

SAMPLE DESIGN: Sierra Leone Crime Victimization Survey

SAMPLING FRAME

The sample for the crime victimisation study (n=1200) was selected from the sampling frame of the National Bureau of Statistics of Sierra Leone. This sampling frame (all enumeration areas in the country) was derived from the population and housing census of 2004. The design is a four stage stratified sample with the province as the first stratum, followed by the rural/urban level, then Enumeration areas and finally by gender.

The country is divided into 4 administrative regions (the provinces) and in turn, each province is sub-divided into districts, each district into local council, each local council into chiefdoms and finally, each chiefdom is broken down into sections. In addition to these administrative units, each Section was sub-divided into smaller convenient areas called census enumeration areas (EAs) during the 2004 population census. At the time of the population and housing census Sierra Leone had 4 provinces and 16 districts. About 9671 EAs were created for the purpose of the 2004 census. The EAs have census information on all households. Demarcated cartographic materials for each EA is available and these were used to locate actual starting points for the interviews.

STRATIFICATION

For the selection of the master sample, EAs were grouped by province and within each province by rural and urban location. 36% of the citizens are resident in urban areas whilst 64% inhabit the rural areas. This stratification is reflected in the sample.

SAMPLE SIZE

With a sample size of 1200 individuals, the level of confidence is estimated at 97% with a margin of error of + or - 3%. A design effect of 1.85 was used to reduce the loss of precision arising from clustering.

SELECTION OF THE SAMPLE

The sample was been selected using a stratified two-stage cluster design consisting of 150 clusters, 54 in the urban and 96 in the rural areas. Once the number of households was allocated to each province by urban and rural areas, the numbers of clusters was

calculated based on an average sample take of 8 completed interviews. In each urban or rural area in a given province, clusters were using the Equal Probability Selection Method (EPSEM). The selection is done using the following formula:

$$P_{1i} = (a / b) \times (b m_i / \sum m_i)$$

where

a : number of EAs in the ISS in the given combination of residence area and province,

b : number of EAs in the master sample in the given combination of residence area and province,

m_i : measure of size of i-th EA

$\sum m_i$: measure of size for the corresponding combination of residence area and province

In each selected cluster, a household listing operation was carried out, between the end of last year and the beginning of the present year, and households will be selected to achieve a fixed sample take per cluster. However, since the ISS sample is unbalanced among residence area and province, it will require a final weighing adjustment procedure to provide estimates at every other domain of study.

In a given province, if c is the fixed number of households selected out of the total households (L_i) -found in the listing process - for the i-th cluster, then the household probability in the selected i-th cluster can be expressed as

$$P_{2i} = (c / L_i)$$

The final households overall probability in the i-th cluster could be calculated as

$$f_i = P_{1i} * P_{2i}$$

and the sampling design weight for the i-th cluster is given as

$$1 / f_i = 1 / (P_{1i} * P_{2i})$$

ESTIMATION OF THE POPULATION PARAMETERS

The estimates for the population indicators may be proportions, ratios (means) or totals. The estimation process involves multiplying the weighting factor, W_{hj} with the sample value and summing up the products. Hence for the parameter Y , the weighted estimate is given by

$$\hat{Y} = \sum_h \sum_i \sum_j W_{hi} Y_{hij}$$

for the value of Y on the j -th individual or household in the i -th cluster in the h -th province.

For a ratio estimate, the estimates for Y and X will be weighted before the estimation of the ratio using the result

$$R = \frac{\hat{Y}}{\hat{X}}$$

ESTIMATION OF SAMPLING ERRORS

Estimates from the sample are subject to sampling and non-sampling errors. It is, therefore, important that the reliability of the data collected in the survey be established. Sampling errors are usually controlled through the sample design while the latter are not easy to control since they arise from various sources including failure of the enumerator to locate a respondent for interview, mistakes in recording the response from a respondent, mistakes during the data entry process and other causes which are unrelated to the design.

Now, the sample selected for the survey is one of the many possible samples that could come up in repeated sample selection process from the population. Estimates based on different samples from the population would have differences associated with the selections. The variations observed in different independent selections of samples amount to sampling errors. As a measure of these errors, the square root of the variance of the estimates from the survey provides a measure of the sampling errors of the sample design.

Since the sample design is not a simple random sample, variance estimation will be complicated due to the need to take care of the complexity of the design, which is essentially a two-stage stratified cluster. In the estimation of the standard errors of the population

parameters, therefore, the ultimate cluster method of variance estimation will be used. This is considered appropriate because the variability of the weights within the strata is not significant.

The computation of the variances will be done after the completion of the cleaning and validation process.

Since the estimates from the sample may be totals or ratios, estimators for both cases of the standard errors are provided.

ESTIMATES OF VARIANCE FOR TOTAL

Let the estimate for a total be x' such as the number of mothers citing some particular aspect of immunization in a given domain. The variance is estimated by using the formula:

$$\text{var}(x'_d) = \frac{m_d}{m_d - 1} \left[\sum_i x_{id}^2 - \frac{(\sum_i \bar{x}_d)^2}{m_d} \right]$$

Where:

$\text{var}(x'_d)$ = the variance of the estimated total in the d -th domain

m_d = the number of sample clusters in the d -th domain

x_{id}^2 = weighted estimate of the variable in the i -th sample cluster in the d -th domain

\bar{x}_d = mean of the indicator in the d -th domain.

ESTIMATES OF VARIANCE FOR RATIOS

For a simple proportion r estimated in the survey using

$$r = \frac{y}{x}$$

the variance was estimated using the result

$$\text{var}(r) = \frac{1}{x^2} [\text{var}(y) + r^2 \text{var}(x) - 2r \text{cov}(x,y)]$$

Where $\text{var}(y)$, $\text{var}(x)$ and $\text{cov}(xy)$ are variances of y , x and covariance of x and y respectively.

THE SOFTWARE FOR ESTIMATING THE VARIANCE

Estimation of variances for selected variables was done using the Cenvar software of the IMPS.

SAMPLE ALLOCATION

The Primary Sampling Unit (PSU) – the cluster - for the survey is defined on basis of EAs from the 2004 census frame, as having one (or more) EAs per cluster. The number of clusters in each district is randomly allocated proportional to their total population. The following table shows the proportional distribution, (PPS).

Sample for Sierra Leone Crime Victimization Survey –Enumeration areas

Urban - 54 EAs

EACODE	PROVINCE	DISTRICT	LOCALCOUNCIL	CHIEFDOM	SECTION
11020615	Eastern	Kailahun	Kailahun District	Jawie	Sowa
11111008	Eastern	Kailahun	Kailahun District	Njaluahun Lower	Sei I
12080137	Eastern	Kenema	Kenema District	Bambara	Bonya
12140106	Eastern	Kenema	Kenema District	Small Bo Kenema	Fallay Gbo Lambayama
12910526	Eastern	Kenema	Kenema Town	Town Kenema	A-Re Gbo Kakajama A-
12910726	Eastern	Kenema	Kenema Town	Town	Nja

12911016	Eastern	Kenema	Kenema Town	Kenema Town	Gbo Kakajama A-Shi
13040507	Eastern	Kono	Kono District	Gbense	Moindekor
13910102	Eastern	Koidu Town	Sembahun Town Koidu/New	Koidu Town	Gbense-Sina Town
13910401	Eastern	Koidu Town	Sembahun Town Koidu/New	Koidu Town	Tankoro-Kinsey
13910601	Eastern	Koidu Town	Sembahun Town	Koidu Town	Tankoro-Lebanon
21120117	Northern	Bombali	Bombali District	Sella Limba	Kamakwie
21910509	Northern	Makeni	Makeni Town	Makeni Town	Bombali Sebora - M Bombali Sebora –
21910908	Northern	Makeni	Makeni Town	Makeni Town	W
22030606	Northern	Kambia	Kambia District	Magbema Wara Wara	Rokupr
23110310	Northern	Koinadugu	Koinadugu District	Yagal	Zone 3
24060321	Northern	Port Loko	Port Loko Distri	Lokomasama	Kamasondo
24080801	Northern	Port Loko	Port Loko Distri	Marampa	Lunsar-Old Town
25070104	Northern	Tonkolili	Tonkolili District	Kunike	Masingbi
31040209	Southern	Bo	Bo District	Boama	Fallay
31910205	Southern	Bo	Bo Town	Bo Town	East Ward- Bumpeh-W
31910708	Southern	Bo	Bo Town	Bo Town	East Ward- Messima
31911208	Southern	Bo	Bo Town	Bo Town	North Ward-Kissy T West Ward-Moriba
31912011	Southern	Bo	Bo Town	Bo Town	T

32040103	Southern	Bonthe	Bonthe District	Imperri	Babum
33060232	Southern	Moyamba	Moyamba District	Kaiyamba	Koromboya
34100816	Southern	Pujehun	Pujehun District	Soro Gbema	Zoker I
41030503	Western	Western Area Rur	Western Rural District	Waterloo Rural	Waterloo Village A
41040105	Western	Western Area Rur	Western Rural District	York Rural	Gbendembu
41040604	Western	Western Area Rur	Western Rural District	York Rural	Sattia/Tombo
42010235	Western	Western Area Urb	Western Area Urban	Central I	Mountain Regent
42020108	Western	Western Area Urb	Western Area Urban	Central II	Connaught Hospital
42030202	Western	Western Area Urb	Western Area Urban	East I	Fourah Bay
42030321	Western	Western Area Urb	Western Area Urban	East I	Kossoh Town
42040306	Western	Western Area Urb	Western Area Urban	East II	Foulah Town
42040603	Western	Western Area Urb	Western Area Urban	East II	Magazine
42050112	Western	Western Area Urb	Western Area Urban	East III	Allen Town I
42050417	Western	Western Area Urb	Western Area Urban	East III	Congo Water I
42050624	Western	Western Area Urb	Western Area Urban	East III	Grass Field
42050829	Western	Western Area Urb	Western Area Urban	East III	Jalloh Terrace
42051034	Western	Western Area Urb	Western Area Urban	East III	Kissy Bye Pass I

42051321	Western	Western Area Urb	Western Area Urban	East III	Kissy Mess Mess
42051704	Western	Western Area Urb	Western Area Urban	East III	Mamba Ridge II
42051907	Western	Western Area Urb	Western Area Urban	East III	Old Warf
42052211	Western	Western Area Urb	Western Area Urban	East III	Robis
42052601	Western	Western Area Urb	Western Area Urban	East III	Thunderhill
42060315	Western	Western Area Urb	Western Area Urban	West I	Kingtom
42070113	Western	Western Area Urb	Western Area Urban	West II	Brookfields-Congo
42070315	Western	Western Area Urb	Western Area Urban	West II	Congo Town New England-
42070504	Western	Western Area Urb	Western Area Urban	West II	Hannes
42080107	Western	Western Area Urb	Western Area Urban	West III	Aberdeen
42080512	Western	Western Area Urb	Western Area Urban	West III	Juba/Kaningo
42080704	Western	Western Area Urb	Western Area Urban	West III	Malama/Kamayama
42080913	Western	Western Area Urb	Western Area Urban	West III	Pipeline/Wilkinson

Rural 96

EAs

EACODE	PROVINCE	DISTRICT	LOCALCOUNC	CHIEFDOM	SECTION
11020403	Eastern	Kailahun	Kailahun District	Jawie	Lower Luyengeh
11040108	Eastern	Kailahun	Kailahun District	Kissi Teng	Bumasadu

11050211	Eastern	Kailahun	Kailahun District	Kissi Tongi	Konio
11060305	Eastern	Kailahun	Kailahun District	Kpeje Bongre	Falloh
11080211	Eastern	Kailahun	Kailahun District	Luawa	Gao
11080703	Eastern	Kailahun	Kailahun District	Luawa	Mano-Sewallu
11090401	Eastern	Kailahun	Kailahun District	Malema	Pelegbambeima
11110401	Eastern	Kailahun	Kailahun District	Njaluahun	Fauya
11120202	Eastern	Kailahun	Kailahun District	Penguia	Jagor
11140107	Eastern	Kailahun	Kailahun District	Yawei	Bendu
12010611	Eastern	Kenema	Kenema District	Dama	Lower Dabor
12030406	Eastern	Kenema	Kenema District	Gaura	Mendekelema
12040406	Eastern	Kenema	Kenema District	Gorama Mende	Kualley
12060504	Eastern	Kenema	Kenema District	Koya	Upper Koya
12080305	Eastern	Kenema	Kenema District	Lower Bambara	Gboro
12080642	Eastern	Kenema	Kenema District	Lower Bambara	Nyawa
12110106	Eastern	Kenema	Kenema District	Nomo	Faama
					Kagbado
12120603	Eastern	Kenema	Kenema District	Nongowa	Njeigbla
12140109	Eastern	Kenema	Kenema District	Small Bo	Fallay
12150308	Eastern	Kenema	Kenema District	Tunkia	Giewoma
13010103	Eastern	Kono	Kono District	Fiama	Dumbia
13040102	Eastern	Kono	Kono District	Gbense	Banfinfeh
13060202	Eastern	Kono	Kono District	Kamara	Gbondu
13090106	Eastern	Kono	Kono District	Nimikoro	Bafinfeh
13090415	Eastern	Kono	Kono District	Nimikoro	Jaiama
13110216	Eastern	Kono	Kono District	Sandor	Dangbaidu
13111021	Eastern	Kono	Kono District	Sandor	Yawatanda
13130213	Eastern	Kono	Kono District	Tankoro	Tankoro
21020102	Northern	Bombali	Bombali District	Bombali Sebora	Kafala
				Gbanti	
21030702	Northern	Bombali	Bombali District	Kamarank	Makulon
				Gbendembu	
21041202	Northern	Bombali	Bombali District	Ngowa	Mamaka
21070106	Northern	Bombali	Bombali District	Makari Gbanti	Gborbana

21080101	Northern	Bombali	Bombali District	Paki Masabong	Kathanthan
21100102	Northern	Bombali	Bombali District	Sanda Loko Sanda	Banka
21110602	Northern	Bombali	Bombali District	Tendaran	Rogbin
21120602	Northern	Bombali	Bombali District	Sella Limba	Manonkoh
22011003	Northern	Kambia	Kambia District	Bramaia	Kanku Bramaia
22030209	Northern	Kambia	Kambia District	Magbema	Kamba
22040403	Northern	Kambia	Kambia District	Mambolo	Mayakie
22051002	Northern	Kambia	Kambia District	Masungbala	Samu
22060908	Northern	Kambia	Kambia District	Samu	Mapotolon
22070405	Northern	Kambia	Kambia District	Tonko Limba	Magbonkoh
23020204	Northern	Koinadugu	District Koinadugu	Diang	Gbenekoro
23040110	Northern	Koinadugu	District Koinadugu	Kasunko	Gbonkobor
23050414	Northern	Koinadugu	District Koinadugu	Mongo	Mongo I
23060404	Northern	Koinadugu	District Koinadugu	Neya	Nyedu
23070402	Northern	Koinadugu	District Koinadugu	Nieni	Wollay
23090506	Northern	Koinadugu	District Koinadugu	Sulima Wara Wara	Ganya
23100803	Northern	Koinadugu	District	Bafod Bureh Kasseh	Kaponpon
24010801	Northern	Port Loko	Port Loko Distri	Ma	Makana
24020901	Northern	Port Loko	Port Loko Distri	Buya Romende	Robis
24040304	Northern	Port Loko	Port Loko Distri	Kaffu Bullom	Lungi
24050402	Northern	Port Loko	Port Loko Distri	Koya	Futa
24051503	Northern	Port Loko	Port Loko Distri	Koya	Robia
24060504	Northern	Port Loko	Port Loko Distri	Lokomasama	Katonga
24070101	Northern	Port Loko	Port Loko Distri	Maforki	Batpolon

24072102	Northern	Port Loko	Port Loko Distri	Maforiki	Marunia
24090201	Northern	Port Loko	Port Loko Distri	Masimera	Biss-Manika
				Sanda	
24100704	Northern	Port Loko	Port Loko Distri	Magbolont	Magbolontor
25010307	Northern	Tonkolili	Tonkolili District	Gbonkolenken	Mayeppoh
25020306	Northern	Tonkolili	Tonkolili District	Kafe Simiria	Mabonto
25050101	Northern	Tonkolili	Tonkolili District	Kholifa Rowala	Bo Road
25060104	Northern	Tonkolili	Tonkolili District	Kunike Barina	Makali
25070608	Northern	Tonkolili	Tonkolili District	Kunike	Thambaya
25090211	Northern	Tonkolili	Tonkolili District	Sambaya	Buyan
25110110	Northern	Tonkolili	Tonkolili District	Yoni	Foindu
25110805	Northern	Tonkolili	Tonkolili District	Yoni	Masengbe
31010403	Southern	Bo	Bo District	Badjia	Njargbahun
31030305	Southern	Bo	Bo District	Bagbwe(Bagbe)	Niawa
31040708	Southern	Bo	Bo District	Boama	Sannah
31050804	Southern	Bo	Bo District	Bumpe Ngao	Taninahun
31070510	Southern	Bo	Bo District	Jaiama Bongor	Tongowa
31090205	Southern	Bo	Bo District	Komboya	Kemoh
31100613	Southern	Bo	Bo District	Lugbu	Yorma
31130607	Southern	Bo	Bo District	Tikonko	Njagbla II
31140508	Southern	Bo	Bo District	Valunia	Seilenga
32020507	Southern	Bonthe	Bonthe District	Bum	Lanje
32050104	Southern	Bonthe	Bonthe District	Jong	Basiaka
32070202	Southern	Bonthe	Bonthe District	Kwamebai Krim	Kwako Lanten
32091003	Southern	Bonthe	Bonthe District	Sittia	Sampoh
			Moyamba		
33010902	Southern	Moyamba	District	Bagruwa	Sembehun
			Moyamba		
33021305	Southern	Moyamba	District	Bumpeh	Yengessa
			Moyamba		To -
33041009	Southern	Moyamba	District	Fakunya	Ndambalenga
			Moyamba		
33060105	Southern	Moyamba	District	Kaiyamba	Angigboya

33090102	Southern	Moyamba	Moyamba District	Kori	Zone – 1
33100801	Southern	Moyamba	Moyamba District	Kowa	Tawoveihun
33120504	Southern	Moyamba	Moyamba District	Ribbi	Masarakulay
33140505	Southern	Moyamba	Moyamba District	Upper Banta	Songbo
34020403	Southern	Pujehun	Pujehun District	Galliness Perri	Gendema I
34040204	Southern	Pujehun	Pujehun District	Panga Kabonde	Banyande
34050408	Southern	Pujehun	Pujehun District	Makpele	Selimeh
34070801	Southern	Pujehun	Pujehun District	Mono Sakrim	Sowa
34100704	Southern	Pujehun	Pujehun District	Soro Gbema	Moiwebu
41010301	Western	Area Rur	Western Rural District	Koya Rural	Magbafti
41030308	Western	Area Rur	Western Rural District	Waterloo Rural	Hastings Village A
41040612	Western	Area Rur	Western Rural District	York Rural	Sattia/Tombo