:D3)	22-Jun-2022 = SUM(E2:E3)/D6			
9		**Average follow-up:**		3.5 = AVERAGE(D4:D5)	16-Mar-2025 = SUM(E4:E5)/D7			
10								
11					**Estimated baseline poverty rate (%):**			83.8 = H6/D6*100
12					**Estimated follow-up poverty rate (%):**			79.4 = H7/D7*100
13								
14				**Average years between follow-up and baseline interviews:**				2.73 = (E9-E8)/365
15								
16			**Estimated annual net change in head-count poverty rate (percentage points):**					−1.6 = (H12-H11)/H14
17								
18					**Participating households at baseline:**			1,000
19					**Participating households at follow-up:**			700
20								
21				**Estimated average number of on-going participating people:**				4,225 = (D8*H18+D9*H19)/2
22								
23				**Estimated annual net change in the number of poor people:**				−68 = H21*H16/100
24	Rows of data are sorted by Survey, then by Interview date, then by the ID of the participant of record.							

3.2.5 Number of poor people with two independent samples

For a pro-poor program, the bottom line is not the annual net change in the poverty rate but rather the annual net change in the number of poor participants.

To calculate this, the first step is to estimate the average number of household members in the population of on-going households from baseline to follow-up, accounting for drop-out. In the example here, the population of the baseline 2022 cohort in 2022 is 1,000 in-coming households. By the end of the 2025 follow-up period, 300 households dropped out, leaving 700 from the 2022 cohort. If drop-out took place at a constant pace and was unrelated with changes in poverty, then an estimate of the average number of on-going participating people is the equal-weighted average of the number of participating people among households interviewed at baseline and follow-up. In a given round, the number of participating people is the average household size for that round's interviewed households (in our example, 6.0 at baseline and 3.5 at follow-up), multiplied by the number of participating households in the population in the given round (1,000 at baseline and 700 at follow-up), and divided by two (the number of rounds). This is

$$\frac{6.0 \cdot 1{,}000 + 3.5 \cdot 700}{1+1} = 4{,}225 \text{ people.}$$

The second and last step is to multiply the estimated annual net change in the head-count poverty rate (here, −1.6 percentage points, or −0.016) by the estimated number of on-going participants (here, 4,225). For 100% of the national line, this gives an annual net change in the number of poor people of about $-0.016 \cdot 4{,}225 \approx -68$ people per year. This negative change is a (non-compounded) decrease in poverty; the number of poor people in participating households decreases (improves) by about 68 each year.

Given the scorecard's assumptions, both approaches to estimating change over time (one sample scored twice, and two independent samples) are unbiased. In general, the two approaches give different estimates (as in this example) because they interview different households at different times. All else constant, scoring one sample twice has smaller margins of error. Still, there may be context-specific reasons (related to operational costs or non-sampling errors) to score two independent samples.

4. How to design scorecard surveys and samples

To design a scorecard survey and its sample, a program must decide:[26]

- **Who will do interviews**
- **Where and how to do interviews**
- **How to record responses and scores**
- **How to calculate estimates and report/analyze them**
- **Which participating households to interview**
- **How many participating households to interview**
- **How frequently to interview households**
- **Whether to track a population across multiple time periods**
- **Whether to interview the same participants twice**

Decisions should follow from the program's goals, the business issues to be informed, and the budget. The central goals of the design are to:

- Inform issues that matter to the program
- Make sure that the sample is representative of a well-defined population

4.1 Who will do interviews

The enumerators who interview participating households must be trained to follow the **Interview Guide**. Enumerators may be:

- Program employees
- Third-party contractors

4.2 Where and how to do interviews

Interviews should be:

- In-person, and
- At the sampled household's dwelling, and
- Done by an enumerator trained to follow the **Interview Guide**

This is the only recommended way. It follows SSL in the 2018 IHS, so it provides the most-accurate and most-consistent data (and thus the best estimates).

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[26] **IRIS Center** (2007) and **Toohig** (2008) also discuss this topic, covering sampling, budgeting, training, logistics, interviewing, piloting, and recording data.

Of course, it is possible to do interviews in non-recommended ways such as:

- Without an enumerator (such as by respondents' filling out paper or web forms on their own or responding to questions sent via e-mail, texts, or robo-calls)
- Away from home (such as at a program's service point or a local meeting place)
- Not in-person (such as with an enumerator by phone)

While non-recommended methods may reduce costs, they also affect responses[27] and thus reduce the accuracy of estimates. This is why interviewing by a trained enumerator at the dwelling is recommended.

In some contexts—such as when a program's service agents do not already visit participants at their dwelling anyway as part of their normal work—a program might be willing to trade some accuracy for a lower-cost, non-recommended approach. The business wisdom of this choice depends on context-specific factors that each program must judge for itself. To judge carefully, a program that is considering a non-recommended method should do a small test to see how responses differ when compared with a trained enumerator at the dwelling. Furthermore, all reporting should discuss the possible consequences of the non-recommended method.

4.3 How to record responses and scores

Responses and scores may be recorded by enumerators on:

- Paper, and then keyed into a database or spreadsheet at an office
- A device running a **browser-based app** and then uploaded to a database[28]

4.4 How to calculate estimates and report/analyze them

Analysts can calculate estimates by plugging data into spreadsheets (following the examples in Section **3**) or with the **ProveIt™-brand reporting and analysis tool**. **Schreiner** (2014) describes how to report and analyze scorecard estimates.

[27] **Schreiner**, 2015.

[28] **Scorocs** can help users set up a mobile, paper-less data-entry system or to transfer data from paper forms into a database at the office. Support is also available for calculating estimates and for reporting and analysis.

4.5 Which participating households to interview

Given a population relevant for a particular business decision, the participating households to be interviewed can be:

- All relevant participants (a census)
- A representative sample of relevant participants
- All relevant participants in a representative sample of relevant service points and/or in a representative sample of relevant service agents
- A representative sample of relevant participants in a representative sample of relevant service points and/or in a representative sample of relevant service agents

A census is rarely appropriate, except for very small programs. Nevertheless, it may be less costly to interview all in-coming households as a standard part of in-take rather than managing who gets scored and who does not.

4.6 How many participating households to interview

If not determined by other factors, the number of participating households to interview can be derived from sample-size formulas to achieve a desired confidence level for a desired margin of error (**Annex 6**).

The focus of sample design, however, should be less on having enough interviews to achieve some arbitrary level of statistical significance and more on having a representative sample from a well-defined population that is relevant for informing decisions that matter to the program.

In practice, non-sampling errors in implementation and in the definition of the population often matter at least as much as errors due to smaller samples. Programs are often concerned about sample size, but there is no point in deriving the ideal sample size unless proportional effort goes to mitigating other sources of error and then accounting for margins of error in the analysis stage. Of course, larger samples produce more-reliable estimates. In practice, however, almost no one reports or considers margins of error (even though they all should), and estimates based on at least 1,000 interviews will rarely raise eyebrows (**Annex 6**).

4.7 How frequently to interview households

The frequency of scorecard surveys can be:

- As a once-off project (precluding estimating change)
- Every three years (or at any other fixed or variable time interval, allowing estimating change)
- Each time a service agent visits a participant at home (allowing estimating change)

4.8 Whether to track a population across multiple time periods

The scorecard can estimate changes in poverty across periods, but not all programs want to do this. Some programs want to assess poverty only for in-coming participants.

4.9 Whether to interview the same participants twice

If a scorecard is to be applied more than once in order to estimate changes in poverty, then it can be applied with:

- One sample of participants, all of whom are scored at both baseline and follow-up
- Two samples of participants from the same population cohort, with the first sample scored at baseline and the second sample scored at follow-up.

All else constant, scoring one sample twice gives smaller margins of error. In addition, this approach may be less costly at follow-up, given that the sampled households have already been tracked down at baseline. Also, the follow-up round could be based on a random sample of the households interviewed at baseline.

4.10 Example of survey design in Bangladesh

An example set of choices is illustrated by the microfinance arms of BRAC and ASA, two pro-poor titans in Bangladesh who each have
about 7 million participating households and who made plans to apply the scorecard for Bangladesh[29] with a sample of about 25,000 participants each.

Their design is that all loan officers in a random sample of branches score all participants each time these loan officers visit a homestead (about once a year) as part of their standard due diligence prior to loan disbursement. The loan officers record responses on paper in the field before sending the forms to a central office to be entered into a database and converted to poverty likelihoods for further analysis.

[29] **Schreiner**, 2013.

5. How to use scores for targeting

When a program uses the scorecard for segmenting (*targeting*) participants for differentiated treatment based on poverty, people in households with scores at or below a program-selected cut-off are labeled *targeted* and given one type of treatment. People in households with scores above the cut-off are labeled *non-targeted* and given another type of treatment.[30]

Households that score at or below a given cut-off should be labeled as *targeted*,[31] not as *poor*.[32]

Targeting is successful to the extent to which poor people truly below a poverty line are targeted (*inclusion*) or non-poor people truly above a poverty line are not targeted (*exclusion*).

Of course, no poverty-assessment tool is perfect, and targeting is unsuccessful to the extent to which poor people truly below a poverty line are not targeted (*undercoverage*) or non-poor people truly above a poverty line are targeted (*leakage*).

---

[30] *Targeting status* (having a score at or below a targeting cut-off) is not the same concept as *poverty status* (having consumption expenditure below a poverty line). Poverty status is a fact that is defined by whether consumption expenditure is below a poverty line as directly measured by a survey. In contrast, targeting status is a program's policy choice that depends on a cut-off and on an indirect estimate from a scorecard.

[31] Other labels can be meaningful as long as they describe the segment and do not confuse targeting status (having a score below a program-selected cut-off) with poverty status (having consumption expenditure below an externally-defined poverty line). Examples of such labels include: *Groups A, B, and C*; *People with scores of 29 or less, 30 to 69, or 70 or more*; and *People who qualify for reduced fees, or who do not qualify*.

[32] After all, it is very unlikely that all targeted households are poor (their consumption expenditure is below a given poverty line). In the context of the scorecard, the terms *poor* and *non-poor* have specific definitions that are based on consumption expenditure and a poverty line. Using these same terms for targeting status is incorrect and misleading.

Figure 13 below depicts these four possible targeting outcomes. Targeting accuracy varies by the cut-off score. A higher cut-off has better inclusion and better undercoverage (but worse exclusion and worse leakage). In contrast, a lower cut-off has worse inclusion and worse undercoverage (but better exclusion and better leakage).

Figure 13: Possible targeting outcomes

Observed poverty status		Targeting segment: Targeted	Targeting segment: Not targeted
Poor		**Inclusion** Poor correctly targeted	**Undercoverage** Poor mistakenly not targeted
Non-poor		**Leakage** Non-poor mistakenly targeted	**Exclusion** Non-poor correctly not targeted

Programs should weigh these trade-offs when setting a cut-off. A formal way to do this is to assign net benefits—based on a program's values and mission—to each of the four possible targeting outcomes and then to choose the cut-off that maximizes the sum of net benefits.[33]

The five tables below show the scorecard's targeting outcomes by poverty line and by score cut-off for people in Sierra Leone:

- Figure 14: Inclusion (% people who are poor and correctly targeted)
- Figure 15: Undercoverage (% people who are poor but mistakenly not targeted)
- Figure 16: Leakage (% people who are not poor but mistakenly targeted)
- Figure 17: Exclusion (% people who are not poor and correctly not targeted)
- Figure 18: Hit rate (% people correctly targeted, that is, inclusion plus exclusion)

For a given score cut-off, each of the five figures below also show the share of all people who are targeted.

[33] Adams and Hand, 2000; Hoadley and Oliver, 1998.

Figure 14: Inclusion (% people who are poor and correctly targeted)

Targeting cut-off	% all people who are targeted	Inclusion (%)														
		National lines				Intl. 2011 PPP lines				Percentile-based lines						
		Food	100%	150%	200%	$1.90	$3.20	$5.50	$21.70	10th	20th	40th	50th	60th	80th	90th
<=13	5.0	2.9	4.9	4.9	4.9	4.7	4.9	4.9	5.0	2.6	3.7	4.6	4.9	4.9	4.9	4.9
<=18	9.9	4.4	9.6	9.8	9.8	9.0	9.8	9.8	9.9	3.9	6.0	8.9	9.5	9.7	9.9	9.8
<=22	15.6	6.3	14.9	15.5	15.5	13.7	15.5	15.5	15.6	5.6	9.0	13.5	14.6	15.1	15.5	15.5
<=25	22.0	7.8	20.4	21.7	21.8	18.3	21.7	21.9	22.0	6.9	11.4	18.0	19.8	20.8	21.8	21.7
<=28	28.3	9.3	25.5	28.0	28.1	22.6	27.9	28.2	28.3	7.7	13.3	22.2	24.6	26.4	27.9	28.0
<=30	33.2	10.0	29.7	32.8	32.9	26.0	32.7	33.0	33.2	8.3	14.9	25.3	28.4	30.8	32.7	32.9
<=32	38.1	10.5	33.5	37.5	37.8	29.0	37.3	37.9	38.1	8.6	16.4	28.2	31.8	34.7	37.5	37.7
<=35	44.5	11.3	38.3	43.6	44.1	32.6	43.4	44.2	44.4	9.0	17.8	31.5	35.9	39.8	43.5	44.1
<=38	50.5	11.7	42.2	49.4	50.1	35.1	48.8	50.2	50.5	9.3	18.3	33.4	39.4	44.0	49.2	50.1
<=40	54.6	12.0	45.3	53.4	54.2	37.3	52.6	54.3	54.6	9.3	18.9	35.2	41.9	47.3	53.2	54.1
<=43	59.9	12.2	48.1	58.4	59.4	39.0	57.5	59.6	59.9	9.5	19.1	36.8	44.3	50.5	58.3	59.4
<=46	66.1	12.2	50.4	63.4	65.3	40.6	62.0	65.7	66.1	9.5	19.4	38.3	46.4	53.4	63.2	65.3
<=49	70.6	12.2	52.6	67.0	69.7	41.7	65.3	70.2	70.6	9.5	19.4	39.1	48.0	55.9	66.8	69.7
<=52	76.7	12.2	54.1	71.5	75.1	42.3	69.3	75.7	76.7	9.5	19.4	39.5	48.8	57.5	71.3	75.1
<=55	80.7	12.3	54.9	74.1	78.4	42.7	71.3	79.4	80.7	9.5	19.5	39.9	49.3	58.4	74.0	78.6
<=58	86.2	12.4	55.7	77.0	82.5	42.9	73.9	84.3	86.2	9.5	19.5	40.1	49.6	59.2	76.9	82.9
<=64	91.2	12.4	56.2	79.2	85.9	43.0	75.3	88.3	91.2	9.5	19.5	40.2	49.7	59.7	78.9	86.5
<=74	96.5	12.4	56.4	80.8	88.8	43.0	76.2	91.7	96.5	9.5	19.5	40.2	49.8	59.9	80.2	89.4
<=100	100.0	12.4	56.4	81.0	89.6	43.0	76.3	92.6	99.9	9.5	19.5	40.2	49.8	59.9	80.4	90.0

Scorecard applied to the validation sample.

Figure 15: Undercoverage (% people who are poor but mistakenly not targeted)

Targeting cut-off	% all people who are targeted	Undercoverage (%)														
		National lines				Intl. 2011 PPP lines				Percentile-based lines						
		Food	100%	150%	200%	$1.90	$3.20	$5.50	$21.70	10th	20th	40th	50th	60th	80th	90th
<=13	5.0	9.5	51.5	76.1	84.7	38.4	71.4	87.7	94.9	6.9	15.8	35.6	44.9	55.0	75.5	85.1
<=18	9.9	8.0	46.8	71.2	79.8	34.0	66.5	82.8	90.0	5.6	13.5	31.3	40.3	50.2	70.6	80.2
<=22	15.6	6.1	41.5	65.6	74.1	29.3	60.9	77.1	84.3	3.9	10.5	26.7	35.2	44.8	65.0	74.5
<=25	22.0	4.5	35.9	59.3	67.8	24.7	54.6	70.7	77.9	2.6	8.1	22.2	30.0	39.1	58.7	68.3
<=28	28.3	3.1	30.8	53.0	61.5	20.4	48.5	64.4	71.6	1.9	6.2	18.0	25.2	33.5	52.5	62.0
<=30	33.2	2.3	26.7	48.2	56.7	17.1	43.7	59.6	66.7	1.2	4.6	14.9	21.4	29.1	47.7	57.1
<=32	38.1	1.9	22.8	43.5	51.8	14.1	39.0	54.7	61.8	1.0	3.1	12.0	18.0	25.2	42.9	52.3
<=35	44.5	1.1	18.0	37.5	45.5	10.5	33.0	48.4	55.5	0.5	1.7	8.7	13.9	20.1	36.9	45.9
<=38	50.5	0.7	14.2	31.6	39.5	7.9	27.6	42.4	49.4	0.3	1.2	6.8	10.4	15.9	31.2	39.9
<=40	54.6	0.4	11.1	27.6	35.4	5.8	23.7	38.3	45.3	0.2	0.6	5.0	7.9	12.6	27.2	35.9
<=43	59.9	0.2	8.3	22.6	30.2	4.0	18.9	33.0	40.0	0.1	0.4	3.4	5.5	9.4	22.1	30.6
<=46	66.1	0.1	5.9	17.6	24.4	2.4	14.3	26.9	33.8	0.1	0.1	1.9	3.4	6.5	17.2	24.7
<=49	70.6	0.1	3.7	14.0	19.9	1.3	11.0	22.4	29.3	0.1	0.1	1.1	1.8	4.0	13.6	20.3
<=52	76.7	0.1	2.3	9.6	14.5	0.7	7.0	16.9	23.2	0.0	0.1	0.7	1.0	2.4	9.1	14.9
<=55	80.7	0.1	1.5	6.9	11.2	0.3	5.0	13.2	19.2	0.0	0.0	0.3	0.5	1.5	6.5	11.4
<=58	86.2	0.0	0.7	4.0	7.1	0.2	2.4	8.3	13.7	0.0	0.0	0.2	0.2	0.7	3.5	7.1
<=64	91.2	0.0	0.2	1.8	3.7	0.0	1.0	4.3	8.7	0.0	0.0	0.0	0.1	0.2	1.6	3.5
<=74	96.5	0.0	0.0	0.2	0.8	0.0	0.1	0.9	3.4	0.0	0.0	0.0	0.0	0.0	0.2	0.6
<=100	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Scorecard applied to the validation sample.

Figure 16: Leakage (% people who are not poor but mistakenly targeted)

Targeting cut-off	% all people who are targeted	Leakage (%)														
		National lines				Intl. 2011 PPP lines				Percentile-based lines						
		Food	100%	150%	200%	$1.90	$3.20	$5.50	$21.70	10th	20th	40th	50th	60th	80th	90th
<=13	5.0	2.2	0.1	0.1	0.1	0.4	0.1	0.1	0.0	2.4	1.4	0.4	0.1	0.1	0.1	0.1
<=18	9.9	5.5	0.3	0.1	0.1	0.9	0.1	0.1	0.0	6.0	3.9	1.1	0.5	0.3	0.1	0.1
<=22	15.6	9.3	0.7	0.1	0.1	1.9	0.1	0.1	0.0	10.0	6.6	2.1	1.0	0.5	0.1	0.1
<=25	22.0	14.2	1.6	0.3	0.2	3.7	0.3	0.1	0.0	15.1	10.6	4.0	2.2	1.2	0.3	0.3
<=28	28.3	19.0	2.8	0.3	0.2	5.7	0.4	0.1	0.0	20.6	15.0	6.1	3.7	1.9	0.4	0.3
<=30	33.2	23.2	3.6	0.4	0.3	7.2	0.5	0.2	0.0	24.9	18.4	7.9	4.9	2.4	0.5	0.4
<=32	38.1	27.6	4.6	0.6	0.3	9.2	0.8	0.2	0.0	29.6	21.8	9.9	6.4	3.5	0.7	0.4
<=35	44.5	33.2	6.1	0.9	0.3	11.9	1.1	0.2	0.0	35.4	26.7	13.0	8.6	4.7	1.0	0.4
<=38	50.5	38.8	8.3	1.1	0.4	15.4	1.7	0.3	0.0	41.2	32.2	17.1	11.1	6.5	1.3	0.4
<=40	54.6	42.6	9.3	1.2	0.4	17.3	2.0	0.3	0.0	45.3	35.7	19.4	12.7	7.3	1.4	0.5
<=43	59.9	47.7	11.9	1.5	0.5	20.9	2.5	0.3	0.0	50.5	40.8	23.2	15.7	9.5	1.7	0.6
<=46	66.1	53.9	15.7	2.7	0.8	25.5	4.1	0.4	0.0	56.6	46.7	27.8	19.7	12.7	3.0	0.8
<=49	70.6	58.4	18.0	3.6	0.9	28.9	5.3	0.4	0.0	61.1	51.2	31.6	22.6	14.8	3.9	0.9
<=52	76.7	64.5	22.7	5.3	1.7	34.4	7.4	1.0	0.0	67.2	57.3	37.2	27.9	19.3	5.4	1.6
<=55	80.7	68.5	25.8	6.7	2.3	38.0	9.4	1.4	0.0	71.2	61.3	40.8	31.4	22.3	6.8	2.1
<=58	86.2	73.9	30.6	9.2	3.8	43.4	12.3	1.9	0.0	76.7	66.8	46.2	36.7	27.0	9.4	3.4
<=64	91.2	78.8	35.0	11.9	5.2	48.2	15.9	2.9	0.0	81.7	71.7	51.0	41.5	31.5	12.3	4.7
<=74	96.5	84.1	40.1	15.7	7.7	53.4	20.3	4.8	0.0	87.0	77.0	56.3	46.7	36.6	16.2	7.1
<=100	100.0	87.6	43.6	19.0	10.4	57.0	23.7	7.4	0.1	90.5	80.5	59.8	50.2	40.1	19.6	10.0

Scorecard applied to the validation sample.

Figure 17: Exclusion (% people who are not poor and correctly not targeted)

Targeting cut-off	% all people who are targeted	Exclusion (%)														
		National lines				Intl. 2011 PPP lines				Percentile-based lines						
		Food	100%	150%	200%	$1.90	$3.20	$5.50	$21.70	10th	20th	40th	50th	60th	80th	90th
<=13	5.0	85.5	43.5	18.9	10.3	56.6	23.6	7.3	0.1	88.1	79.2	59.4	50.1	40.0	19.5	9.9
<=18	9.9	82.1	43.3	18.9	10.3	56.0	23.6	7.3	0.1	84.4	76.6	58.7	49.7	39.8	19.5	9.9
<=22	15.6	78.3	42.9	18.8	10.3	55.1	23.5	7.3	0.1	80.5	73.9	57.7	49.2	39.6	19.4	9.9
<=25	22.0	73.4	42.0	18.7	10.2	53.3	23.4	7.3	0.1	75.4	69.9	55.8	48.0	38.9	19.3	9.7
<=28	28.3	68.6	40.9	18.6	10.2	51.3	23.2	7.3	0.1	69.8	65.5	53.7	46.5	38.2	19.2	9.7
<=30	33.2	64.4	40.1	18.5	10.1	49.7	23.1	7.2	0.1	65.6	62.2	51.9	45.4	37.7	19.1	9.6
<=32	38.1	60.0	39.0	18.3	10.1	47.8	22.9	7.2	0.1	60.9	58.7	49.8	43.8	36.7	18.9	9.6
<=35	44.5	54.5	37.5	18.1	10.1	45.1	22.6	7.2	0.1	55.0	53.8	46.8	41.6	35.5	18.6	9.6
<=38	50.5	48.8	35.4	17.9	10.0	41.6	21.9	7.1	0.1	49.2	48.3	42.7	39.1	33.6	18.3	9.6
<=40	54.6	45.0	34.3	17.8	10.0	39.6	21.7	7.1	0.1	45.2	44.8	40.4	37.5	32.8	18.1	9.5
<=43	59.9	39.9	31.8	17.5	9.9	36.0	21.2	7.1	0.1	40.0	39.7	36.6	34.5	30.6	17.9	9.4
<=46	66.1	33.8	28.0	16.3	9.6	31.5	19.6	7.0	0.1	33.9	33.8	32.0	30.5	27.4	16.6	9.2
<=49	70.6	29.2	25.7	15.4	9.4	28.1	18.4	7.0	0.1	29.3	29.3	28.2	27.6	25.4	15.7	9.1
<=52	76.7	23.1	20.9	13.7	8.7	22.6	16.2	6.4	0.1	23.2	23.2	22.6	22.3	20.8	14.1	8.4
<=55	80.7	19.2	17.8	12.3	8.0	18.9	14.2	6.0	0.1	19.3	19.2	18.9	18.8	17.8	12.7	7.9
<=58	86.2	13.8	13.1	9.8	6.6	13.6	11.3	5.5	0.1	13.8	13.7	13.6	13.5	13.1	10.2	6.6
<=64	91.2	8.8	8.6	7.0	5.1	8.8	7.8	4.5	0.1	8.8	8.8	8.8	8.8	8.6	7.3	5.3
<=74	96.5	3.5	3.5	3.3	2.7	3.5	3.4	2.6	0.1	3.5	3.5	3.5	3.5	3.5	3.3	2.9
<=100	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Scorecard applied to the validation sample.

Figure 18: Hit rate (% people correctly targeted, that is, inclusion plus exclusion)

Targeting cut-off	% all people who are targeted	Hit rate (= Inclusion + Exclusion) (%)														
		National lines				Intl. 2011 PPP lines				Percentile-based lines						
		Food	100%	150%	200%	$1.90	$3.20	$5.50	$21.70	10th	20th	40th	50th	60th	80th	90th
<=13	5.0	88.4	48.4	23.8	15.2	61.2	28.5	12.2	5.1	90.7	82.8	64.0	55.0	44.9	24.4	14.8
<=18	9.9	86.5	52.9	28.7	20.1	65.1	33.4	17.1	10.0	88.4	82.6	67.6	59.2	49.5	29.3	19.7
<=22	15.6	84.7	57.8	34.3	25.8	68.8	39.0	22.8	15.6	86.1	83.0	71.2	63.8	54.6	34.9	25.3
<=25	22.0	81.3	62.5	40.4	32.0	71.6	45.1	29.2	22.1	82.3	81.3	73.8	67.8	59.7	41.1	31.5
<=28	28.3	77.9	66.4	46.6	38.3	73.9	51.1	35.5	28.4	77.5	78.9	75.9	71.2	64.7	47.1	37.8
<=30	33.2	74.5	69.7	51.3	43.1	75.7	55.8	40.3	33.3	73.9	77.0	77.2	73.7	68.5	51.8	42.5
<=32	38.1	70.5	72.6	55.9	47.9	76.7	60.2	45.1	38.2	69.5	75.1	78.0	75.6	71.4	56.4	47.3
<=35	44.5	65.8	75.8	61.6	54.2	77.7	66.0	51.4	44.5	64.0	71.6	78.3	77.5	75.3	62.2	53.7
<=38	50.5	60.5	77.6	67.3	60.1	76.7	70.7	57.4	50.5	58.5	66.7	76.1	78.5	77.6	67.5	59.6
<=40	54.6	57.0	79.6	71.1	64.1	76.9	74.3	61.5	54.7	54.5	63.7	75.6	79.4	80.1	71.4	63.6
<=43	59.9	52.1	79.8	75.9	69.3	75.0	78.7	66.7	60.0	49.4	58.8	73.4	78.8	81.1	76.1	68.8
<=46	66.1	46.0	78.4	79.8	74.8	72.1	81.6	72.7	66.1	43.3	53.2	70.4	76.9	80.8	79.8	74.4
<=49	70.6	41.5	78.3	82.4	79.1	69.8	83.7	77.2	70.7	38.8	48.6	67.3	75.6	81.2	82.5	78.8
<=52	76.7	35.4	75.0	85.2	83.8	64.9	85.5	82.1	76.8	32.7	42.6	62.1	71.1	78.3	85.5	83.5
<=55	80.7	31.5	72.7	86.4	86.4	61.7	85.6	85.4	80.8	28.8	38.7	58.8	68.1	76.2	86.7	86.5
<=58	86.2	26.1	68.7	86.8	89.1	56.5	85.2	89.8	86.3	23.3	33.2	53.6	63.1	72.3	87.1	89.5
<=64	91.2	21.2	64.8	86.3	91.1	51.8	83.1	92.8	91.2	18.3	28.3	49.0	58.5	68.3	86.1	91.7
<=74	96.5	15.9	59.9	84.1	91.5	46.6	79.6	94.2	96.5	13.0	23.0	43.7	53.3	63.4	83.6	92.2
<=100	100.0	12.4	56.4	81.0	89.6	43.0	76.3	92.6	99.9	9.5	19.5	40.2	49.8	59.9	80.4	90.0

Scorecard applied to the validation sample.

For an example cut-off of 43 or less in the previous figures, 59.9 percent of all people in Sierra Leone would be targeted, and outcomes for 100% of the national line in the validation sample would be:

- Inclusion: 48.1 percent are below the line and correctly targeted
- Undercoverage: 8.3 percent are below the line and mistakenly not targeted
- Leakage: 11.9 percent are above the line and mistakenly targeted
- Exclusion: 31.8 percent are above the line and correctly not targeted

Increasing the cut-off to 46 or less increases the share of of all people targeted to 66.1 percent. The higher cut-off improves inclusion and undercoverage but worsens leakage and exclusion:

- Inclusion: 50.4 percent are below the line and correctly targeted
- Undercoverage: 5.9 percent are below the line and mistakenly not targeted
- Leakage: 15.7 percent are above the line and mistakenly targeted
- Exclusion: 28.0 percent are above the line and correctly not targeted

Which cut-off is preferred depends on the sum of net benefits. If each targeting outcome has a per-person benefit or cost, then total net benefit for a given cut-off is:

Benefit per person correctly included	x	People correctly included	−
Cost per person mistakenly not covered	x	People mistakenly not covered	−
Cost per person mistakenly leaked	x	People mistakenly leaked	+
Benefit per person correctly excluded	x	People correctly excluded.	

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

- Assign benefits and costs to possible outcomes, based on its values and mission
- Tally total net benefits for each cut-off using **Figure 14** to **Figure 17** above for a chosen poverty line
- Select the cut-off with the highest total net benefit

The most difficult step is assigning benefits and costs to targeting outcomes. A pro-poor program that uses targeting—with or without the scorecard—should thoughtfully consider how it values successful inclusion and exclusion versus errors of undercoverage and leakage. It is healthy to go through a process of thinking explicitly and intentionally about how targeting outcomes are valued.

A common choice of benefits and costs is the *hit rate*, where total net benefit is the number of people correctly included or correctly excluded:

Hit rate =	1	x	People correctly included	−
	0	x	People mistakenly undercovered	−
	0	x	People mistakenly leaked	+
	1	x	People correctly excluded.	

Figure 18 shows the scorecard's hit rate for all cut-offs and poverty lines. For the example of 100% of the national line in the validation sample, total net benefit under the hit rate for a cut-off of 43 or less is 79.8 percent. That is, about four in five people in Sierra Leone are correctly classified.

The hit rate weighs the successful inclusion of people below a poverty line the same as the successful exclusion of people above the line. If a program values inclusion more (say, twice as much) than exclusion, then it can reflect this by setting the benefit for inclusion to 2 and the benefit for exclusion to 1. Then the chosen cut-off will maximize (2 x people correctly included) + (1 x people correctly excluded).

As an alternative to assigning benefits and costs to targeting outcomes and then setting a score cut-off to maximize net benefits, a pro-poor program could set cut-offs based on aspects of targeting accuracy from the three figures below:

- **Figure 19: Share of targeted people who are poor**
- **Figure 20: Poor people correctly targeted per non-poor person mistakenly targeted**
- **Figure 21: Share of poor people who are targeted**

Figure 19: Share of targeted people who are poor

Targeting cut-off	% all people who are targeted	% targeted people who are poor														
		National lines				Intl. 2011 PPP lines				Percentile-based lines						
		Food	100%	150%	200%	$1.90	$3.20	$5.50	$21.70	10th	20th	40th	50th	60th	80th	90th
<=13	5.0	57.2	97.5	97.9	97.9	92.7	97.9	97.9	99.2	52.2	73.0	92.2	97.5	97.5	97.9	97.9
<=18	9.9	44.3	96.6	98.9	98.9	90.8	98.9	98.9	99.6	39.4	60.4	89.2	95.3	97.2	98.9	98.9
<=22	15.6	40.5	95.4	99.1	99.3	88.1	99.1	99.3	99.8	35.9	57.9	86.5	93.7	96.5	99.1	99.1
<=25	22.0	35.6	92.8	98.7	99.1	83.3	98.7	99.5	99.8	31.4	51.9	81.8	89.8	94.6	98.7	98.7
<=28	28.3	32.7	90.2	98.8	99.3	79.9	98.5	99.6	99.9	27.1	47.1	78.5	87.0	93.3	98.6	99.0
<=30	33.2	30.2	89.3	98.6	99.2	78.2	98.4	99.5	99.9	25.0	44.7	76.2	85.4	92.7	98.5	98.9
<=32	38.1	27.5	87.9	98.3	99.2	75.9	97.9	99.4	99.9	22.5	42.9	73.9	83.2	90.9	98.2	99.0
<=35	44.5	25.4	86.2	98.0	99.3	73.3	97.6	99.5	99.9	20.3	40.0	70.8	80.7	89.5	97.9	99.1
<=38	50.5	23.1	83.6	97.8	99.3	69.5	96.6	99.5	99.9	18.4	36.3	66.2	78.0	87.2	97.4	99.2
<=40	54.6	21.9	82.9	97.8	99.2	68.3	96.4	99.5	99.9	17.1	34.6	64.5	76.7	86.6	97.4	99.1
<=43	59.9	20.4	80.2	97.5	99.2	65.1	95.9	99.5	99.9	15.8	31.9	61.4	73.8	84.2	97.1	99.0
<=46	66.1	18.5	76.3	96.0	98.7	61.5	93.8	99.4	99.9	14.3	29.3	58.0	70.1	80.8	95.5	98.7
<=49	70.6	17.3	74.5	94.9	98.7	59.1	92.5	99.4	99.9	13.4	27.4	55.3	68.0	79.1	94.5	98.7
<=52	76.7	16.0	70.4	93.1	97.8	55.2	90.3	98.7	99.9	12.4	25.3	51.5	63.6	74.9	92.9	97.9
<=55	80.7	15.2	68.0	91.7	97.1	52.9	88.3	98.3	100.0	11.8	24.1	49.4	61.1	72.3	91.5	97.4
<=58	86.2	14.3	64.6	89.3	95.6	49.7	85.7	97.8	100.0	11.1	22.6	46.4	57.5	68.7	89.1	96.1
<=64	91.2	13.6	61.6	86.9	94.2	47.2	82.6	96.8	100.0	10.5	21.4	44.1	54.5	65.4	86.5	94.8
<=74	96.5	12.8	58.4	83.8	92.0	44.6	79.0	95.0	100.0	9.9	20.2	41.7	51.6	62.1	83.2	92.6
<=100	100.0	12.4	56.4	81.0	89.6	43.0	76.3	92.6	99.9	9.5	19.5	40.2	49.8	59.9	80.4	90.0

Scorecard applied to the validation sample.

Figure 20: Poor people correctly targeted per non-poor person mistakenly targeted

Targeting cut-off	% all people who are targeted	Poor people targeted per non-poor person targeted														
		National lines				Intl. 2011 PPP lines				Percentile-based lines						
		Food	100%	150%	200%	$1.90	$3.20	$5.50	$21.70	10th	20th	40th	50th	60th	80th	90th
<=13	5.0	1.3:1	39.5:1	46.9:1	46.9:1	12.7:1	46.9:1	46.9:1	128.8:1	1.1:1	2.7:1	11.8:1	39.5:1	39.5:1	46.9:1	46.9:1
<=18	9.9	0.8:1	28.3:1	93.8:1	93.8:1	9.8:1	93.8:1	93.8:1	255.7:1	0.7:1	1.5:1	8.3:1	20.2:1	35.3:1	93.8:1	93.8:1
<=22	15.6	0.7:1	20.6:1	112.0:1	147.6:1	7.4:1	112.0:1	147.6:1	401.5:1	0.6:1	1.4:1	6.4:1	14.9:1	27.6:1	112.0:1	112.0:1
<=25	22.0	0.6:1	12.9:1	77.8:1	111.0:1	5.0:1	77.8:1	208.8:1	567.2:1	0.5:1	1.1:1	4.5:1	8.8:1	17.4:1	77.8:1	77.8:1
<=28	28.3	0.5:1	9.3:1	82.4:1	143.0:1	4.0:1	66.0:1	268.7:1	729.5:1	0.4:1	0.9:1	3.7:1	6.7:1	14.0:1	70.9:1	100.3:1
<=30	33.2	0.4:1	8.3:1	73.1:1	122.3:1	3.6:1	61.5:1	185.9:1	856.1:1	0.3:1	0.8:1	3.2:1	5.8:1	12.8:1	65.1:1	93.3:1
<=32	38.1	0.4:1	7.3:1	58.9:1	119.3:1	3.2:1	46.7:1	168.2:1	983.3:1	0.3:1	0.8:1	2.8:1	5.0:1	10.0:1	54.2:1	94.4:1
<=35	44.5	0.3:1	6.3:1	48.6:1	139.2:1	2.7:1	40.6:1	196.2:1	1,146.1:1	0.3:1	0.7:1	2.4:1	4.2:1	8.5:1	45.8:1	110.2:1
<=38	50.5	0.3:1	5.1:1	44.6:1	136.5:1	2.3:1	28.4:1	199.1:1	1,301.9:1	0.2:1	0.6:1	2.0:1	3.5:1	6.8:1	37.5:1	117.3:1
<=40	54.6	0.3:1	4.9:1	43.5:1	127.7:1	2.2:1	26.6:1	198.7:1	1,408.3:1	0.2:1	0.5:1	1.8:1	3.3:1	6.5:1	37.2:1	106.4:1
<=43	59.9	0.3:1	4.0:1	38.6:1	118.5:1	1.9:1	23.2:1	188.6:1	1,545.9:1	0.2:1	0.5:1	1.6:1	2.8:1	5.3:1	34.0:1	101.3:1
<=46	66.1	0.2:1	3.2:1	23.9:1	78.6:1	1.6:1	15.1:1	173.3:1	1,704.5:1	0.2:1	0.4:1	1.4:1	2.3:1	4.2:1	21.4:1	78.9:1
<=49	70.6	0.2:1	2.9:1	18.5:1	74.8:1	1.4:1	12.3:1	165.0:1	1,821.3:1	0.2:1	0.4:1	1.2:1	2.1:1	3.8:1	17.2:1	75.8:1
<=52	76.7	0.2:1	2.4:1	13.5:1	45.3:1	1.2:1	9.3:1	76.2:1	1,979.2:1	0.1:1	0.3:1	1.1:1	1.7:1	3.0:1	13.1:1	45.7:1
<=55	80.7	0.2:1	2.1:1	11.1:1	33.6:1	1.1:1	7.6:1	57.8:1	2,082.3:1	0.1:1	0.3:1	1.0:1	1.6:1	2.6:1	10.8:1	37.2:1
<=58	86.2	0.2:1	1.8:1	8.4:1	21.9:1	1.0:1	6.0:1	43.8:1	2,224.4:1	0.1:1	0.3:1	0.9:1	1.4:1	2.2:1	8.2:1	24.6:1
<=64	91.2	0.2:1	1.6:1	6.6:1	16.4:1	0.9:1	4.7:1	30.4:1	2,352.1:1	0.1:1	0.3:1	0.8:1	1.2:1	1.9:1	6.4:1	18.3:1
<=74	96.5	0.1:1	1.4:1	5.2:1	11.6:1	0.8:1	3.8:1	19.0:1	2,488.8:1	0.1:1	0.3:1	0.7:1	1.1:1	1.6:1	4.9:1	12.5:1
<=100	100.0	0.1:1	1.3:1	4.3:1	8.6:1	0.8:1	3.2:1	12.5:1	806.3:1	0.1:1	0.2:1	0.7:1	1.0:1	1.5:1	4.1:1	9.0:1

Scorecard applied to the validation sample. "All poor" means "Only poor targeted".

Figure 21: Share of poor people who are targeted

Targeting cut-off	% all people who are targeted	% poor people who are targeted														
		National lines				Intl. 2011 PPP lines				Percentile-based lines						
		Food	100%	150%	200%	$1.90	$3.20	$5.50	$21.70	10th	20th	40th	50th	60th	80th	90th
<=13	5.0	23.3	8.7	6.1	5.5	10.8	6.5	5.3	5.0	27.6	18.8	11.5	9.9	8.2	6.1	5.5
<=18	9.9	35.6	17.0	12.2	11.0	21.0	12.9	10.6	9.9	41.2	30.8	22.1	19.0	16.2	12.2	10.9
<=22	15.6	51.1	26.4	19.1	17.3	31.9	20.3	16.7	15.6	58.8	46.3	33.6	29.4	25.1	19.2	17.2
<=25	22.0	63.3	36.3	26.8	24.3	42.6	28.5	23.7	22.0	72.5	58.6	44.8	39.7	34.8	27.0	24.2
<=28	28.3	75.0	45.3	34.5	31.4	52.6	36.5	30.5	28.3	80.4	68.4	55.3	49.5	44.1	34.7	31.1
<=30	33.2	81.0	52.6	40.4	36.8	60.4	42.8	35.7	33.2	87.2	76.3	62.9	57.0	51.4	40.7	36.5
<=32	38.1	84.9	59.5	46.3	42.2	67.3	48.9	40.9	38.2	90.0	84.0	70.1	63.8	57.9	46.6	41.9
<=35	44.5	91.3	68.0	53.8	49.3	75.7	56.8	47.8	44.5	94.5	91.1	78.3	72.0	66.5	54.1	49.0
<=38	50.5	94.4	74.9	61.0	55.9	81.6	63.9	54.3	50.5	97.2	94.0	83.1	79.1	73.5	61.2	55.6
<=40	54.6	96.8	80.3	65.9	60.5	86.6	69.0	58.7	54.6	98.0	96.9	87.6	84.2	79.0	66.2	60.1
<=43	59.9	98.7	85.3	72.1	66.3	90.6	75.3	64.4	60.0	99.2	98.1	91.5	88.9	84.3	72.5	66.0
<=46	66.1	98.9	89.5	78.3	72.8	94.4	81.2	71.0	66.1	99.4	99.4	95.3	93.1	89.1	78.6	72.5
<=49	70.6	98.9	93.4	82.7	77.8	97.0	85.6	75.8	70.7	99.4	99.4	97.1	96.5	93.3	83.0	77.4
<=52	76.7	99.0	95.9	88.2	83.8	98.4	90.8	81.8	76.8	99.6	99.6	98.3	98.1	95.9	88.7	83.4
<=55	80.7	99.3	97.4	91.4	87.5	99.2	93.4	85.7	80.8	100.0	99.8	99.2	99.1	97.5	92.0	87.4
<=58	86.2	100.0	98.8	95.1	92.0	99.6	96.8	91.0	86.3	100.0	99.9	99.6	99.5	98.9	95.7	92.1
<=64	91.2	100.0	99.7	97.8	95.9	99.9	98.7	95.3	91.3	100.0	100.0	100.0	99.9	99.7	98.1	96.1
<=74	96.5	100.0	100.0	99.8	99.1	100.0	99.8	99.0	96.6	100.0	100.0	100.0	100.0	100.0	99.8	99.3
<=100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Scorecard applied to the validation sample.

For example, a pro-poor program could set a score cut-off to achieve a desired poverty rate—say, 80 percent—among targeted people.
For 100% of the national line, targeting those who score 43 or less would target 59.9 percent of people in Sierra Leone and give a head-count poverty rate among those targeted of 80.2 percent (**Figure 19**).

Figure 20 is a different way of looking at this same aspect of targeting accuracy. It shows the number of poor people correctly targeted (included) for each non-poor person mistakenly targeted (leakage). For 100% of the national line and a score cut-off of 43 or less, about 4.0 poor people are successfully targeted for every one non-poor person mistakenly targeted.

Alternatively, a pro-poor program might seek to target a desired share—such as half—of poor people in Sierra Leone. For 100% of the national line, **Figure 21** shows that a score cut-off of 30 or less would target 33.2 percent of all people in Sierra Leone, a segment that includes about half (52.6 percent) of all poor people.

Interview Guide

Citations in this **Interview Guide** come from:

Statistics Sierra Leone. (2018) "Sierra Leone Integrated Household Survey: Interviewer Manual, 2018 (revised)" [the *Manual*], **link**.

G1. Basic interview instructions

The scorecard can be filled out on paper in the field, with responses entered later in a spreadsheet or in your own database. Alternatively, Scorocs' cloud-based **data-collection tool** works in a web browser on any device, allowing data entry in the field or in the office. If there is no connection, then data is stored on the device until it can be uploaded.

The scorecard should be administered by enumerators trained to follow this **Interview Guide**.

Fill out the scorecard header and the **Back-page Worksheet** first, following the directions found there.

In the scorecard header, fill in the exact number of household members in the space "Number of household members" based on the list that you the enumerator made as part of the **Back-page Worksheet**.

Do not directly ask the first scorecard question ("In which district does the household live?"). Instead, fill in the response based on the knowledge that you the enumerator have of the district where the household lives.

In the same way, do not directly ask the second scorecard question ("How many members does the household have?"). Instead, mark the response based on the number of household members that you listed on the **Back-page Worksheet**.

Furthermore, do not directly ask the third scorecard question ("What is the main construction material of the outside walls of the household's dwelling?"). Instead, mark the response based on what you the enumerator can directly observe of the outside walls. If you are not completely sure, then ask the question directly of the respondent, and record his/her reponse.

Ask all of the six remaining questions directly of the respondent.

Read each question aloud word-for-word, in the order presented in the scorecard. Do not read the response options.

Study this **Interview Guide** carefully, and carry it with you while you work. Follow its instructions (including this one).

Remember that the respondent for the interview need not be the household member who is the participant of record with your program.

Likewise, the service agent to be recorded in the scorecard header is not necessarily the same as you the enumerator who does the interview. Rather, the service agent is the employee of the pro-poor program with whom the participant of record has an on-going relationship. If there is no such service agent, or if you do not know if there is such a service agent, or if you do not know the name of the service agent, then write “NONE” or “UNKNOWN” in the relevant spaces in the scorecard header.

In general, do not leave blank spaces in the header. If the requested information is unknown, does not exist, or is not applicable, then write “UNKNOWN”, “NONE”, or “NOT APPLICABLE” in the blanks. This shows that you the enumerator tried to obtain the data. This may help avoid returning to the household later to try to collect uncollectible data.

When you mark a response to a scorecard question, write the point value in the “Score” column and then circle the spelled-out response option, the pre-printed point value, and the hand-written points, like this:

8. How many mobile phones does the household have?	A. None	0	
	B. One	7	**7**
	C. Two or more	11	

When an issue comes up that is not addressed in this **Interview Guide**, its resolution should be left to the unaided judgment of you the enumerator and the respondent, as that apparently was the practice in the 2018 IHS. That is, a program should not promulgate any definitions or rules (other than those in this **Interview Guide**) to be used by all its enumerators. Anything not explicitly addressed in this **Interview Guide** is to be left to the unaided judgment of each individual enumerator and the respondent.

Do not read the response options to the respondent. Instead, read the question, and then stop; wait for a response. If the respondent asks for clarification or otherwise hesitates or seems confused, then read the question again or provide additional assistance based on this **Interview Guide** or as you the enumerator deem appropriate.

In general, you should accept the responses given by the respondent. Nevertheless, if the respondent says something—or if you see or sense something—that suggests that the response may not be accurate, that the respondent is uncertain, or that the respondent desires assistance in figuring out how to respond, then you should read the question again and provide whatever help you deem appropriate based on this this **Interview Guide**.

While responses to questions in the scorecard are verifiable, in most cases you do not need to verify responses. You should verify only if something suggests to you that a response may be inaccurate and thus that verification might improve data quality. For example, you might choose to verify if the respondent hesitates, seems nervous, or otherwise gives signals that he/she may be lying, confused, or uncertain.

Likewise, verification may be called for if a child in the interviewed household or if a neighbor says something that does not square with a respondent's response. Verification may also be a good idea if you can see something yourself that suggests that a response may be inaccurate, such as a consumer durable that the respondent claims not to possess, or a child eating in the room or in the yard who has not been counted as a member of the household.

In general, the application of the scorecard should mimic as closely as possible the application of the 2018 IHS by SSL. For example, interviews should done in-person by a trained enumerator at the dwelling of the participating household because that is what SSL did in the 2018 IHS.

G2. Translation

You the enumerator should do the interview in a language which both you and the respondent speak and understand well.

The scorecard itself, the **Back-page Worksheet**, and this **Interview Guide** are available English and Krio. There are not yet official, professional translations to other languages spoken in Sierra Leone such as Mende and Temne. Users should check **scorocs.com** to see what translations have been done since this writing. If there is not yet an official, professional translation to a desired language, then please contact **Scorocs** to arrange to collaborate on one.

G3. General interview guidance from the *Manual*

G3.1 Introductions

According to p. 3 of the *Manual*, you the enumerator should emphasize the following when introducing yourself to the interviewed household:

- The household's responses will help your program to understand its participants
- Responses will be kept strictly confidential

G3.2 Who should be the respondent?

Remember that the respondent for the interview need not be the household member who is the participant of record with your program.

According to p. 10 of the *Manual*, the scorecard questionnaire "should be completed with the assistance of the household head and other household members as needed. If the head is not present, then interview the member who is acting as the head or another responsible adult member of the interviewed household."

G3.3 Who is the head of the household?

Note that the head of the household may or may not be the household member who is the participant of record with your program.

Every household has one (and only one) head. The head of the interviewed household must be a member of the interviewed household. A person cannot be the head of more than one household because no one can be a member of more than one household.

According to p. 3 of the *Manual*, the *head of the household* is "usually the member of the household who makes major economic and social decisions on behalf of the household and who is recognized as head by the other members of the household.

"Usually the head of the household is the person who provides the resources to cover most of the needs of the household and who is familiar with all the activities and occupations of the household members. Note that the head is not necessarily the oldest member of the household, nor is the head necessarily the member who earns the most money from employment, from a business activity, or from the sale of farm produce. You the enumerator must listen carefully to the household members and allow them to point out to you the member who is the head of their household."

G4. Guidelines for each question in the scorecard

G4.1 In which district does the household live?

A. Kenema, or Pujehun
B. Tonkolili, or Bombali
C. Freetown (western area, rural), Port Loko, Bo, Moyamba, Karene, Falaba, or Koinadugu
D. Kono, or Bonthe
E. Freetown
F. Kailahun, or Kambia

Unless you have to, do not directly ask this question of the respondent. Instead, fill in the response based on your knowledge of the district where the household lives.

G4.2 How many members does the household have?

G. Nine or more
H. Eight
I. Seven
J. Six
K. Five
L. Four
M. Three
N. One or two

Do not directly ask this question of the respondent. Instead, mark the response based on the number of household members that you the enumerator listed on the **Back-page Worksheet**.

According to p. 3 of the *Manual*, a *household* is "one person or a group of persons who normally eat and live together and who recognize a particular person as their head. The members of a household share a cooking arrangement (that is, they eat from the same pot). A household may occupy a whole building, part of a building, or many buildings.

"A man with several wives might maintain separate living quarters for his wives and their children. In such cases, each wife and her children constitute separate households [if they do not share a cooking arrangement. The husband is counted as the head of only one of the households of his wives, usually the one in which he spends the most time. If he spends time equally between households, then count him as a member of the interviewed household only if he spent the previous night there].

"The following are examples of households:

- A single person—whether a man or a woman—who lives alone
- A man and his wife
- A woman and her children
- A man and his wife/wives and their children, fathers/mothers, nephews/nieces, and other relatives or non-relatives"

According to pp. 10–11 of the *Manual*, you the enumerator "should record the members of the household in the following order:

- *Head of the household* (even if he/she is absent on the day of the interview)
- *Spouse (eldest) of the head* (as long as he/she usually lives and sleeps in the dwelling and takes his/her meals together with the interviewed household)
- *Children of the head* who usually live and sleep in the dwelling and who take their meals together with the interviewed household (even if absent on the day of the interview)
- *All other persons related to the head* or related to his/her spouse(s) who usually live and sleep in the dwelling and who take their meals together with the interviewed household (even if absent on the day of the interview)
- *All other persons unrelated to the head* and unrelated to his/her spouse(s) who usually live and sleep in the dwelling and who take their meals together with the interviewed household (even if absent on the day of the interview). Examples of such household members who are unrelated to the head include friends, servants, lodgers, and so on

"Make sure that you the enumerator list as members of the household all persons—even if they are not present on the day of the interview—who usually live, sleep, and eat together with the interviewed household. Examples include those who are temporarily away for school, vacation, seasonal work, illness, birth, military training, prison, and so on.

"Do not count tenants (people who pay the interviewed household to live in its dwelling) as members of the interviewed hosuehold unless the tenants eat with the interviewed household.

"Make sure that the list of the members of the interviewed household is complete. Check that it includes all small children in the household, and double-check with each woman in the household that you have included all of her young children, including any newborn babies who have not yet been officially named."

According to pp. 13–14 of the *Manual*, count as members of the interviewed household anyone who has been absent from the interviewed household (regardless of the reason) for three months or less. Likewise, count as a member of the interviewed household anyone who has been away from the interviewed household for at least four months and who is living in an institution.

Do not count as a member of the interviewed household anyone who has been absent for at least four months and who has been living with another household. For example, a child of the head of the interviewed household who has spent the past nine months living with an auntie in Freetown to go to school would not be counted as a member of the interviewed household.

G4.3 What is the main construction material of the outside walls of the household's dwelling?

A. Wattle and mud, or mud bricks
B. Mud bricks plastered with cement, or other
C. Cement blocks, wooden boards, or corrugated iron/zinc sheets

If you can, record the response to this question based on your own observation. If you are not completely certain of the appropriate response, then ask the question directly of the respondent.

According to p. 32 of the *Manual*, a *dwelling* is "a set of rooms with one or more doors to the outside, generally intended for one household.

"A dwelling may be part or all of a physical building, or in some cases consist of multiple buildings.

"It is possible for people sharing a dwelling to maintain separate households. For example, suppose that a dwelling is two shared rooms, a parlor and a cooking area. Two brothers share the dwelling, each with one bedroom. Both are married, and the wives cook separately.

A dwelling may be:

- "A single unit that consists of one freestanding house or hut
- A single unit in a building with multiple units. The different units may be on different storeys, or next to each other. A dwelling may also share a physical structure with space that is used for another purpose, for example, a shop or a business
- Multiple structures (physical buildings), for example, multiple huts"

G4.4 Does the household cook mostly with charcoal, cooking gas, or electricity?

A. No
B. Yes

The *Manual* has no additional information about this question.

G4.5 What kind of toilet does the household use?

A. None (bush, field, waterside), hanging toilet/hanging latrine, or composting toilet
B. Pit latrine without slab (open pit) or with slab, ventilated improved pit latrine (VIP), flush (to pit latrine, septic tank, or piped sewer system)

The *Manual* has no additional information about this question.

G4.6 How many mattresses does the household have?

A. None
B. One
C. Two
D. Three or more

According to p. 35 of the *Manual*, “Count only mattresses that are mainly for the household’s own use and enjoyment. Do not count mattresses that are mainly for use in a business. For example, [if the household runs a hotel, then do not count mattresses used in the hotel].”

The *Manual* has no additional information about this question.

G4.7 Does the household have a television?

A. No
B. Yes

According to p. 35 of the *Manual*, “Count only televisions that are mainly for the household’s own use and enjoyment. Do not count televisions that are mainly for use in a business. For example, [if the household runs a restaurant, then do not count televisions that are used in the restaurant for the entertainment of patrons].”

The *Manual* has no additional information about this question.

G4.8 How many mobile phones does the household have?

A. None
B. One
C. Two or more

According to p. 35 of the *Manual*, “Count only mobile phones that are mainly for the household’s own use and enjoyment. Do not count mobile phones that are mainly for use in a business. For example, [if the household runs a pay-per-call telephone kiosk, then do not count mobile phones that are used by paying customers to make calls].”

The *Manual* has no additional information about this question.

G4.9 In the past 12 months, did the household grow rice or cassava for its own consumption?

A. Yes
B. No

According to p. 9 of the *Manual*, the *past 12 months* cover "the last completed month before the interview, together with the 11 months previous to the last completed month.

"For example, if a household is interviewed in April of 2022, then the last 12 months are April 2021 through March 2022.

2021												2022			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	April
			Last 12 months												Interview

The *Manual* has no additional information about this question.

Technical Annexes: Overview

The technical annexes cover advanced or technical aspects of the scorecard. While program managers can skip the annexes and still benefit from using the scorecard, understanding the details will increase the usefulness of scorecard estimates and improve implementation and interpretation.

The annexes cover:

Annex 1 Data used for construction and validation

Statistics Sierra Leone (SSL) fielded the 2018 Integrated Household Survey (IHS) with 6,810 households from January to December, 2018. This is Sierra Leone's most-recent national household consumption-expenditure survey.

Questions and points for the scorecard are selected (*constructed*) based on data from a random three-fifths of the households in the 2018 IHS. These same three-fifths of households are also used to associate (*calibrate*) scores with poverty likelihoods for all supported poverty lines.

Data from the other two-fifths of households from the 2018 IHS is used to test (*validate*) the scorecard's accuracy for one-period estimates of poverty rates *out-of-sample*, that is, with data that is not used in construction nor calibration. Data from those same two-fifths of households are also used for out-of-sample validation of targeting accuracy.

Annex 2 Definition of *poverty*

A household's *poverty status* as poor or non-poor depends on whether its consumption expenditure in leones (SLL per adult equivalent per day or per person per day) is below a given poverty line. Thus, a definition of *poverty* is a poverty line together with a measure of consumption expenditure from the 2018 IHS.

The definition of consumption expenditure used with the 2018 IHS is documented by de la Fuente and Foster (**2019**, pp. 3–5). Because the definition "improves on and therefore diverges from that used in 2003/4" (p. 2), poverty estimates from Sierra Leone's old scorecard[34] are not comparable with poverty estimates from the new scorecard here. Thus, it is not possible to estimate changes in poverty with a baseline from the old scorecard and a follow-up from the new scorecard; both baseline and follow-up should be from the new scorecard.

Because pro-poor programs in Sierra Leone may want to use different or various poverty lines, the scorecard supports 15 lines:

- Food line
- 100% of the national line
- 150% of the national line
- 200% of the national line
- $1.90/day 2011 PPP line
- $3.20/day 2011 PPP line
- $5.50/day 2011 PPP line
- $21.70/day 2011 PPP line
- First-decile (10^{th}-percentile) line
- First-quintile (20^{th}-percentile) line
- Second-quintile (40^{th}-percentile) line
- Median (50^{th}-percentile) line
- Third-quintile (60^{th}-percentile) line
- Fourth-quintile (80^{th}-percentile) line
- Tenth-decile (90^{th}-percentile) line

[34] **Schreiner**, 2011.

A2.1 National poverty lines

The cost-of-basic-needs approach[35] is used to derive Sierra Leone's two official poverty lines: a food line, and a food-plus-non-food ("national") line.

A2.1.1 Food line

Sierra Leone's food poverty line is the cost of of a food basket that provides a minimum standard of 2,700 Calories per adult equivalent per day. The items in the basket and their shares are based on food consumption in the 2018 IHS. The cost of the items is adjusted for price differences across months during the 2018 IHS and across urban and rural areas within each of seven geographic regions.

The average food line in average prices for Sierra Leone overall during the 2018 IHS is SLL5.80 per adult-equivalent per day, giving a national head-count poverty rate for this line of 12.9 percent (**Figure 10**).

A2.1.2 National line

The national poverty line (usually called "100% of the national line") is the food line, plus a minimum standard for non-food consumption expenditure. This is taken as the non-food consumption expenditure in the 2018 IHS for households whose observed food consumption expenditure is at the food line. After adjusting the prices of non-food items for monthly differences during the 2018 IHS as well as for differences across five markets, the average national (food-plus-non-food) poverty line for Sierra Leone overall is SLL10.71 per adult equivalent per day, with a head-count poverty rate of 56.8 percent (**Figure 10**).[36]

150% of the national line and 200% of the national line are multiples of 100% of the national line.

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[35] **Ravallion**, 1998.

[36] The head-count poverty rates reported here for all of Sierra Leone for the food line and 100% of the national line match those in **de la Fuente and Foster** (2019, pp. 10–11), suggesting that the scorecard here uses the same data and calculations as SSL.

A2.2 International 2011 PPP poverty lines

The World Bank tracks world-wide poverty with four 2011 PPP poverty lines:[37]

- $1.90/day Low-income countries (the international "extreme poverty" line)
- $3.20/day Lower-middle-income countries
- $5.50/day Upper-middle-income countries
- $21.70/day High-income countries

The $1.90/day "extreme poverty" line is the most relevant for Sierra Leone.

The purpose of PPP lines is to adjust for differences in purchasing power across countries due to the fact that non-tradable goods and services are usually less costly in poorer countries while tradables are more costly. PPP adjustments improve the international comparability of poverty estimates.

International 2011 PPP lines for Sierra Leone are derived from:

- 2011 PPP (revised) exchange rate for Sierra Leone for "individual consumption expenditure by households":[38] SLL1.82553 per $1.00
- Average all-Sierra Leone Consumer Price Index[39] (CPI):
  - Calendar-year 2011: 197.065
  - Calendar-year 2018: 376.394
- Household-specific geographic and temporal price indexes for the 2018 IHS

Given this, the $1.90/day 2011 PPP line for Sierra Leone overall is:

$$\$1.90 \cdot 2011\ \text{PPP factor} \cdot \frac{\text{CPI}_{2018}}{\text{CPI}_{2011}} = \$1.90 \cdot 1.82553 \cdot \frac{376.394}{197.065} = \text{SLL}6.62\ \text{per person.}$$

This $1.90/day line and its corresponding head-count poverty rate of 43.0 percent (**Figure 10**) match those of the World Bank's **PovcalNet** for Sierra Leone in 2018.

The 2011 PPP lines for $3.20/day, $5.50/day, and $21.70/day are multiples of the $1.90/day line.

[37] **Jolliffe and Prydz**, 2016; **Ferreira *et al.***, 2016.
[38] **World Bank**, 2020, Table E.3, column 13, p. 136.
[39] Base = 100 in calendar-year 2010, **link**.

A2.3 Percentile-based poverty lines

The scorecard supports percentile-based poverty lines.[40] This facilitates a number of types of analyses. For example, the second-quintile (40th-percentile) line might be used to help track Sierra Leone's progress toward the **World Bank**'s (2013) goal of "shared prosperity/inclusive economic growth", defined as income growth among the bottom 40 percent of the world's people.

Analyzed together, the four quintile lines (or all seven supported percentile lines) can also be used to look at the relationship of consumption expenditure with health outcomes (or anything else related with the distribution of consumption expenditure). The scorecard thus offers an alternative for health-equity analyses that typically have used an asset index (such as that supplied with the data from the Demographic and Health Surveys) to compare an estimate of socio-economic status with health outcomes.[41]

Of course, relative-wealth analyses are also possible with scores from the scorecard. But support for relative consumption expenditure lines also allows for a more straightforward use of a single tool to analyze any or all of:

- Relative wealth (via scores)
- Absolute consumption expenditure (via poverty likelihoods and absolute poverty lines)
- Relative consumption expenditure (via poverty likelihoods and percentile-based poverty lines)

Unlike the scorecard, asset indexes only estimate relative wealth. Furthermore, the scorecard—unlike asset indexes—uses a straightforward, well-understood standard for socio-economic status whose definition is external to the tool itself (that is, consumption expenditure relative to a poverty line defined in monetary units).

In contrast, an asset index defines *poverty* in terms of its own questions and points, without calibration or reference to an external standard. This means that two asset indexes with different questions or different points—even if derived from the same data for a given country—imply two distinct definitions of *poverty*. In the same set-up, two scorecards would provide comparable estimates under a single definition of *poverty*.

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[40] Percentiles are defined in terms of all people in Sierra Leone. For example, the head-count poverty rate for the first-quintile (20th-percentile) poverty line is 20.0 percent for Sierra Leone overall (**Figure 10**).

[41] **Rutstein and Johnson**, 2004.

Annex 3 Scorecard construction

For Sierra Leone, about 75 candidate questions are prepared in these areas:

- Household composition (such as the number of household members)
- Education (such as whether the female head—or the eldest wife of the male head—can read English))
- Employment (such as the number of household members who are self-employed)
- Health (such as whether any household member has a disability)
- Housing (such as the main material of the outside walls)
- Ownership of consumer durables (such as televisions or cell phones)
- Ownership of agricultural implements (such as axes or cutlasses)
- Agriculture (such as growing rice or cassava for own consumption)
- Location of the dwelling (such as the district)

To facilitate the estimation of change over time, preference is given to questions with greater sensitivity to changes in poverty. For example, the ownership of a mobile phone is probably more responsive to changes in poverty than is the age of the head of the household).

The scorecard itself is built using 100% of the national poverty line and Logit regression on the construction sub-sample. Questions are selected based on both judgment and statistics.

The first step is to use Logit to build a draft scorecard for each candidate question. The power of each one-question draft scorecard to rank households by poverty status is assessed via the concentration index.[42]

[42] **Ravallion**, 2009.

One of the one-question draft scorecards is then selected based on:[43]

- Improvement in accuracy
- Acceptability to users in terms of:
  - Simplicity
  - Cost of collection
  - Concordance with:
    - Experience
    - Theory
    - Common sense
- Sensitivity to changes in consumption expenditure
- Variety among types of questions
- Applicability across districts
- Tendency to have a slow-changing relationship with poverty
- Relevance for distinguishing among people at the poorer end of the distribution of consumption expenditure
- Verifiability

A series of two-question draft scorecards are then built, each adding a second question to the one-question scorecard selected from the first step. The best two-question draft scorecard is then selected, again using judgment to balance statistical accuracy with non-statistical criteria. These steps are repeated until the scorecard has nine questions that work well together.

The last step is to transform the Logit coefficients into non-negative integers such that scores range from 0 to 100, with lower scores corresponding with greater poverty.

This algorithm is similar to common R^2-based stepwise least-squares regression. It differs from naïve stepwise in that the selection of questions considers both statistical[44] and non-statistical criteria. The use of non-statistical criteria can improve robustness against violations in the scorecard's basic assumptions. It also helps to ensure that questions are straightforward, common-sense, inexpensive-to-collect, and acceptable to users.

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[43] **Schreiner *et al.***, 2014; **Zeller**, 2004.

[44] The statistical criterion is not the *p* value of an estimated coefficient but rather a question's contribution to the ranking of households by poverty status in the context of a scorecard with eight other questions.

The single scorecard here applies to all of Sierra Leone. Customizing poverty-assessment tools by urban/rural does not improve targeting accuracy much.[45] Segment-specific tools may improve the accuracy of estimates of poverty rates,[46] but:

- They run a greater risk of overfitting[47]
- Most of their benefit can be had in a single scorecard that includes a question that identifies the specific segment of interest (such as, in the case of Sierra Leone, the district of residence)[48]

[45] **Brown, Ravallion, and van de Walle**, 2018; **World Bank**, 2012; **Sharif**, 2009; Schreiner, **2006** and **2005**; **Narayan and Yoshida**, 2005; and **Grosh and Baker**, 1995.
[46] **Diamond *et al.***, 2016; **Tarozzi and Deaton**, 2009.
[47] **Haslett**, 2012.
[48] **Schreiner**, 2016b.

Annex 4 Estimates of poverty likelihoods

This annex tells how scores are converted into estimates of poverty likelihoods.

Scores are on an ordinal scale from 0 to 100. Higher scores signal less poverty, but not how much less. The ordered symbols that are used to represent scores are numbers, but those symbols do not stand for the normal cardinal numbers that you can do math on. For example, a score of 20 plus a score of 10 is not 30 of anything, just as the letter "A" plus the letter "B" is not the letter "C" (nor is it anything else).

To get cardinal units, a look-up table is used to convert scores to *poverty likelihoods*, that is, probabilities of having consumption expenditure below a poverty line. For the example of 100% of the national line, scores of 41−43 correspond with a poverty likelihood of 49.5 percent, and scores of 44−46 correspond with a poverty likelihood of 44.1 percent (**Figure 1**).

The poverty likelihood associated with a score varies by poverty line. For example, scores of 41−43 are associated with a likelihood of 49.5 percent for 100% of the national line but with a likelihood of 30.8 percent for the $1.90/day 2011 PPP line.

A4.1 Calibrating scores with poverty likelihoods

A given score is associated ("calibrated") with an estimated poverty likelihood that is defined as the share of people in the construction sub-sample who have the score and who live in households with per-adult-equivalent or per-capita consumption expenditure below a given poverty line.

For the example of 100% of the national line and a score of 41−43 (**Figure 22** below), there are 5,960 (normalized) households in the construction sample. Of these, 2,950 (normalized) have consumption expenditure below the poverty line. The estimated poverty likelihood associated with a score of 41−43 is then 49.5 percent, because 2,950 ÷ 5,960 ≈ 0.495 = 49.5 percent.

The same method is used to calibrate all scores with poverty likelihoods for all 15 supported poverty lines.[49]

[49] If needed to ensure that likelihoods never increase as scores increase, likelihoods across adjacent scores are averaged before grouping scores into ranges. This preserves unbiasedness while preventing higher scores from being associated with higher likelihoods.

Figure 22: Estimation of poverty likelihoods (100% of national line)

Score	Households in range and < poverty line		All households in range		Poverty likelihood (%)
0–13	3,288	÷	3,412	=	96.4
14–18	3,378	÷	3,516	=	96.1
19–22	4,881	÷	5,112	=	95.5
23–25	3,202	÷	3,376	=	94.9
26–28	4,278	÷	4,767	=	89.7
29–30	2,511	÷	3,033	=	82.8
31–32	3,638	÷	4,574	=	79.5
33–35	4,206	÷	5,707	=	73.7
36–38	4,445	÷	6,775	=	65.6
39–40	2,536	÷	4,027	=	63.0
41–43	2,950	÷	5,960	=	49.5
44–46	2,285	÷	5,177	=	44.1
47–49	1,650	÷	4,950	=	33.3
50–52	1,510	÷	5,518	=	27.4
53–55	883	÷	4,199	=	21.0
56–58	688	÷	4,758	=	14.5
59–64	405	÷	7,805	=	5.2
65–74	202	÷	8,875	=	2.3
75–100	8	÷	8,459	=	0.1

Number of all households normalized to sum to 100,000.

A4.2 Objectivity of estimates of poverty likelihoods

Even though scorecard questions are selected partly based on judgment related to non-statistical criteria, the calibration process produces estimates of poverty likelihoods that are objective, that is, derived from monetary poverty lines and from survey data on consumption expenditure.[50] The fact that some choices in scorecard construction are informed by judgment in no way impugns the objectivity of the estimated likelihoods, as that depends on using data (and nothing else) in score calibration, not on using data (and nothing else) in scorecard construction.

A4.3 Why not use the Logit formula?

The scorecard is based on a Logit regression (**Annex 3**). This means that poverty likelihoods could be estimated not with a calibrated look-up table (**Figure 1**) but rather with the Logit formula of $2.718281828^{\beta X} \times (1 + 2.718281828^{\beta X})^{-1}$, where β is a vector of the Logit coefficients and X is a vector of a household's responses.

The scorecard uses the calibration approach is because the Logit formula is intimidating. Program managers can understand poverty likelihoods defined as the share of people with a given score in the construction sample from Sierra Leone's 2018 IHS who have consumption expenditure below a poverty line. A calibrated look-up table also allows analysts to convert scores to likelihoods without any math at all. This calibration approach can also improve accuracy, especially with large samples.

[50] The calibrated likelihoods would be objective even if scorecard construction did not use any data at all. In fact, objective scorecards of proven accuracy are often constructed using only expert judgment (**Caire**, 2004; **Schreiner *et al.***, 2014).

Annex 5 Error and margins of error

This annex discusses the scorecard's estimation error for head-count poverty rates in a single time period, as well as margins of error for all estimates.

A5.1 Estimation errors

A5.1.1 What is estimation error?

Estimation error is the distance and direction by which a scorecard's estimate tends to differ from the true value in the population.

For example, the estimation error of Sierra Leone's scorecard for estimates of head-count poverty rates in a single time period
by 100% of the national poverty line is −3.1 percentage points (**Figure 2**).

An unadjusted estimate can usually be improved—that is, moved closer to the true value in the population—by subtracting off the known estimation error. For example, if the unadjusted estimate is 83.8 percent, and if the estimation error is −3.1 percentage points, then an improved estimate is 83.8 − (−3.1) = 86.9 percent.

A5.1.2 What estimation errors are reported for the Sierra Leone scorecard?

Estimation errors are reported for estimates of head-count poverty rates in a single time period for the 15 supported poverty lines for Sierra Leone.

The estimation errors are derived *out-of-sample*. This means that the scorecard (made from the construction sample from the 2018 IHS, **Annex 1**) is tested with repeated sub-samples of households from the validation sample that were not used to construct the scorecard. The estimation error is the average of the differences between scorecard estimates and observed poverty rates across these repeated sub-samples.

There is no data now on consumption-expenditure-based poverty in the future, so it is impossible to report estimation errors for estimates of annual net changes in head-count poverty rates across two time periods. The scorecard cannot be tested *out-of-time* because it is both constructed and validated with data from a single time period (2018).

In practice, the scorecard—like all poverty-assessment tools—is always applied both out-of-sample and out-of-time. Being out-of-sample violates the assumption that the scorecard is applied to a sample from the same population whose data was used to construct the scorecard. Being out-of-time violates the assumption that the relationships between poverty and scorecard questions are the same as in the population whose data was used to construct the scorecard.

The unknown degree and unknown consequences of these inevitable violations of the scorecard's assumptions means that actual estimation errors will differ from those reported here in unknowable ways.[51] Still, the estimation errors (and margins of error) reported here are the best available, and it makes sense to account for them.

A5.1.3 How to estimate estimation errors

Given the scorecard's standard assumptions, an unbiased estimator of *estimation error* is the average of differences between scorecard estimates and observed values in repeated sub-samples from the validation sample.[52]

It is possible to compare estimated and observed poverty rates because the 2018 IHS records actual (not estimated) consumption-expenditure-based poverty status for households in the validation sample. The observed (not estimated) poverty likelihood in the 2018 IHS is either 100 percent (for poor households) or 0 percent (for non-poor households). For a given poverty line, the observed (not estimated) head-count poverty rate is the household-size-weighted average of the observed poverty likelihoods.

The scorecard can also be applied to the same validation sub-sample (ignoring that actual poverty status is observed) to estimate the poverty rate as the household-size-weighted average of estimated poverty likelihoods (Section **3.1**).

The scorecard's error in a given validation sub-sample is then the difference between the scorecard's estimate versus the observed value.

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[51] Estimation errors due to being out-of-time can be measured with post-2018 data (say, from a future IHS). Of course, future IHS data is not yet available, and even after it is available, there will still be some unknown out-of-time error (and out-of-sample error will still be completely unknown).

[52] This is the *bootstrap approach*. The average of estimates from repeated samples from the validation sample is an unbiased estimator of the true value in the population of Sierra Leone overall. The population's true value is taken as the value in the 2018 IHS (even though the IHS is itself only a sample).

Different sub-samples from the validation sample result in different errors. The estimate of the scorecard's general *estimation error* is the average of these errors across many sub-samples.[53] In turn, the scorecard estimate's margin of error reflects the extent of the spread of the distribution of all the sub-samples' errors around their average.[54]

A5.1.4 Estimation errors for estimates of poverty rates in one time period

The first line in **Figure 2** ("Estimation error") presents estimation errors for estimates of poverty rates in one time period for Sierra Leone's 15 supported lines.

A5.2 Margins of error

A5.2.1 What are margins of error?

Like any statistic, a scorecard estimate depends on a particular sample from a population. Because samples are drawn at random, each sample is different, and different samples give different scorecard estimates. Scorecard estimates are *unbiased*—under the standard assumptions—because the average of scorecard estimates across many repeated samples is the same as the single true value in the population.

In any single sample, however, unusual luck may push an estimate for that sample far from the true value in the population. Larger samples provide more chances for luck to even out, so large errors are less likely in larger samples.[55]

For a given estimate, sample size, and confidence level, the *margin of error* is the range of true population values that is (in some specified degree) consistent with the estimate.

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[53] Households in a sub-sample are drawn *with replacement*; each draw is from the full pool, including households that have already been drawn. Thus, a given household may appear in a given sub-sample once, more than once, or not at all.
[54] See **Schreiner** (2021) for details on the α factor and the formulas for estimation errors, margens of error, and ideal sample sizes in **Annex 5** and **Annex 6**.
[55] When flipping a fair (unbiased) coin, the true probability of "heads" is 50 percent. *Unbiasedness* means that the average of the share of "heads" across many samples will be close to 50 percent. In a single sample of 10 tosses, however, the chances of getting at least six "heads" (at least 60 percent of the 10 tosses, with an error of at least 10 percentage points) is about 37 percent. In a single sample of 100 tosses, the chances of such a large error is smaller (about 3 percent). Larger samples reduce the risk that estimates will be far from true values.

A margin of error has two parts:

- The margin of error itself (such as ±2.0 percentage points). This range is centered on the estimate
- A confidence level (such as 90 percent) that the true value falls within the margin of error

All else constant, narrower margins of error or higher confidence levels mean that it is more likely that the sample-based estimate is closer to the true population value.

To illustrate, suppose that the adjusted estimate of the head-count poverty rate for 100% of the national line is 86.9 percent and that the sample size is n = 1,024. Given 90-percent confidence,[56] the margin of error is ±3.1 percentage points (**Figure 2**). Absent other sources of error and given the scorecard's standard assumptions, this means that there is a 90-percent chance that the true population value is in the range from 86.9 − 3.1 = 83.8 percent to 86.9 + 3.1 = 90.0 percent, with the most-likely true value being the center of the range (the 86.9-percent estimate).

Said another way, "With 90-percent confidence, the estimate has a margin of error from 83.8 to 90.0 percent." This means that the true population value has a:

- 5-percent chance of being less than 83.8 percent
- 90-percent chance of being between 83.8 and 90.0 percent
- 5-percent chance of being greater than 90.0 percent

A5.2.2 Why do margins of error matter?

For a given confidence level, managers should put more weight on estimates with narrower margins of error.

As a hypothetical example, a pro-poor program in Sierra Leone probably is indeed pro-poor if the scorecard estimate of the head-count poverty rate for in-coming participants by 100% of the national poverty line with 80-percent confidence is 70.0 percent with a margin of error of ±5.0 percentage points, that is, from 65.0 to 75.0 percent. This is because the estimate and its margin of error suggest that the true poverty rate of in-coming participants is unlikely to be less than or about the same as the all-Sierra Leone poverty rate for this line of 56.8 percent (**Figure 10**).

If, however, the margin of error were ±15.0 percentage points (that is, from 55.0 to 95.0 percent), then there is a non-negligible chance that the poverty rate of in-coming participants is less than or about the same as that for Sierra

[56] Most real-world decisions are made with much less than 90-percent confidence.

Leone overall (56.8 percent) and thus that the program may not actually be pro-poor.

So far, almost all analyses of scorecard estimates have ignored margins of error. This deficient practice increases the risk of bad decisions. Do not make this mistake.

A5.2.3 Margins of error for estimates of poverty rates in one time period for the Sierra Leone scorecard

For sample sizes of n = 1,024 and 90-percent confidence and across all supported poverty lines, the margins of error for estimates of head-count poverty rates in a single time period for the Sierra Leone scorecard are ±3.7 percentage points or smaller (**Figure 2**). Given the scorecard's standard assumptions, this means that in 90 of 100 samples of this size, the true population value is within ±3.7 percentage points or less of the error-adjusted estimate.

A5.2.4 How to calculate margins of error

The **ProveIt™-brand reporting and analysis tool** calculates margins of error for all scorecard estimates discussed here. Analysts may also use the formulas below.

A5.2.5 Formula for margins of error for estimates of head-count poverty rates in a single time period

All formulas for margins of error involve the following elements:

±c is the margin of error as a proportion (*e.g.*, ±0.020 for ±2.0 percentage points),

z is from the Normal distribution and is $\begin{cases} 1.04 \text{ for confidence levels of 70 percent} \\ 1.28 \text{ for confidence levels of 80 percent} \\ 1.64 \text{ for confidence levels of 90 percent} \end{cases}$,

σ is the standard error of the estimated poverty rate, that is, $\sqrt{\frac{\hat{p} \cdot (1-\hat{p})}{n}} \cdot \varphi$,

$\hat{p}$ is the estimated poverty rate as a proportion,

φ is the finite population correction factor $\sqrt{\frac{N-n}{N-1}}$,

N is the population size in terms of households (not members of households),

n is the sample size (in terms of interviewed households, not members of interviewed households), and

α is an adjustment factor specific to the scorecard, estimator, and poverty line.

Suppose that the following are given:

- A confidence level that corresponds with z
- A sample-based estimate $\hat{p}$
- A population size N
- A sample n, and
- An adjustment factor α for a specific poverty line from **Figure 2**

Then the formula[57] for the margin of error $\pm c$ is $\pm z \cdot \alpha \cdot \sqrt{\frac{\hat{p} \cdot (1-\hat{p})}{n}} \cdot \sqrt{\frac{N-n}{N-1}}$.

To illustrate, Sierra Leone's 2018 IHS gives a direct-measure head-count poverty rate for 100% of the national line of $\hat{p}$ = 56.8 percent (**Figure 10**). The adjustment factor α is 1.00 by definition because $\hat{p}$ is a direct-measure estimate, not an indirect-scorecard estimate.[58] Sierra Leone in 2018 has a population of households (not people) of N = 1,410,825, and the IHS sample size is n = 6,810. Given a desired confidence level of 90 percent, z is 1.64. The margin of error $\pm c$ is then about ±1.0 percentage points:

$$\pm z \cdot \alpha \cdot \sqrt{\frac{\hat{p} \cdot (1-\hat{p})}{n}} \cdot \sqrt{\frac{N-n}{N-1}} = \pm 1.64 \cdot 1.00 \cdot \sqrt{\frac{0.568 \cdot (1-0.568)}{6{,}810}} \cdot \sqrt{\frac{1{,}410{,}825-6{,}810}{1{,}410{,}825-1}}.$$

This implies a 90-percent chance that Sierra Leone's true head-count poverty rate for 100% of the national line in 2018 is in the range from 56.8 − 1.0 = 55.8 percent to 56.8 + 1.0 = 57.8 percent.

[57] This formula ignores how sampling variability affects the derivation of the scorecard. It also ignores that household size varies and that larger households are more likely to have higher poverty likelihoods. This understates the margin of error.
[58] For scorecard estimates, α for a given poverty line is in **Figure 2**.

A5.2.6 Margins of error for estimates of numbers of poor people in a single time period

The lower (upper) limit of the margin of error for an estimate of numbers of poor people is the number of people in participating households, multiplied by the lower (upper) limit of the margin of error of the head-count poverty-rate estimate.

To illustrate, the baseline example in Section **3.1** has an estimated poverty rate of 86.9 percent. With 70-percent confidence, the margin of error is about ±30.9 percentage points,[59] or from 86.9 − 30.9 = 56.0 percent to 86.9 + 30.9 = 117.8 percent ≈ 100.0 percent (because poverty rates cannot exceed 100 percent). The margin of error is huge because the sample size of $n = 2$ interviewed households is very small.[60]

The estimated number of people in participating households in the example in Section **3.1.1** is 6,000,[61] so the lower limit of the 70-percent margin of error for the estimated number of poor people is 6,000 · 0.560 = 3,360. The upper limit is 6,000 · 1.000 = 6,000. This example estimate—based as it is on a sample of two households—is better understood not as "all people in participating households are poor" but rather as "at least about 56.0 percent are poor".

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[59] The example in Section 3.1.1 has an estimate of 86.9 percent with $N = 1{,}000$, $n = 2$, and $\alpha = 1.21$ (**Figure 2**). For 70-percent confidence, $z = 1.04$. The margin of error $\pm c$ for the head-count poverty-rate estimate is then

$$\pm 0.300 \approx \pm 1.04 \cdot 1.21 \cdot \sqrt{\frac{0.869 \cdot (1 - 0.869)}{2}} \cdot \sqrt{\frac{1{,}000 - 2}{1{,}000 - 1}}.$$

[60] Yet the formulas for margin of error still apply, and the estimator is still unbiased.

[61] The formula for margin of error for the estimated number of poor people ignores that the estimated number of people in participating households has its own margin of error. This understates the margin of error.

A5.2.7 Margins of error for estimates of the annual net change in head-count poverty rates across two periods for one sample, scored twice

In this case, the formula for the margin of error ±*c* is:

$$\pm\frac{z\cdot\alpha}{y}\cdot\sqrt{\frac{\hat{p}_{rise}\cdot(1-\hat{p}_{rise})+\hat{p}_{fall}\cdot(1-\hat{p}_{fall})+2\cdot\hat{p}_{rise}\cdot\hat{p}_{fall}}{n}}\cdot\sqrt{\frac{N-n}{N-1}}$$, where

- *z*, α, *N*, and *n* are defined as above
- $\hat{p}_{rise}$ is the estimated share of members of sampled households that rise above the poverty line from below
- $\hat{p}_{fall}$ is the estimated share of members of sampled households that fall below the poverty line from above
- *y* is the household-size-weighted average of years between interviews

Illustrating with the earlier example of one sample scored twice (Section **3.2.1**), $\hat{p}_{rise}$ is the share of household members estimated to rise above a poverty line from below. This is the absolute value of the sum of the estimated *negative* changes in the number of members in poor households (from rows 3 and 4 of column M in **Figure 11**, here | −0.380 + −0.435 | = +0.815), divided by the sum across all sampled households of each household's average household size across baseline and follow-up of 5.5 + 7.5 = 13.0 (from rows 3 and 4, column G). Thus, $\hat{p}_{rise}$ = +0.815 ÷ 13.0 = 0.063.

In turn, $\hat{p}_{fall}$ is the share of household members estimated to fall below a poverty line from above. This is the sum of the estimated *positive* net changes in the number of members in poor households (from rows 3 and 4 of column M in **Figure 11)**, which is (+0.00) + (+0.00) = +0.000 (because the estimated poverty likelihood did not increase for any households). Dividing this by the sum across all sampled households of each household's average household size across baseline and follow-up (5.5 + 7.5 = 13.0) gives $\hat{p}_{fall}$ = 0.000 ÷ 13.0 ≈ 0.000.[62]

The household-size-weighted average of the number of years between interviews *y* is 3.00 (from row 9, column M in **Figure 11)**.

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[62] $\hat{p}_{fall}-\hat{p}_{rise}$ is the estimated net poverty-rate change. In this example, $\hat{p}_{fall}$ = 0.000 and $\hat{p}_{rise}$ = 0.063, so 0.000 − 0.063 = −0.063, which is the estimated (non-annual) −6.3 percentage-point decrease (improvement) in the poverty rate in **Figure 11**.

With sample size n = 2 interviewed households, population N of 1,000 households, confidence level of 70 percent (z = 1.04), and the α adjustment factor for this estimator (regardless of poverty line) of 1.14,[63] the margin of error ±c is about ±0.068 ≈

$$\pm\frac{1.04\cdot 1.14}{3.00}\cdot\sqrt{\frac{0.063\cdot(1-0.063)+0.000\cdot(1-0.000)+2\cdot 0.063\cdot 0.000}{2}}\cdot\sqrt{\frac{1{,}000-2}{1{,}000-1}}.$$

The example's estimated net annual poverty-rate change is about −2.1 percentage points (**Figure 11**), so the 70-percent margin of error is from −2.1 − 6.8 = −8.9 to −2.1 + 6.8 = +4.7 percentage points. The margin of error shows that—due to the tiny sample of n = 2—this estimate is uninformative; the true net change in the population could be strongly negative, close to zero, or strongly positive.

This example shows why margins of error are useful. Without them, program managers might believe that there was evidence that poverty rates decreased by about 2.1 percentage points per year even though the data in this sample is also consistent with widely different rates and directions of change.

A5.2.8 Margins of error for estimates of the annual net change in the number of poor people across two periods for one sample, scored twice

The lower (upper) limit of the margin of error for an estimate of annual net change in the number of poor people for one sample, scored twice is the average number of people in participating households from baseline to follow-up, multiplied by the lower (upper) limit of the margin of error of the estimated annual net change in the head-count poverty rate.

To illustrate with the example in Section **3.2.1** for one sample scored twice, the estimated annual net change in the poverty rate is about −2.1 percentage points. As just shown, the tiny sample size of n = 2 means that the 70-percent margin of error runs from −8.9 to +4.7 percentage points.

[63] **Schreiner**, 2021.

The estimated average number of on-going participating people per year is 5,450 (**Figure 11**).[64] Thus, the lower limit of the 70-percent margin of error for the estimated annual net change in the number of poor people is
5,450 · (−0.089) ≈ −485 (a net decrease in poor people), and the upper limit is
5,450 · (+0.047) ≈ +256 (a net increase in poor people). The small sample leads to a large margin of error, so the estimate is not likely to be useful because it is consistent with a true reduction, a true increase, or a true change of zero.

A5.2.9 Margins of error for estimates of the annual net change in head-count poverty rates across two periods for two independent samples

The formula for the margin of error ±*c* is $\pm\frac{z\cdot\alpha}{y}\cdot\sqrt{\frac{2\cdot\hat{p}\cdot(1-\hat{p})}{n}}\cdot\sqrt{\frac{N-n}{N-1}}$.

with *z*, α, *y*, $\hat{p}$ and *N* defined as above. There are *n* households sampled and interviewed at baseline, and another *n* households sampled and interviewed at follow-up.

Illustrating with the example for two independent samples in Section **3.2.4**:

- *z* = 1.04, assuming a desired confidence level of 70 percent
- α = 1.10, the adjustment factor (regardless of poverty line) for this estimator[65]
- *y* = 2.73, the years between the average interview at baseline and follow-up
- $\hat{p}$ = 0.838, the unadjusted) estimate of the poverty rate at baseline
- *N* = 850, the average number of households across baseline (1,000) and follow-up (700)
- *n* = 2, the sample size in both baseline and follow-up

The margin of error ±*c* is ±0.154 ≈ $\pm\frac{1.04\cdot1.10}{2.73}\cdot\sqrt{\frac{2\cdot0.838\cdot(1-0.838)}{2}}\cdot\sqrt{\frac{850-2}{850-1}}$.

The example's estimated net annual poverty-rate change is −1.6 percentage points (**Figure 12**). Thus, the 70-percent margin of error is
from −1.6 − 15.4 = −17.0 percentage points
to −1.6 + 15.4 = +13.8 percentage points. The tiny sample is consistent with a true value in the population that is strongly negative, close to zero, or strongly positive. This again shows why margins of error matter.

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[64] See footnote **61**.
[65] **Schreiner**, 2021.

A5.2.10 Margins of error for estimates of the annual net change in the number of poor people across two periods for two independent samples

The lower (upper) limit of the margin of error for an estimate of annual net change in the number of poor people for two independent samples is the average number of people in participating households from baseline to follow-up, multiplied by the lower (upper) limit of the margin of error of the estimated annual net change in the head-count poverty rate.

To illustrate, the example in Section **3.2.5** for two independent samples estimates the annual net change in the poverty rate as −1.6 percentage points. As just shown, the 70-percent margin of error runs from −17.0 to +13.8 percentage points.

The estimated average number of on-going participating people is 4,225.[66] Thus, the lower limit of the 70-percent margin of error for the estimated annual net change in the number of poor people per year is $4{,}225 \cdot (-0.170) \approx -718$ (a net decrease in poor people), and the upper limit is $4{,}225 \cdot (+0.138) \approx +583$ (a net increase in poor people). The margin of error again shows that the estimate does not reveal much about the true value in the population.

[66] See footnote **61**.

Annex 6 Formulas for sample size

Before drawing a sample of households to interview, the formulas here can be used to calculate the sample size that corresponds to a program's:

- Desired margin of error for the eventual scorecard estimate, and
- Desired confidence level for the margin of error, and
- Pre-estimation guess of the true population value to be estimated

These formulas may or may not be useful, for several reasons.

First, programs sometimes collect scorecard data but then fail to report and analyze it. In such cases, the entire project is a waste, so there is no point in worrying about sample size. This is why programs must plan and budget for reporting and analysis. If the remaining budget (after planning for reporting and analysis) will not cover at least 1,000 interviews, then ignore the formulas below and do as many interviews as the budget allows.

Second, both statistical sample size and psychological sample size matter. On the one hand, samples smaller than n = 300 often seem too small. On the other hand, samples of at least n = 1,000 usually seem large enough.

Third, calculating an optimal sample size makes sense only if a program:

- Has reason to desire a particular margin of error or level of confidence[67]
- Plans to report and analyze margins of error (as already mentioned)

If margins of error are not understood or will not be reported and analyzed, then just interview as many participating households as the budget allows.

Fourth, sample-size calculations are sometimes unneeded. For example, using the scorecard for segmenting requires interviewing all relevant participants. Likewise, doing a basic check on the fulfillment of a pro-poor mission may be less costly if all in-coming participants are scored as a routine step of the in-take process rather than repeatedly deciding at the moment whether to score a given enrollee.

[67] Academic conventions for levels of confidence, when applied to business, often imply unnecessarily large samples.

In sum, go ahead with the formulas below if you:

- Reserve resources for reporting and analysis, and
- Understand margins of error and will report and analyze them, and
- Plan to estimate net changes in poverty over time, and
- Can afford at least 1,000 interviews at both baseline and follow-up

Otherwise:

- If checking fulfillment of a pro-poor mission, then score all in-coming participants at in-take
- If segmenting by poverty, then score all relevant participants
- If estimating changes in poverty, then score as many participants as the budget allows

A6.1 Sample-size formula for estimates of head-count-poverty rates in a single time period

In this case, the formula for the sample size n (the number of participating households to be interviewed) is $n = N \cdot \left(\frac{z^2 \cdot \alpha^2 \cdot \tilde{p} \cdot (1-\tilde{p})}{z^2 \cdot \alpha^2 \cdot \tilde{p} \cdot (1-\tilde{p}) + c^2 \cdot (N-1)} \right)$,

where n, c, z, α, and N are defined as in **Annex 5**, and $\tilde{p}$ is a before-estimation guess for the poverty rate to be estimated.[68]

The illustration below of the calculation of the sample size n uses these values:

- The population of participating households is N = 10,000
- The desired confidence level for the margin of error is 80 percent, so z = 1.28
- The poverty line is 100% of the national line, so α = 1.21 (**Figure 2**)
- The pre-estimation expected poverty rate is the all-Sierra Leone rate for 100% of the national line in 2018, so $\tilde{p}$ = 56.8 percent = 0.568 (**Figure 10**)
- The desired margin of error $\pm c$ = ±3.0 percentage points = ±0.030

Given these hypothetical values,

$$n = 10{,}000 \cdot \left(\frac{1.28^2 \cdot 1.21^2 \cdot 0.568 \cdot (1-0.568)}{1.28^2 \cdot 1.21^2 \cdot 0.568 \cdot (1-0.568) + 0.03^2 \cdot (10{,}000-1)} \right) \approx 614.$$

[68] If the population N is "large" relative to the expected sample size n, then the formula can be taken as $n = \left(\frac{\alpha \cdot z}{c} \right)^2 \cdot \tilde{p} \cdot (1-\tilde{p})$.

A6.2 Sample-size formula for estimates of annual net changes in head-count-poverty rates across two time periods with one sample scored twice

In this case, *n* households are interviewed at baseline, and those same *n* households are interviewed again at follow-up. The formula for *n* is:

$$2 \cdot \left(\frac{z \cdot \alpha}{c} \right)^2 \cdot [-0.01 + 0.016 \cdot y + 0.56 \cdot p_{\text{pre-baseline}} \cdot (1 - p_{\text{pre-baseline}})] \cdot \sqrt{\frac{N - n}{N - 1}},$$

where *n*, α, *z*, *c*, and *N* are defined as above, *y* is the number of years between baseline and follow-up, and $p_{\text{pre-baseline}}$ is the population's expected head-count poverty rate prior to the baseline interviews.

The illustration below for this formula uses the following values:

- The poverty line is 100% of the national line
- The desired confidence level for the margin of error is 80 percent, so $z = 1.28$
- $\alpha = 1.14$ (regardless of the scorecard or poverty line
- The desired margin of error $\pm c = \pm 3.0$ percentage points = ±0.030
- The number of years between baseline and follow-up is $y = 3$
- The pre-estimation expected pre-baseline poverty rate is the all-Sierra Leone rate for 100% of the national line in 2018: $p_{\text{pre-baseline}} = 56.8$ percent = 0.568 (**Figure 10**)
- The population of participating households is $N = 10{,}000$

Assuming *N* is large relative to *n* so that $\sqrt{\frac{N - n}{N - 1}} \approx 1$, then the baseline sample size *n* is $2 \cdot \left(\frac{1.28 \cdot 1.14}{0.03} \right)^2 \cdot [-0.01 + 0.016 \cdot 3 + 0.56 \cdot 0.568 \cdot (1 - 0.568)] \cdot 1 \approx 830.$

The follow-up sample size is also 830.

A6.3 Sample-size formula for estimates of annual net changes in head-count poverty rates across two time periods with two independent samples

This formula is two (2), multiplied by the formula for sample size for an estimate at a point in time. If *n* and $\tilde{p}$ are the same at both baseline and follow-up, then

$$n = 2 \cdot N \cdot \left(\frac{z^2 \cdot \alpha^2 \cdot \tilde{p} \cdot (1-\tilde{p})}{z^2 \cdot \alpha^2 \cdot \tilde{p} \cdot (1-\tilde{p}) + c^2 \cdot (N-1)} \right).$$ [69]

There are *n* interviews at baseline, and another *n* interviews at follow-up. For this estimator and regardless of the scorecard or poverty line, α = 1.10.

To illustrate with the same hypothetical values as in the example just above (except that now α = 1.10), the sample size at baseline *n* is:

$$2 \cdot 10{,}000 \cdot \left(\frac{1.28^2 \cdot 1.10^2 \cdot 0.568 \cdot (1-0.568)}{1.28^2 \cdot 1.10^2 \cdot 0.568 \cdot (1-0.568) + 0.03^2 \cdot (10{,}000-1)} \right) \approx 1{,}026.$$

The sample size at follow-up is also *n* = 1,026.

[69] If the *N* is large relative to *n*, then the formula is about $n = 2 \cdot \left(\frac{\alpha \cdot z}{c} \right)^2 \cdot \tilde{p} \cdot (1-\tilde{p})$.

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