Migration and mortality in sub-Saharan Africa: Evidence from the Nairobi Urban Health and Demographic Surveillance System (NUHDSS)

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Introduction

In many countries in sub-Saharan Africa (SSA), the inability of national authorities to provide decent living conditions and basic social services to urban residents has created a new face of urbanization whereby a vast majority of urban residents live in overcrowded slums and shantytowns. While urbanization is expected to bring about prosperity in African cities, it has, on the contrary, been accompanied by growing inequities between the rich and the poor, increasing slum populations and concentration of health risks and hazards. This situation has challenged the urban advantage that commonly assumes that urban dwellers fare better than their rural counterparts in terms of economic and health conditions [1, 2]. Nairobi, Kenya's capital city, is a typical example of an African city whose growth happened amidst declining economy and poor governance. Although Nairobi remains attractive to many migrants as the major labour market in Kenya [3], a significant proportion of them ended up living in slums or slum-like conditions in the city, without proper access to basic social services such as sanitation and affordable clean water [4-6].

Several studies have highlighted the significant disadvantages faced by the slum residents of Nairobi with respect to morbidity [5, 7], access to health services [7-11], mortality [12, 13], and risky sexual practices [6, 14] relative to other population sub-groups, including rural residents. However, very few studies have addressed how migration affects the uniquely poor health outcomes observed among slum dwellers in SSA. This is partly due to the lack of appropriate data to address this question in the region. For example, studies on the relationship between migration and mortality in SSA usually focus on the rural-urban divide and often examine under-five mortality using Demographic and Health Surveys (DHS) data, due to the scarcity of data on adult mortality [2, 15-17]. Mixed findings have been reported in these studies; with some showing a disadvantage in child survival of urban migrants relative to natives and others concluding that migration between urban and rural areas is selective upon health in both directions. In a recent study based on longitudinal data, Bocquier and colleagues show that children born in the slum to recent migrant mothers have higher risk of dying than children born out of the slum or born to long-term residents [18].

In order to contribute to the understanding of the effect of migration on health in SSA, we take advantage, in this paper of the longitudinal data collected between 2003 and 2010 from the Nairobi Urban Health and Demographic Surveillance System (NUHDSS) to study the link between migration and mortality among slum residents. The NUHDSS is being run by the African Population and Health Research Center in two informal settlements in Nairobi – Korogocho and Viwandani since 2002. The longitudinal nature of the data will help address some of the gaps in the above-mentioned analyses. Unlike the previous studies, we examine the relation between migration and mortality among adults in the two slum areas. The NUHDSS involves visits to all households once every four months to collect information on key socio-

demographic and health events including births, migrations, deaths and causes of death (through verbal autopsies), immunization coverage, morbidity, health-seeking behavior, school attendance, marital status, household possessions and amenities, and livelihood sources. The two slum areas are characterized by high circular migration, with more than a quarter of the residents moving in (26.7%) and out (27.1%) of the slums every year [19].

Given the longitudinal nature of the data, we will apply Event History Analysis (EHA) techniques (Kaplan-Meier estimates, Cox regression) to examine the influence of migration on mortality of adults aged 15 years and above. To control for selection bias due to out-migration, we will use a two-stage equation model that has originally been developed for the control of endogeneity in cross-sectional data, by first estimating the propensity to migrate from a migration model. In doing so, we will have mortality estimates under the conditions prevailing in the slums only (i.e. without out-migration).

Previous studies showed that children in such areas are exposed to disproportionately high health hazards. Bocquier et al. (2010) showed the impact of mother and child migration on children survival using the above-mentioned two-stage model. Slum-born have higher mortality than non slum-born, an indication that delivery in the slums has long-term health consequences for children. Children born in the slums to women who were pregnant at the time of migration have the highest risk of dying.

The analysis on adult mortality uses the same rationale, mortality analysis controlling for migration. We assume that mortality is under-estimated in slum communities with high circular migration and particularly poor health environment. Migration is a selective process that leads the healthier to move to and stay in the slum areas. Actually, not only people who migrate are probably the healthier ones since destination areas such as slums are not suitable place for seeking treatment but it is also likely that sick people move out of such unhealthy environment to seek health care in their places of origin. Preliminary results confirm broadly these hypotheses. In-depth analysis will aim at confirming findings controlling for various factors, including quality of data collection. Also, cause-of-death data will allow us to determine for which disease the migration selection bias is the highest.

Preliminary findings

Graph 1 displays annualized death rates during the period 2003-2010, for males and females aged at least 15 years. It shows different patterns for males and females, indicating considerable overlap of male and female mortality rates during the period. From 2003 to the early years of 2004, females have higher mortality rates than their male counterparts. The same is observed from end of 2004 until mid-2005. Males' mortality is higher between 2007 and 2009, except from the early months of 2009.

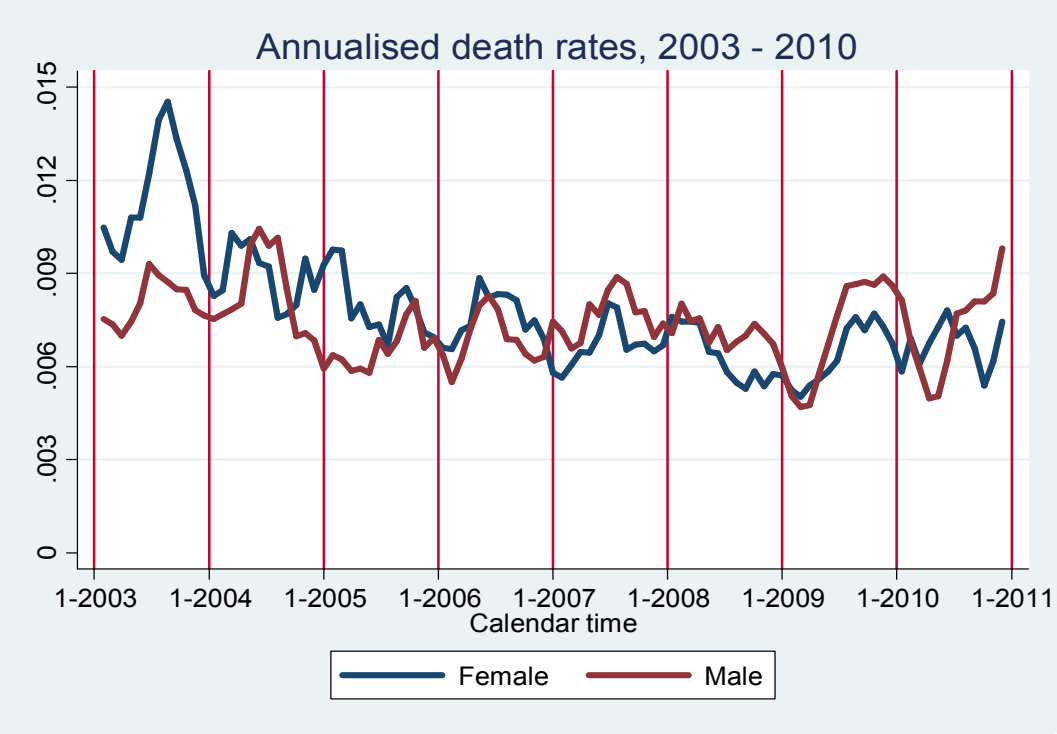

Figure 1: Annualized mortality rates during the period 2003-2010, by gender

Table 1 shows crude death rates for the adult population (aged 15 years and above) of the two slum settlements, by gender and specific periods. Findings indicate that mortality has decreased during the 8-year period. In particular, the decrease between 2003-2005 and 2006-2008 is remarkable. Females' mortality is higher than that of males during the period 2003-2005 but is lower thereafter. Over the past 8 years, the decrease is much steeper among females than males.

Table 1. Crude death rates per 1000 person-years and 95% confidence intervals by gender

	2003-2005	2006-2008	2009-2010
Males	7.69	7.17	7.11
	[7.06 - 8.38]	[6.57 - 7.82]	[6.42 - 7.88]
Females	9.37	6.87	6.45
	[8.52 - 10.31]	[6.18 - 7.64]	[5.68 - 7.31]
Total	8.36	7.04	6.83
	[7.85 - 8.91]	[6.59 - 7.53]	[6.31 - 7.40]

Table 2 shows the median age at death computed from Kaplan-Meier estimates. Findings show that for each sex, the median age at death has increased over the 8-year period. This increase is steeper among females, corroborating the higher decrease in crude death rates observed earlier among women. Also, this confirms the higher mortality for women observed during the 2003-2005 period as women show lower mean age at death during this period. The gender gap in favor of men reduced over time, passing from 2.8 years in the 2003-2005 period to 0.3 years in the 2006-2008 years. It has turned into women's favor during the 2009-2010 period (0.3 years).

Table 2. Mean age at death by gender

	2003-2005	2006-2008	2009-2010
Males	52.5	52.8	52.7
Females	49.7	52.5	53.0
Total	51.7	53.1	52.6

Figure 2 shows the age-specific rates (Log-scale) for the adult population during the period 2003-2010. Findings indicate that men have higher risks of dying between 15 and 24 years old but the mortality rates are higher for women from age 24 until 42. Not much difference is observed thereafter, except for the 65-69 and 75-79 age groups (males have higher mortality).

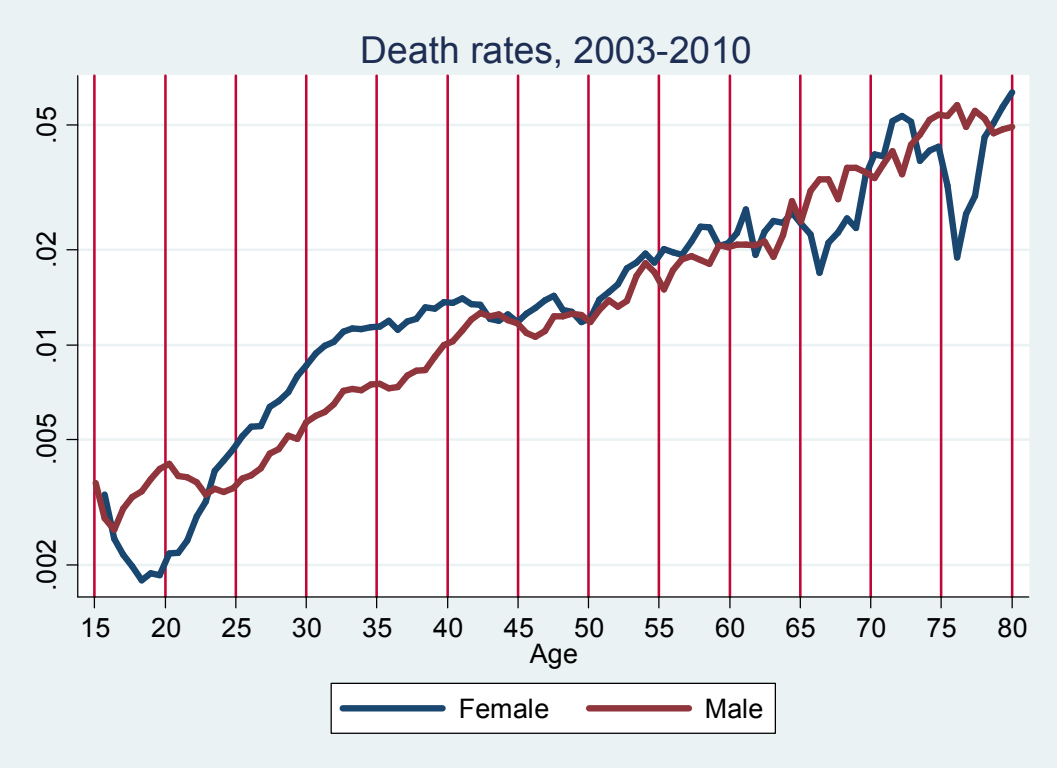

Figure 2: Age-specific mortality rates during the period 2003-2010, by gender

The patterns and trends in adult mortality rates observed between 2003 and 2010 in the two slum communities may be due to several factors. For example, one would argue that mortality is under-estimated in such settings characterized by high circular migration and poor living conditions. It is possible that through migration selection, slum residents who move out or into the slums are the healthier ones. To ascertain this, we first run a simple Cox model on mortality by age in which duration of residence (measured in years) and calendar period are controlled for. Figure 3 displays mortality hazard ratios by duration of residence, separately for males and females. Non-migrants (duration 0) constitute the reference category.

For both sexes, lower relative risks are observed in the 6 months – 12 months duration of residence bracket. For women, the mortality risks become greater for migrants between 1 and 3.5 years of residence, as compared to non-migrants. The highest relative risk is observed after 8 years of residence. For males, higher hazard ratios are observed for migrants whose duration

of residence is 3.5, 4.5 or 5 years. The highest relative risk is observed after 7.5 years of residence.

These analyses will be further refined by running a model that allows producing mortality hazard ratios by age category and duration of residence. In addition, we will run a two-stage equation model as described above that allows estimating mortality risks under the conditions prevailing in the slums. Causes of deaths from the Verbal Autopsy data collected in the NUHDSS will be used to run competing risks model, thus allowing us to determine for which disease the migration selection bias is the highest.

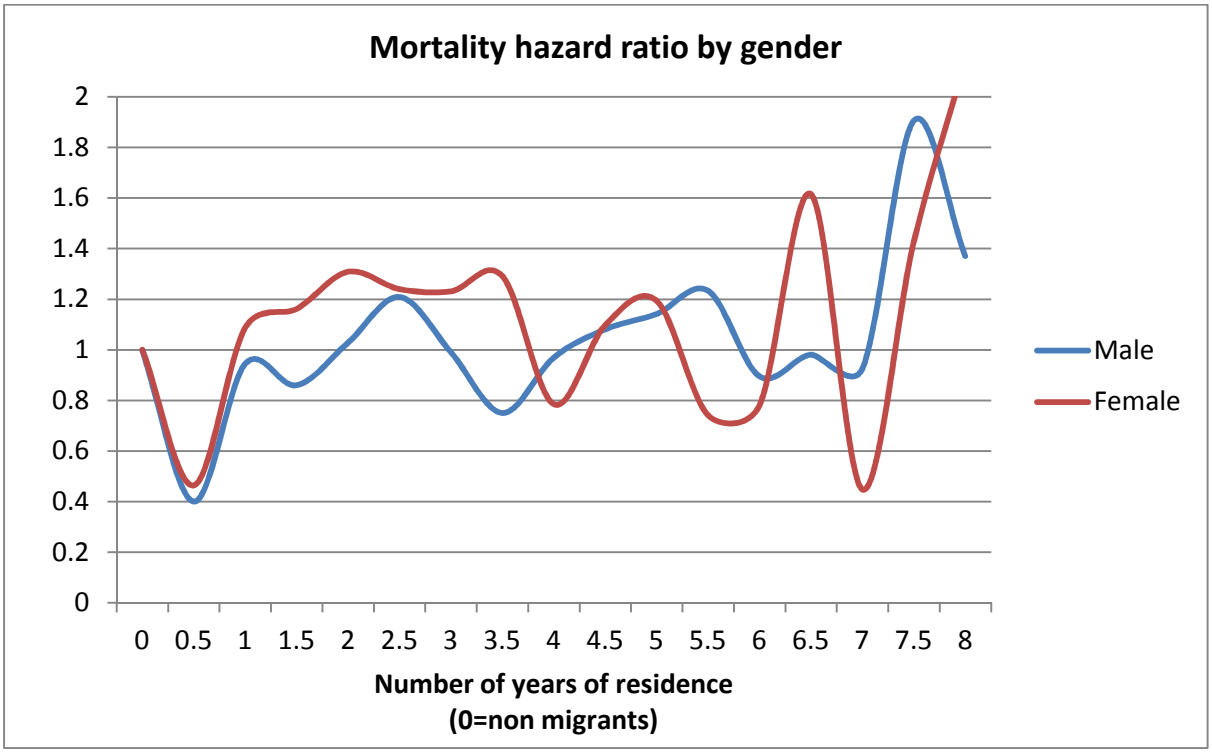

Figure 3: Annualized mortality rates during the period 2003-2010, by gender

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