Solid Waste Management in Urban Africa: Methodological Approaches to Data Collection on Vulnerability, Capacity and Loss Assessment in Nairobi, Mombasa and Dakar

Dickson A. Amugsi, Kanyiva Muindi, Blessing Mberu

Work Package 1: Methodology Overview

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1 Introduction

This study involves three case studies of vulnerability, capacity and loss assessment (VCLA) in relation to solid waste management in three cities: Nairobi and Mombasa in Kenya, and Dakar in Senegal. The substantive focus of the study is to understand the impacts of a key every day, man-made primary hazard - namely poor solid waste management (SWM), and relevant associated secondary hazards, such as soil, groundwater and air pollution, flooding and fires, on human health. The study is built on three main components: Policy review, demographic and epidemiological surveys and biomedical investigation of poor SWM and health nexus. This paper focuses on the demographic and epidemiological component of the project.

1.1 Research Aim and Questions

The aim of the study is to assess different risks arising from exposure to poor solid waste management practices and the capacity of authorities and communities to deal with these risks.
The study seeks to address the following research questions:

1. What strategic frameworks, policies and institutional arrangements exist for effective SWM in the three cities and to what extent do they cover associated risks to health?
2. What actual investments, practices and interests currently shape the realities of SWM? What relative roles do public, private and third sector actors play in the process?
3. What is the relative exposure of residents of slum settlements compared to less deprived city areas to poor SWM associated health outcomes?
4. What knowledge and attitude do stakeholders have in relation to environmental and health risks due to poor SWM at individual, household and community levels?
5. What disparities exist in vulnerability, capacity and loss to health due to poor SWM across age groups and gender?
6. What are the linkages between poor SWM and secondary hazards such as flooding in the three cities?

2 Overview/Summary of methods

2.1 Study design

The study employed mixed methods approach (quantitative and qualitative). The quantitative method entailed a cross-sectional population based survey. The qualitative methods utilized

included, key informant interviews (KIIs), focus group discussions (FGDs) and In-depth Interviews (IDIs), and were implemented across a wide spectrum of SWM stakeholders at the community, institutional, county and national levels. For the policy review, we employed analytical review methodology to examine integrated environmental management policies and sector specific policies in relation to SWM.

3 Data collection

Quantitative data collection

The aim of the quantitative household survey data collection was to generate robust representative data on the scope of socio-demographic patterns and correlates of the various domains of vulnerability and capacity and subjective views on loss to health due to SWM. Data on household knowledge, attitude and practice on SWM were collected using a structured questionnaire, administered to household heads in the selected study communities. The questionnaire comprises a household roster that captures the background characteristics of all household members and questions on household characteristics; household practices regarding waste storage, collection and disposal; knowledge, attitudes and practices in relation to health risks associated with SWM as well as associated challenges such as crime and conflict in the SWM sector.

Qualitative data collection

The qualitative data collection were aimed to investigate in-depth, the underlying disparities in vulnerabilities and capacity at individual, household and community levels, and evaluate the narratives of experiences that have a significant impact on solid waste management. The qualitative data collection also sought to identify and interrogate existing policies and policy gaps from key policy actors and other stakeholders who need to act to create better solid waste management practices that address associated loss to health. To this end, three separate data collection approaches were employed: focus group discussions (FGDs), Key Informant Interviews (KIIs) and In-depth Interviews (IDIs). Study participants' diversity was critical to our goal of generating robust and grounded knowledge on SWM in Kenya and Senegal.

3.1 Sample Size Determination

The formula which was used in determining the sample size for the survey was as follows:

$$n = \frac{t_{\frac{\alpha}{2}}^2 p(1-p) .D_{eff} .N_{resp}}{\varepsilon^2} \quad \text{..... (1)}$$

Where;

n = estimated sample size

t = abscissa of the normal curve that cuts of an area (alpha) at the tails which is determined by the desired confidence level. In the case of the current survey the desired confidence level was 95%.

p = proportion of the population that possess a given attribute that is key for the survey. This may be obtained from a previous survey or in its absence it is estimated with the possible maximum value of 0.5 which gives the largest possible sample size.

α = level of statistical confidence, 5% in the case of this study

ε =the margin of error to be tolerated was set at 5%

D*eff* = design effect which arises from the effect of clustering associated with increased variances. In this study a design effect of 2 was used.

N*resp* = potential non-response due to various factors which include refusal by some respondents. It was assumed that the sensitivity of the issues in this survey may lead to some non-response and as such, a non-response adjustment of 5% was applied to sustain an optimal sample size.

Using the values provided above, the estimates for the sample sizes for the survey were obtained. The samples were allocated to the various locations of the cities, proportionate to the population sizes.

3.1.1 Allocation of the Sample to Strata

In this survey, the Locations constituted strata and within each location the enumeration areas (EAs) were the Primary Sampling Units (PSUs) for the selection of the sample. The sample design was stratified cluster sample design. The estimated sample sizes were allocated to the locations using the proportional allocation method. This method was preferred to equal allocation because it produces low variances in the estimates.

3.1.2 Cluster Sizes

Since the stratified cluster sample design was adopted for the survey, it was important to fix the number of interviews to be done in each cluster. Building on the demographic and health survey practices (1) and as the surveys were implemented in urban areas where household density was expected to be high, we interviewed a fixed number of 20 households per EA (cluster).

3.1.3 The Selection of the Sample

There were two stages of sample selection in the survey. At the first stage, the selection involved the clusters which were also referred to as the Primary Sampling Units (PSUs). At the second stage, the households, which were the Ultimate Sampling Units (USUs) were selected for the interviews. Within the household there was no selection as the head of the household was the respondent to all the issues of the survey. In the absence of the head of the household, the next most senior member of the household was interviewed.

3.1.4 Selection of the Clusters

Within each stratum (location), an independent selection of EAs (clusters) was done using the Probability Proportional to Population Size (PPS) method. The measure of size for the selection of the EAs was the number of households.

3.1.5 The Selection of the Households

The selection of the households was done using the systematic sampling method. This method has been proved theoretically to be identical to the simple random sampling method. The survey team carried out a quick count of the households in the EA and based on this information, determined a sampling interval for the selection of the households. The team then moved from one end of the EA to the other through the sampling interval and selecting the households for interview.

3.2 Sampling strategy for qualitative study

Purposive sampling was used to select participants for the qualitative study. This sampling method was used to enable us get people who would be in the best position to provide us with rich information on the issues that were being explored. Gender was considered in the selection of study participants.

3.3 Potential biases and limitation

In the household survey, we assumed that the head of household will be in a position to provide adequate information on individual members of the household and adequately evaluate the household's vulnerability, capacity and loss to health related to poor SWM. This may not be the case in situations where the household head may not be the respondent. Therefore, in the event of the respondent not being the household head, we cannot say for sure that the views expressed by that respondent represents the true views of the household head. Nevertheless, to ensure that majority

(if not all) our respondents were the household heads, we made sure that revisit was conducted in cases where the household heads were not available at the time of the first visit.

4 Data analysis – approach and techniques

Analysis of quantitative and qualitative data

The quantitative data analysis were performed using STATA version 14.0. The analysis involved descriptive analysis to provide general information on the characteristics of the sample. Differences in means between groups for continuous variables were tested using independent samples t-test and proportions tested using chi square test. Multivariate logistic regression methods were used to examine the associations between the explanatory and outcome variables. The qualitative data were analyzed using NVivo. The data were synthesized using thematic, content and narrative analyses and triangulated with quantitative analysis results to provide a robust picture of people's perspectives on solid waste management and health related risks arising from poor solid waste management practices.

5 Impact plans

The study aimed to better understand SWM and the associated risks, and to break the cycles by which vulnerability and the incapacity to cope with hazards accrue in urban areas. The evidence generated will be used to influence policy and action, specifically promoting better waste management practices that reduce exposure, vulnerability and loss to health and to promote capacity for risk reduction at community, national and regional levels. We will facilitate dialogue amongst practitioners, policy/decision makers and the general public on the value of specific innovative waste management actions informed by the study.

3. Lessons learnt

We had challenges working with the Kenyan National Bureau of Statistics (KNBS) in our effort to obtain sampling frame and maps for the conduct of the study. One of the key challenges was the cost of the maps and services that they were expected to provide, which was way above what we budgeted for. To overcome this, an individual consultant was engaged to provide us with the services we requested from KNBS. And he successfully carried out the assignment at a cost far lower than what the KNBS requested. The lesson learnt here is that in some circumstances, it is more cost effective to engage the services of individuals rather than state institutions. There was also the challenge of reaching out to stakeholders, especially government officials. We addressed this by

engaging the services of Research Triangle Africa (RTA), a group that have been working with government officials and other stakeholders for several years. The lesson learnt is that engaging local institutions could make it easier for researchers to reach out to people they may have difficulties reaching by themselves.

References

1. Aliaga, A. and R. Ren (2006). "Optimal sample sizes for two-stage cluster sampling in Demographic and Health Surveys.