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QUEEN'S UNIVERSITY CANADA

HOUSEHOLD SURVEY ON FOOD SECURITY IN THE CITY OF CAPE TOWN

SAMPLE DESIGN AND METHODOLOGY

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Sample Design and Methodology

SAMPLE DESIGN AND METHODOLOGY

SAMPLE DESIGN

- The sample for the 2013 Food Security Study was designed as a multi-stage, stratified, random probability sample of 2,500 households that were representative of the City of Cape Town.
- Face-to-face personal interviews were conducted in the respondents' homes, with the head of the household or a responsible adult in the household.
- The questionnaire was translated into Afrikaans and Xhosa.
- The sample frame used was based on the Census 2011 EA sample frame, updated with the latest population estimates.
- An EA is the smallest geographic area for which population data – such as the number of dwellings and households in the EA, and the age, gender, race, and incomes of all the people who live in the EA – is available.
- EAs were considered as the primary sampling units (PSUs), households as the secondary sampling units (SSUs), and adults aged 18 years and older as the ultimate sampling units (USUs).
- The number of households per EA was used as the measure of size (MOS).

SAMPLE STRATIFICATION

- The first sample stratification was 10% high-income areas, 20% medium-income areas and 70% low-income areas.
- A stratification variable was developed to divide the areas of the City of Cape Town into high-, medium- and low-income areas.
- Statistics South Africa's Annual Household Income by EA data was used to establish the dominant household (HH) income for each EA.
- The table overleaf shows the distribution of households by income category.




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SAMPLE DESIGN AND METHODOLOGY
SAMPLE DESIGN

TABLE 1: Annual Household Income (Cape Town)

ANNUAL HOUSEHOLD INCOME	NUMBER OF HOUSEHOLDS	PERCENTAGE
No income	146,517	13.71
R 1 - R 4,800	29,373	2.75
R 4,801 - R 9,600	42,420	3.97
R 9,601 - R 19,600	113,277	10.60
R 19,601 - R 38,200	170,823	15.99
R 38,201 - R 76,400	154,428	14.45
R 76,401 - R 153,800	139,347	13.04
R 153,801 - R 307,600	126,624	11.85
R 307,601 - R 614,400	92,859	8.69
R 614,001 - R 1,228,800	38,019	3.56
R 1,228,801 - R 2,457,600	9,750	0.91
R 2,457,601 or more	5,064	0.47
Unspecified	72	0.01
Grand Total	**1068573**	**100.00**

- For the low-income group, we took the first six categories (from no income to R76,400 per annum), which accounted for 61% of households.
- The middle-income group was formed using the R76,401 - R307,600 income range (or about 25% of households), while the high-income group used the remaining categories (R307,601 and above, or 14% of households) for which data existed.
- Table 2 (below) shows the sample allocation and proportions:

TABLE 2: Allocation by Household (HH) Income

HH INCOME CATEGORY	GROUPED HH INCOME	PERCENTAGE	SAMPLE SIZE
Low	R 0 – R 38,200	61.47	1,800
Middle	R 76,401 – R 307,600	24.89	500
High	R 307,601 and above	13.63	200

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SAMPLE DESIGN AND METHODOLOGY
SAMPLE ALLOCATION

- Based on the aforementioned allocation, we determined the dominant household income category for each EA.
- Then we used the power allocation rule to allocate the EAs according to the dominant income group for each EA.
  - The power allocation rule is a disproportionate allocation technique that is applied internationally and was used to determine the number of EAs to be drawn per stratum.
  - The aim of using the power allocation rule is to somewhat decrease the allocation of EAs to the larger strata, and to somewhat increase the allocation to the smaller strata.
  - Using this technique, one can ensure – as far as the overall sample size allows – that the sample sizes are large enough in each of the stratum, thus providing good precision and a sufficiently large basis for meaningful analysis within each income category.
- AFSUN undertook a baseline urban food security survey in Cape Town in 2008, focusing on the food security status of the city's poor communities, namely Khayelitsha, Philippi, and Ocean View.
- In order to provide comparability with the 20018 survey and to maintain city-wide coverage, it was decided to oversample Khayelitsha. The sample was drawn from all EAs in Khayelitsha, however, and not only from those surveyed in 2008.
- It was thus decided that Ocean View should not be oversampled and incorporated into the rest of the sample.
- In Philippi, it was decided that we should sample the same areas that were sampled in the 2008 study (Wards 33, 34 and 80 only) in order to have comparability with the 2008 study for at least one area.
- It was also decided that DuNoon had to be oversampled, as the area was of special interest to the City of Cape Town.
- The second stage of sampling was the allocation of the sample to cover the aforementioned issues.




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SAMPLE DESIGN AND METHODOLOGY
SAMPLE ALLOCATION

- Table 3 (below) provides a breakdown of the EAs and households in the City of Cape, stratified by low, middle, and high household income categories:

TABLE 3: Number of EAs And Estimated Households by Main Place and Income Category

STRATUM	LOW HH INCOME	MIDDLE HH INCOME	HIGH HH INCOME	TOTAL
All Areas (excluding Khayelitsha Philippi-Browns Farms and DuNoon)				
EAs	2,599	1,613	952	5,164
HH	545,623	235,864	130,415	911,904
Khayelitsha				
EAs	581	11	0	592
HH	116,293	2,482	0	118,776
Philippi-Browns Farms				
EAs	93	2	0	95
HH	24,963	310	0	25,274
DuNoon				
EAs	28	0	0	28
HH	9,587	0	0	9,587
TOTAL EAs	**3,301**	**1,626**	**952**	**5,879**
TOTAL HOUSEHOLDS	**696,468**	**238,658**	**130,416**	**1,065,541**




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SAMPLE DESIGN AND METHODOLOGY
FINAL SAMPLE

- Table 4 (below) shows a breakdown of the sample of EAs that were drawn:

TABLE 4: Sample of EAs

MP_STRATUM	HH INCOME			TOTAL
	LOW	MIDDLE	HIGH	
All EAs (excluding the below areas)	154	81	33	268
Khayelitsha	63	2	0	65
Philippi-Browns Farms	63	1	0	64
DuNoon	**20**	0	0	20
Total	**300**	**84**	**33**	**417**

- Table 5 (below) provides a breakdown of the sample by the number of interviews per area split by the three household income categories:

TABLE 5: Sample Size – Number of Interviews

MP_STRATUM	HH INCOME			TOTAL
	LOW	MIDDLE	HIGH	
All EAs (excluding the below areas)	844	486	198	1,528
Khayelitsha	378	12	0	**390**
Philippi-Browns Farms	378	6	0	**384**
DuNoon	200	0	0	**200**
Total	**1,800**	**504**	**198**	**2,502**

SELECTION OF HOUSEHOLDS

- In each of the drawn EAs, six households were systematically selected, with the exception of the EAs in DuNoon (where 10 households were systematically selected). Starting points were allocated to ensure coverage of the entire EA.

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DETERMINING OF WEIGHTS

Weights were assigned in order to extrapolate the obtained sample to the population of the City of Cape Town. The development of these weights used the multi-stage sampling methodology, as follows:

- **First stage:** Develop EA Weights;
- **Second stage:** Develop household weights; and
- **Third stage:** Develop respondent weights.

In the first stage, the enumerator areas (EAs) – the primary sampling units (PSUs) – were selected using a probability proportional to size (PPS) method from the population sampling frame. The weight of an EA is given by:

$$W_{PSU} = \left(n_{EA} \frac{PSU_{HH}}{POP_{HH}} \right)^{-1}$$

In the second stage, households were systematically selected within each PSU in the sample. The household weight per PSU is given by:

$$W_{HH} = W_{PSU} \left(\frac{n_{HH}}{PSU_{HH}} \right)^{-1}$$

In the final stage, a person aged 18 years or older was selected from the drawn household. The respondent's weight is given by:

$$W_{PP} = W_{HH} * n_{18+}$$

Finally, the respondent weights was adjusted to compensate for differential non-responses (i.e. under-representation of certain parts of the population).

The SAS macro CALMAR, developed by INSEE in France, was used to benchmark the sample record weights to the 2015 mid-year estimates in respect of province, race, age, and gender.

The following three articles describe the calibration techniques used for benchmarking:

- Deville, J.-C. & Särndal, C.-E. (1992) *Calibration estimators in survey sampling*, Journal of the American Statistical Association 87, 376-382.
- Deville, J.-C., Särndal, C.-E. & Sautory, O. (1993) *Generalized raking procedures in survey sampling*, Journal of the American Statistical Association 88, 1013-1020.
- Neethling, A. & Galpin J.S. (2006) *Weighting of household survey data: a comparison of various calibration, integrated, and cosmetic estimators*, South African Statistical Journal 40, 123-150.

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