



Sample Design for Surveys on International Migration: MEDHIMS Methods and Applications in Egypt and Jordan

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Abstract. This paper will describe the need for special methods to design samples to collect data on international migration from household surveys, focusing on methods for MEDHIMS—Mediterranean Household International Migration Surveys. International migrants are “rare elements”, leading to the desirability of using special methods for sampling, involving (1) locating a sampling frame that provides data on the geographic prevalence of migrants among the country’s population, to use to form strata to sample Primary Sampling Units (PSUs) based on the prevalence of migrants, then oversample PSUs from strata with high proportions of migrants; and (2) in the final stage of sampling areas, for Ultimate Area Units (UAUs)—such as census sectors/enumeration areas—use two-phase sampling, involving in phase one, a quick screening survey of households in each UAU, to identify those with migrants, who are again oversampled, and then interviewed along with non-migrants. The use of over-sampling requires careful collection of data on the numbers of households at each stage so that the probability of a household being selected in each UAU in each PSU can be calculated to determine sampling weights. How the methods were applied in Egypt and Jordan are described, providing valuable lessons for sampling in MEDHIMS.

Key words: rare elements, international migrants, oversampling, weights, Egypt, Jordan

1. Introduction: theoretically ideal approach—sampling rare elements:

The MEDHIMS project grew out of an urgent need to collect better data on international migration and its linkages with socio-economic development in the region, a need recognized by governments in the region as well as international agencies. This need was recognized even before the Arab Spring, civil war and increased ISIS terrorist activities led to vast further increases in international migration in the region and neighboring countries, especially asylum-seekers. A key part of MEDHIMS is the application of appropriate sample designs, to be nationally representative and cost-efficient. Before describing the actual sample designs developed in the first two countries, the theoretically desirable approach is described, based on international migrants for this project being emigrants, return migrants, and forced migrants. Relative to the total populations of the countries, the migrants of interest (at least *recent* migrants, such as in the previous 10 years) are both (a) “rare elements” in the statistical sense, and (b) not distributed randomly in any population.

The “ideal” approach is based on principles of sampling rare elements (Kish, 1965). As described in Bilsborrow et al. (1997) and Bilsborrow (2013), there are two key steps in designing a sample of households to investigate international migration as “rare elements”: (a) stratify areas of the country according to the prevalence of (households with) international migrants and oversample areas with higher prevalence using stratified sampling; and (b) in the last-stage small area units, conduct two-phase sampling, which involves, in the first phase, listing all households in those small sample areas selected (such as census sectors) to classify



them as migrant and non-migrant households, then oversample migrant households, but also sample non-migrants; in the second phase, conduct interviews in the households selected. Regarding (a), the first and fundamental requisite is a data source that identifies households with international migrants as well as non-migrant households (e.g., census, large representative household survey, or continuous population register). The usual ideal source is a (recent) census which included questions on whether the household had a previous member who had moved to live abroad in the last X years and not returned (to identify households with emigrants); and on whether some current member had lived abroad but returned (for return migrant households). (Lack of space prevents a description for forced migrants, though module 1 of the MEDHIMS questionnaire has questions to identify them.

If the census provided more-or-less accurate data from these questions, tabulations can be prepared to classify households as migrant and non-migrant households, leading to estimates of prevalence (or proportion) of migrant households for all administrative-political divisions of the country. Administrative units can then be grouped into strata, such as high, medium and low, with the high stratum being areas with high proportions of households with one or more migrant of interest (such as an emigrant), a medium stratum, and a low stratum with low proportions of households with migrants (the vast majority, with zero or near zero values). Then *stratified sampling* is used to select (sample) areas from each of the (e.g.) three strata, selecting a high *proportion* of areas from the high stratum, a lower proportion from the medium, and a lowest proportion from the low stratum. The result of this stratified sampling is that fieldworkers will concentrate their time interviewing households in areas expected to have more migrant households, and spend much less time searching for them than in a random sample.

Once sample areas (Primary Sampling Units, etc.) are selected using oversampling of areas with higher proportions of migrants, the necessary second step is to undertake *two-phase sampling* in the last, smallest stage area units, commonly census sectors or enumeration areas (EAs)--the Ultimate Area Units (USUs). The first phase begins with a preliminary field operation of quick visits to all households in the sample EA, to ask a few questions to identify if the structure is an occupied residential household and if it has had any prior household member leave to live abroad and remain abroad, or who left and subsequently returned. In this screening operation interviewers spend only a few minutes per household asking any adult member or even a neighbor for this basic data, and record the data, one line per household, on a listing sheet in landscape format. Such a sheet will have separate columns for the household address (or brief description in rural areas), name of household head, number of members, and whether it has an emigrant or a return migrant. From these lists for each EA, households with migrants of interest are oversampled, along with a few non-migrant households per EA, based on criteria established prior to fieldwork on the desired numbers of households with and without migrants. Then in phase 2, the samples of migrant and non-migrant households are interviewed. Since at all stages, higher proportions of migrants (areas, then households at the EA-level stage) are selected than non-migrants, the sample is *not self-weighting*, so careful records must be kept for all EAs on the numbers of households of each type found, the numbers sampled, and the numbers successfully interviewed.

2. Sample design for Egypt



The first need for selecting a sample is an adequate sampling frame, to create strata. This requires having reliable data on households with and without international migrants of interest. The first step, therefore, was to examine the data on international migration from the most 2006 census in Egypt. It was already known that the census greatly undercounted (the stock of) Egyptians living abroad, counting only about 500,000 compared to estimates from independent sources ranging from 3 to 10 million, out of an enumerated population of 72 million. This population was estimated to have reached 81 million in 2010. If the undercount of migrants abroad were distributed randomly, the 2006 census data could still serve as an adequate sampling frame to develop strata based on the prevalence of migrants in administrative areas, but it was known that the undercount was far higher in urban areas, especially the large cities of Cairo and Alexandria, so the census was considered of little use. An alternative was to use data from the recent third round of the National Labor Market Panel Survey (NLMPS), carried out by CAPMAS in 2011-12, which had questions to identify if the household had any former member living abroad as well as return migrants. The sample size of the survey was 12,500 households, from 476 EAs. The total number of out-migrants living abroad was only 803 (with no time cut-off limit on when they left), while 1367 return migrants aged 15+ were found. Data on the prevalence of migrants in the NLMPS were computed for the 200 EAs that overlapped with the master sample based on the 2006 census, to establish high and low strata. The mean proportion of households having a migrant was .081 in the high stratum and .049 in the low stratum. A rule of thumb is that the ratio of the two proportions should be at least 4 (versus 1.65 here) to justify using stratification rather than the easier random selection of EAs. Therefore, it was decided to select a non-stratified probability sample of PSUs from sample number 2 (of 5) of Egypt's 2010 Master Sample (MS), in which EAs were created with probabilities proportional to population size (PPS), and proportional to Egypt's urban (44%)-rural distribution. Unlike most countries, households with international migrants tend to be dispersed all over Egypt, urban and rural. In the selection of households for screening, since the MS was updated less than three years prior to the implementation of the Egypt-HIMS in 2013, it was decided there would be no need for a second field operation to update the household lists in each sample EA—resulting in a considerable saving in field costs.

Given the rareness of recent international migrants (though less so in Egypt than many developing countries), and the availability of sufficient funding, it was decided to select a large, nationally representative sample of 90,000 households. The availability of the MS covering 5024 enumeration areas (EAs), made it appropriate to use it for a sampling frame. The Egypt-HIMS was based on a sample of 1048 Primary Sampling Units (PSUs), which were the 1000 EAs from the MS (with 48 EAs added to meet goals of external funders) and of sufficient size to provide statistically reliable results for the five major regions of Egypt, and for urban and rural populations.

The final Egypt-HIMS sample was selected in *two stages*: (1) 1048 PSUs (EAs) were selected from the MS in proportion to the estimated population size (PPES) of the primary administrative units in Egyptian governorates; and (2) households were selected *a priori* at random from existing (2010) lists in the master sample averaging 230 households in the selected sample EAs; 84 (in rural areas) and 88 (in urban) were screened in the field to determine migration status, aiming to complete 80 interviewed households per EA, allowing for 5% non-response in rural areas and 10% in urban areas. Thus *two-phase sampling* was used in this second and last stage, the first phase being a listing of households to identify



those containing an out-migrant living abroad (emigrant), a return migrant, or no migrant, with households with migrants to be oversampled. Field teams comprised a driver, supervisor, three interviewers, and a field editor. In practice, the supervisor divided the households in the EA into three approximately equal lists, assigning an interviewer to each, who administered the screening questionnaire (Module 1 of the Egyptian questionnaire) to her households. This module sought basic data on household demographics, including country of birth, citizenship, migration, education, etc., for about 90,000 households. If a screened household had an emigrant or return migrant, it was automatically interviewed *on the spot*—completing the rest of the household modules and the individual questionnaires for migrants and one non-migrant per household. If no migrant, the interviewer was to interview one non-migrant household in her list, pre-assigned by the supervisor at random from the order of the non-migrant household encountered. This meant a maximum of 3 non-migrant households would be selected for interview per sample EA (non-migrant households not available or refusing were appropriately not replaced, so often only two were completed in many EAs).

The final sample to be screened comprised 90,000 households, anticipated to include about 6,000 out-migrant households, 6,000 return migrant households, and 3,000 non-migrant households. In practice fieldworkers found 83,741 occupied dwellings, and completed 83,358 in the screening using section 1 of the Egyptian questionnaire, finding 6.3% with emigrants (5,229 households) and 5.6% (4,648) with return migrants, both a bit below the target numbers. Response rates were over 99% for individual interviews of emigrants and return migrants and 98% for non-migrants. Finding fewer households with migrants than expected was likely due to the lack of reliable data on the location of migrants to use for stratification. Since some small percentage of migrant households contain more than one migrant and/or more than one type of migrant (data were collected individually for each), the total number of individual migrant questionnaires implemented was expected to be 7,000 each for out-migrants and return migrants. Since data were obtained in each migrant household for one non-migrant (selected randomly), the number of non-migrant questionnaires to be completed was $6,000 + 6,000 + 3,000 = 15,000$.

The summary listing sheet completed by the supervisor in each EA included data on not only households but the total numbers of *individuals* of each of the four types found, the numbers sampled for interview, and the number of individual interviews completed. This led to additional weights for each type of individual interviewed in the EA, as well as the household weights.

The final sample involved six household sampling weights based on the following (each the inverse of the probability of selection): (1) the sampling rate of the MS (proportion of country's population covered by the MS); (2) the selection of second stage area units (*shiakhas*) from the MS (almost exactly one-fifth); (3) the weight for sample EAs in the sample *shiakhas* (proportion of population), almost always 0.01 to 0.02); (4) the sampling rate of households for listing (sampling 84-88 per EA, from EAs averaging around 230 households, so on average this meant weights of about 3; (5) weights to adjust for any sampling of households with different types of migrants, which applied only to non-migrant households since all migrant households encountered were selected; and (6) adjustments for non-response for the three types of sample households. Finally, there were (7)-(9) three weights for *individuals* successfully interviewed in sample households: emigrants, return migrants and non-migrants.

3. Sample design for Jordan



The two main sources of data on international migrants were the 2004 census and the 2012-13 Job Creation Survey (JCS) based on a large, nearly nationally representative sample of sub-districts. Each was thought to have significant under-reporting of households with emigrants and/or return migrants. Thus an experiment was carried out, to compute the (relative) prevalence of migrants across sub-districts of the two to compare the results to see if, despite deficiencies, the two led to a similar classification of the 89 sub-districts in the country in high, medium, and low migration prevalence rates. A Chi-square test of independence strongly rejected the null hypothesis, indicating a high level of dependency, i.e., very similar classifications of sub-districts into 3 strata. Therefore, data from both sources were drawn upon to create three strata for the 89 sub-districts, and stratified sampling was used to select 30. The distribution of prevalence data for the 89 led to the creation of three strata, 14 in the high stratum, 25 in the medium, and 50 in the low, reflecting the high concentration of households with migrants. Based on estimates of the mean proportion or prevalence of migrants in the three strata and the number of sub-districts, a sample was selected comprising 13 (of the 14) in the high stratum, 11 of 25 in the medium, and 6 of 50 in the low.

The second stage in the 3-stage sample was the selection of Secondary Sampling Units called localities from the 30 sample sub-districts. Data were computed on the prevalence of migrants in localities in the 30 using only the census, since the JCS did not have a large enough number of migrant households at that level. Once tabulations on the prevalence of emigrants and return migrants in localities were obtained from the census, stratification and then oversampling of localities was carried out, resulting in the selection of 172 localities (from the 1,043 in Jordan). At the third and last stage, Ultimate Area Units called blocks were selected at random (numbers of migrant households per block being too small for meaningful strata), with more blocks selected in the localities in the high stratum sub-districts compared to the other strata. The final result was 32 blocks per high stratum sub-district, 16 blocks per medium and 8 per low, a total of 640 blocks (from 14,418 in the country). Two-phase sampling was used in sample blocks, which had a mean expected number of about 84 households in 2014, involving listing households and oversampling those with migrants and selecting two non-migrant households at random from each block.

The final sample had 5 sample household weights: (1) one to adjust for the overall sampling rate of the Master Sample used (covering 40% of the Jordan population); (2) three to adjust for the probability of selection of PSUs (sub-districts) from the three strata; (3) three to adjust for the proportion of localities (population) selected from each sample sub-district; (4) weights to adjust for the probability of selection of blocks from sample localities, different for each locality; and (5) four household-level weights at the last stage, for differentially selecting households with migrant (three) and non-migrant households from listing sheets for blocks. These four weights are specific for each sample block, so careful records need to be maintained. Each household will thus have attached to it five weights multiplied together for weighting the data so that the weighted data of the sample households represents the population of Jordan. Finally, weights are needed for each of the four types of individuals interviewed—emigrants, return migrants, forced migrants, and non-migrants—which varied by block as well as according to the number found, the number selected for interview (viz., all of the emigrants and forced migrants), and the numbers actually interviewed.



50,000 households were administered the screening questionnaire, with those expected to have an emigrant estimated *a priori* to be about 2,000, along with 4,000 return migrant households and fewer than 200 forced migrant households. Interviewing these households was to be complemented by the selection of two non-migrant households per cluster, or $640 \times 2 = 1,280$. Since one non-migrant was to be selected at random for the individual interview in each migrant household as well as in each non-migrant household, the total number of non-migrant individual interviews was expected to be about 7,280. Meanwhile, if the mean number of migrants per migrant household were 1.2, the total numbers of *individual* out-migrant interviews would be about 2,400, along with 4,800 return migrants, and perhaps 600 forced migrants (assuming a mean number of three persons ages 15+ per forced migrant household eligible for the individual interview), yielding 7,800 individual interviews of migrants. The total number of households in the final sample was then estimated to be about 7,480, and total individual interviews around 15,080.

4. Conclusions

Each country is different in important ways, apart from its sources and quality of data on international migration for establishing a sampling frame—a challenge in both countries here. Major lessons are being learned. The data obtained from the survey needs to be checked to see that it represents the country total by multiplying the data for all completed households and individuals by their appropriate weights. This was a laborious process leading to errors found and corrected. Comparing the expected numbers of households and individuals of each type also is important to reveal errors in the original underlying assumptions. Most participating MEDHIMS countries subsequent to Egypt and Jordan will be using censuses with better questions for identifying migrants, and better positioning in the census schedule (e.g., not at the very end). And Morocco, which has already run a pretest, and other countries (also Algeria and Tunisia) aim to use current census data as a sampling frame for their survey shortly after the census, which should provide a better sampling frame. This early experience with three countries—each choosing a different path—shows the need for flexibility, but always keeping an eye on the theoretically ideal approach, to adapt its principles to fit country conditions. Comprehensive, national-level surveys on international migration constitute a new form of data collection, but one certain to be repeated many times in the years to come. At this early stage, it is a learning process, with the goal to strive for improvement.

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