

## SEVEN QUESTIONS ON THE ESTIMATION OF THE NUMBER OF IRAQIS IN JORDAN

### 1. HOW IS THE NUMBER OF IRAQIS ESTIMATED?

We estimate the number in several steps: First we select a probability sample of 1000 census enumeration areas from the about 13,000 enumeration areas defined for the 2004 Census of Jordan. Then we visit every place people may live within each area, and make a list of all households that live there. We also determine whether or not the each household contain one or more member of Iraqi origin. When we know how many Iraqis there are in each selected enumeration area, we can calculate how many Iraqis there are in total by considering how what proportion of the enumeration areas make up of the total number of enumeration areas in Jordan. For example, if the selected number of enumeration areas make up 10 percent of the enumeration areas in Jordan, the total population of Iraqis in Jordan would be 10 times the number of Iraqis observed in the enumeration areas we actually have listed and counted.<sup>1</sup>

### 2. WHAT ARE THESE ENUMERATION AREAS?

They are geographical areas, identified on maps. They each contained about 80 households in the census of 2004. They may be city blocks, villages, or part of villages. The Department of Statistics have divided all of Jordan into such enumeration areas, and have a well organized Geographic Information System that keeps track.

### 3. CAN YOU BE SURE THAT ALL IRAQIS ARE INCLUDED WHEN YOU TRY TO LIST THEM?

No, we cannot be completely sure. But we make a lot of effort to be as exhaustive as possible. The listers are instructed to visit all places people may live, however unlikely a living place it may be. For example, in addition to ordinary houses and apartments, shops, mosques, and factories are visited. Hotels are studied in a separate sample. We return back to many of the listed enumeration areas and go through the work of the listers. Moreover, when we actually interview households, we also select some that have been identified as non-Iraqi, partly in order to check that some Non-Iraqi households were not mis-classified during the listing as Iraqi ones.

We did not encounter much hesitation or unwillingness to be counted.

---

<sup>1</sup> The above assumes that the enumeration areas are selected with the same probability. That is actually not the case, since the actual selection process is somewhat complex. Therefore the actual estimation take into account the individual inclusion probability for each enumeration area.

**4. SINCE THE SAMPLE DEPENDS ON THE ENUMERATION AREAS FROM THE 2004 CENSUS OF JORDAN, WILL NOT THE SAMPLE BE BIASED DOWNWARDS BECAUSE THE POPULATION HAS GROWN SINCE 2004?**

No, while 2004 population figures are used to construct the sample, they only define the inclusion probability of each enumeration area. If all enumerations areas had exactly the same population as in 2004, the listing and subsequent estimation would produce an estimate of the population in 2004. But if on average the increase was 10 percent, we would also estimate a 10 percent larger population. However, large deviations for particular enumeration areas contribute to the uncertainty of the sample.

**5. IRAQIS ARE VERY UNEVENLY DISTRIBUTED ACROSS JORDAN, AND MOST APPEAR TO LIVE IN AMMAN, ZARQA AND IRBID. HAVE YOU TAKEN THAT INTO ACCOUNT?**

Yes, we have. The distribution (allocation) of the sample may be described as a risk averse optimal allocation. By this is meant that we have allocated the sample according to how the Iraqis that were registered in the 2004 census were distributed. Each district in Jordan initially received an allocation of census enumeration areas that was proportional to the number of enumerations areas in the district and the variation between census areas in the number of the Iraqis. It can be shown that such an allocation provides for the most efficient estimate of the number of Iraqis.

However because of the geographical distribution of Iraqis might have changed between 2004 and 2007 because of the immigration, or because of internal migration, three main changes to the sample were made:

First, governorates and districts which because of the allocation mathematics received very few enumeration areas, had their allocation increased, so that one would be able to detect large changes (This is the main risk averse feature of the sample).

Second, outside of Amman, the sample was made adaptive. That is, when we found an enumeration area with above a given number of Iraqis, we would also list the neighboring enumeration areas. The method depends on the assumption that Iraqis in Jordan live in some areas and not in others. Adaptive sampling can be very efficient in estimating the total size of a population.

Third, In Amman the sample was divided into three phases, each phase consisting of selection of 200 enumeration areas. The allocation of the first 200 enumeration areas were optimal based on the 2004 census, and then the allocation of the next 200 was optimal based on the distribution of Iraqis in the first 200. The third phase was then based on the second selection of 200 enumeration areas. In this way the allocation was adapted to be as optimal as possible for the current conditions.

**6. INSTEAD OF ALL THE COMPLEXITY OF THE CHOSEN SAMPLING STRATEGY WOULD IT NOT HAVE BEEN BETTER TO SIMPLY MAKE A MUCH LARGER SAMPLE?**

Not necessarily. A larger sample puts a much greater burden on the field organization, and it becomes much more complex to control what is happening in the field. Even with a larger sample we would have chosen a fairly complex sampling strategy in order to maximize accuracy. How large a sample that can be drawn with sufficient quality control over field work is partly a questions of the funds available.

**7. HOW DID YOU DETERMINE THE SAMPLE SIZE?**

We determined a minimum sample size based on our experiences with estimating the number of internally displaced Palestinians in Jordan. The Palestinians share a number of characteristics with the Iraqi immigrants, such as the clustering in particular areas. We therefore assumed that they would be a relatively good model. We then increased the sample considerably from the minimum, and also allocated the sample more efficiently than what was the case for the sample of Palestinians.