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Selective Adult Migration and Urban-Rural Mortality Differentials in Burkina Faso

Adult mortality in developing countries is always higher in rural areas than in towns and cities. This disadvantage is attributed to more unfavourable health and economic conditions in rural areas, as well as to differences in population structure. However, the migration flows to cities that accompany urbanization may modify the composition of the populations in the areas of origin and destination. Using data from two demographic surveillance sites in Burkina Faso, one rural and the other urban, Bruno LANKOANDÉ and Ali SIÉ inquire here into the role that these population transfers can play in influencing the urban-rural mortality differential. Rural dwellers who migrate to town, as well as those who subsequently return home, are potentially selected in terms of health. To these selection effects are added behavioural changes that occur as migrants adapt to urban life. The links between migration and health turn out to be very complex, and data collected at origin and destination shed new light on health inequalities between urban and rural places of residence.

In sub-Saharan Africa, child and adult mortality are lower in urban than in rural areas (De Walque and Filmer, 2013; Lankoande, 2016; Leon, 2008). This traditional health advantage of cities is under threat, however, because of rapid and often uncontrolled urbanization. Several mechanisms explain this urban advantage, which dates back to the end of the nineteenth century (Fink et al., 2014; Kimani-Murage et al., 2014; Van de Poel et al., 2009). First, radical public health measures were rapidly introduced in urban centres of the colonies, through policies that had proved effective in reducing urban mortality in Europe (Gould, 1998). African countries thus, for the most part, inherited policies very favourable to the cities, which were also the colonies' economic powerhouses. Historically, the urban environment is thus characterized by

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better conditions of hygiene, and easier access to drinking water and health facilities. In addition, urban residents, on average, have higher socioeconomic status and a higher level of education than rural dwellers (Eloundou-Enyegue and Giroux, 2012). The urban health advantage can thus be explained by the combined effects of context and composition. But clearly, urban and rural areas cannot be compared as if they were isolated, since they are affected by substantial migration flows, and migration, due to its effects on health, can shape this urban advantage (Boyle, 2004). The objective of this research is to exploit data from two demographic surveillance sites (DSS) in urban and rural Burkina Faso in order to analyse the net effects of migration on the differences in adult mortality (all causes) between the two places of residence.

Burkina Faso's population was estimated at 18 million in 2015 (United Nations, 2015a). Like other countries in sub-Saharan Africa, the percentage urban, estimated at 30% in 2015, has increased very rapidly in recent years, and will probably exceed 50% by 2050 (United Nations, 2015b). Despite the scarcity of recent data on urban-rural migration flows, studies of the population in the capital, Ouagadougou, indicate that its urban growth is still fuelled by rural outmigration (Guengant, 2009). In terms of health, the average mortality of urban residents is lower than that of rural residents, and this advantage is observed for both children and adults (INSD, 2012; Lankoande, 2016). This urban-rural mortality differential seems to reflect a difference in epidemiological profiles, particularly among adults. In rural areas, infectious and parasitic diseases still dominate because of limited health knowledge, lack of access to care, poor sanitation, environmental factors, and poverty (Ramroth et al., 2012). Conversely, non-communicable diseases dominate in urban areas due to population ageing, reduced physical activity, obesity and increased consumption of tobacco and alcohol (Rossier et al., 2014a; Soura et al., 2014).

To test the effects of migration on the urban-rural adult mortality differential, data from the Ouagadougou and Nouna DSSs are utilized. After reviewing the different research hypotheses and presenting the data and methods, the results obtained are discussed.

I. Literature review and hypotheses

Research on interactions between migration and health, even if more focused on international migration, has given rise to several hypotheses that can contribute to a better understanding of the urban-rural mortality differential at the country level (Boyle, 2004).

First of all, the positive selection hypothesis suggests that because of the stress induced by the process of migration, the need to adapt to a new environment and to enter the labour market, new migrants constitute a positively selected group in terms of health from among the population at origin. These

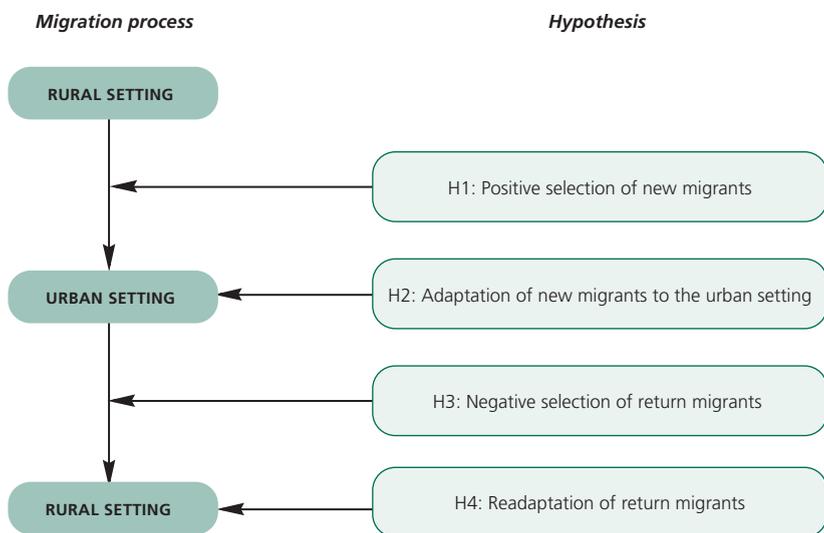
migrants, generally young adults, leave economically disadvantaged zones for more favoured zones, in search of better living conditions (Gerritsen et al., 2013). In both developed and developing countries, empirical results tend to confirm the importance of positive selection among adults. For example, Norman et al. (2005) show that positive selection of migrants in deprived areas contributed to increased health inequalities between deprived and non-deprived regions of England and Wales. In Indonesia, Lu (2008) has also documented this positive selection of migrants, particularly among the young, using longitudinal data. Similar results were found for rural-urban migrants in China, with selection becoming stronger as migration distance increases (Lu and Qin, 2014). Nauman and her colleagues (2015) also observed positive selection of young rural-urban migrants in Thailand.

In addition to being positively selected at origin, the health of new migrants is typically better than that of long-term residents at destination. However, they seem to lose this advantage as time goes by. This process of adaptation has been analysed in detail with regard to rural-urban migration in developing countries, where migrants tend to gradually adopt lifestyles that are prejudicial to health (Peer, 2015). This includes lack of physical activity, alcohol and tobacco consumption and a diet rich in sugar and fat, which are all risk factors for cardiovascular disease. Because of the lack of data on morbidity and mortality, the existing literature tends to focus on how risk factors for cardiovascular disease change for these migrants as their duration of residence in the city increases. For example, one study done in Cotonou, the capital of Benin, found that the risk of overweight and hypertension is positively associated with duration of residence in the city (Sodjinou et al., 2008). In Tanzania, a decline in physical activity and an increase in body mass index were observed among rural-urban migrants after only one year of urban residence (Unwin et al., 2010). Similar results were obtained in Cameroon for rural migrants who had moved to the city within the previous two years (Sobngwi et al., 2004). More recently, Carillo-Larco et al. (2016) found the same results in Peru for body mass index.

Finally, after several years of residence in the city, some rural-urban migrants return home. These return migrants were historically considered as a fringe of the migrant population, positively selected at initial migration, who later returned to their place of origin to benefit from the capital accumulated in the city (Gerritsen et al., 2013). However, in certain contexts like South Africa and eastern Africa, these migrants are also disproportionately affected by chronic diseases, and may return home in search of social support in their place of origin (Bocquier et al., 2014; Clark et al., 2007; Collinson et al., 2014; Levira et al., 2014). In the same way as new migrants become used to living in their areas of destination, return migrants may well readapt to their communities of origin by following the behaviours that prevail there, and this may affect their health.

In sub-Saharan Africa, because of the lack of data on migration and adult health, research on the relationships between migration and health has focused on children and, more recently, on adolescents (Bocquier et al., 2011; Mberu et Mutua, 2015). Some research in South Africa has looked at adults, but specifically in relation to return migration (Bocquier et al., 2014; Clark et al., 2007). A pioneering and exhaustive study on adults was conducted by Ginsburg and colleagues (2016) using data from demographic surveillance sites across sub-Saharan Africa. They tested most of the hypotheses on the links between migration and mortality, and in so doing revealed the diversity of situations. For example, in some contexts migrants are not necessarily selected, and when this selection does take place, it may be positive or negative. The authors also propose an interesting methodology to study links between migration and health based on data relative to migration status and duration of residence in the destination zones. For new migrants, however, the results of this research are difficult to interpret as assumptions must be made about the health risks they encounter before and after migration. The formulation of these hypotheses poses a particular problem in countries like Burkina Faso where, in both rural and urban areas, migrants come from different backgrounds characterized by different health risks (Dabiré, 2016). In urban areas, migration is principally of rural origin, and occurs alongside urban-urban migration and migration from Côte d'Ivoire. In rural areas, rural-rural migration occupies a very important place, and adds to the migration from Côte d'Ivoire and from the country's urban zones. Migration flows must therefore be broken down by provenance to better grasp the net effects of migration on health.

Figure 1. Interactions between migration process and health in Burkina Faso



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Source: Chamchan et al. (2014).

Focusing on migration of rural origin, Figure 1 conceptualizes the migration process and the expected interactions with health. We empirically verify these hypotheses in relation to all-cause mortality using data from the two urban and rural demographic surveillance sites. The hypothesis of positive selection of rural-urban migrants (H1) will translate to lower mortality of these migrants compared with permanent rural residents. To verify the hypothesis of adaptation (H2) of these migrants in the city, not only must the mortality of recent rural-urban migrants be lower than that of permanent urban residents, but the mortality of long-term rural-urban migrants must also be similar to that of permanent urban residents. Higher mortality among recent urban-rural return migrants compared to that of permanent urban residents would confirm the third hypothesis on the negative selection of return migrants (H3). Finally, if the return migrants readapt after returning home (H4), one would expect the mortality of long-term rural-urban-rural return migrants in rural areas to be similar to that of permanent rural residents.

II. Data and methods

1. Data

Data on urban-rural exchanges of migration flows are scant in Burkina Faso. At the same time, measuring adult mortality by place of residence remains problematic for want of reliable data and a robust estimation method (Lankoande, 2016). In this context, data from demographic surveillance sites provides an alternative solution for the detailed study of certain adult demographic phenomena (Bocquier, 2016). Burkina Faso currently has four functional demographic surveillance sites, one in a city (Ouagadougou) and three in rural areas (Nouna, Nanoro, Kaya). To ensure comparability of migration status in urban and rural areas, this study is based on data from the sites of Ouagadougou and Nouna only. The Nouna DSS is the oldest of the rural sites (1992); the others were established after 2007 (Sié et al., 2015). In considering the Ouagadougou DSS as a collection of typical urban districts and that of Nouna as a typical rural area, we test the different hypotheses mentioned earlier among adults aged 15-74 over the period 2009-2013.

The Ouagadougou and Nouna demographic surveillance sites

The Ouagadougou and Nouna demographic surveillance sites are both part of INDEPTH, an international network for the demographic evaluation of populations and their health, and follow a methodology similar to that of other DSSs. This entails collecting data on key demographic events (births, deaths, unions, arrivals, and departures) at regular intervals, after an initial census in the surveillance zone (Sankoh and Byass, 2012). When a death occurs, a verbal autopsy questionnaire is administered to the closest casegiver, to

record the circumstances that led to the death. They are then analysed to establish the likely causes of death in accordance with version 10 of the International Classification of Diseases (ICD-10).

More specifically, the Ougadougou DSS is a research and intervention platform established in 2008 by the Institut supérieur des sciences de la population (Higher institute of population sciences, ISSP) of the University of Ouagadougou in five districts of the northern periphery of Burkina Faso's capital (Rossier et al., 2012). The population under surveillance was estimated at 86,694 individuals in 2013, and a follow-up survey is carried out every 10 months on average. The verbal autopsy data are interpreted with the interVA-4 software recommended by the WHO to determine the likely causes of death with the related probabilities (Byass et al., 2012). The five districts followed by Ougadougou DSS are quite representative of the city periphery and may be grouped in two categories: formal districts (Tanghin, Kilwin) and informal districts (Nonghin, Nioko2, Polesgho). The latter are informal settlement areas where health conditions are most precarious, with populations having difficult access to basic social services such as electricity, drinking water, and health infrastructure. Many residents are young families in search of low-cost housing who move to the area in the hope of owning a plot when the city formally allocates the land. Unlike residents of formal districts, the people living in informal districts are generally of rural origin, and are poorer and less educated on average. In both the formal and informal districts, more than half of all economically active individuals work in commerce or construction. Government employees, while not very numerous, more frequently live in the formal districts. In the zone followed by the Ouagadougou DSS, nine in 10 people are from the Mossi ethnic group, the majority group in Burkina Faso.

The Nouna DSS was created in 1992 by the Centre de recherche en santé de Nouna (Nouna health research centre, CRSN) in rural Kossi province, 300 km from Ouagadougou (Sié et al., 2010). Data on vital events are collected three times a year. Unlike the Ouagadougou site, each completed verbal autopsy questionnaire is interpreted independently by two physicians to establish the principal cause of death. In case of disagreement, the opinion of a third physician is sought. The reference population totalled 96,030 inhabitants in 2013, living in 58 villages and in the town of Nouna. The main ethnic groups are the Soninke, the Bwaba, the Mossi, the Fula, and the Samo. Agriculture and animal husbandry are the main activities. In health terms, the area covered by the Nouna DSS represents a quarter of the Nouna health district. It is served by a hospital in the town of Nouna and 17 health and social care centres (Centre de santé et de promotion sociale, CSPS) distributed among the different villages. The semi-urban zone of Nouna has better health conditions and lower levels of fertility and mortality than the villages followed. However, this mortality differential between the two types of zones only concerns children under age 5. There is no significant difference in adult mortality between the villages and the semi-urban zone.

The variables

In this analysis, migration status is the main independent variable; its effect on all-cause mortality is tested, controlling for the determinants of mortality for which data are available at both sites – namely, age, sex, level of education, marital status, and religion. In a context of low educational levels, religious affiliation may be expected to influence lifestyle and health behaviours. As an example, alongside the parents' socioeconomic and demographic characteristics, religion is a key variable in explaining variations in child vaccination coverage in Ouagadougou (Soutra et al., 2013).

Drawing on the work of Ginsburg et al. (2016), we used information on the provenance and duration of residence of individuals in the two demographic surveillance sites to define different categories of migration status. Since the Nouna DSS was first set up in 1992, this information has been directly available from the complete migration history (entries to and exits from the surveillance zone). The Ouagadougou site being more recent (end of 2008), the definition of migration status is based on information collected in the retrospective “migration history” module, namely place of residence before the first arrival at Ouagadougou and year of first arrival. We thus obtain comparable definitions of migration status in the two sites. All individuals who have lived on one or other site for 10 years or more are considered as permanent residents, and those having resided less than 10 years are considered as migrants. These latter are divided into two categories based on their duration of residence: recent migrants (less than 5 years) and long-term migrants (5-9 years). Migrants are also grouped by provenance in order to distinguish urban-rural migrants from rural-urban migrants. Finally, in the rural areas, because data on migration dynamics are available for a long period, new migrants (recent and long-term) are separated from return migrants (recent and long-term). For these latter, the effects of health risks incurred during their urban residence are controlled for in the analysis by the variable “duration of urban residence”.

Data on causes of death are used solely to illustrate the different epidemiological profiles of the two sites because the proportion of missing data is high, especially in the rural areas. Indeed, 40% of adult deaths at ages 15-74 are from unknown causes in the Nouna DSS (Niamba et al., 2016). This is due mainly to incomplete information recorded in verbal autopsy questionnaires and to the absence of respondents for households that have dispersed after an adult death. For similar reasons, causes of death were not established for 25% of the deaths in Ouagadougou (Rossier et al., 2014b). In light of the limited sample size, the causes of death are grouped into five main categories to show the recurrent diseases prevalent in rural and urban Burkina Faso. Our analysis therefore focuses on malaria, other infectious diseases, cardiovascular diseases, other non-communicable diseases, and deaths from external causes (accidents and violence).

2. Analysis methods

The analyses are limited to adults aged 15-74 during the period 2009-2013. This truncation at age 75 gets around the recurrent problems of data quality at advanced ages without eliminating a large number of observations, given that the study populations are relatively young (Rossier et al., 2012; Sié et al., 2010). The descriptive part consists of comparing adult mortality rates (all causes combined) and by group of causes, between the Ouagadougou and Nouna sites. These rates are obtained in classic fashion by taking the ratio of the number of deaths to the person-years of exposure during the period considered. To take account of differences in age structure, these rates were standardized, using the average age structure of the two sites as the reference. For mortality by cause, deaths from unknown causes were redistributed proportionately across the known causes, on the assumption that under-reporting affects all causes equally.

The data from each DSS was formatted to allow event history analysis. This entails retracing the sequence of life events of each individual from their time of entry into the DSS, with the relevant dates. Under this approach, changes in migration status over time, and in certain characteristics such as level of education and marital status can be taken into account. We subsequently merged the Ouagadougou and Nouna databases for the period 2009-2013 to obtain a single database for analysis. Database merging has already been applied in previous research in the social sciences, especially for surveys that share the same methodologies, as in the present case (Hatt and Waters, 2006; Soura et al., 2015). Moreover, the use of re-sampling techniques such as bootstrap (2,000 replications) in modelling helps to obtain robust estimates of the precision of results.

A semi-parametric Cox model⁽¹⁾ was used to test the effects of migration status on all-cause mortality, controlling for the set of variables cited earlier. Unlike the descriptive analysis, the multivariate model is implemented for both sexes combined due to the limited number of cases. Given that the age of individuals is used as the analysis time, it is not included as a control variable in the Cox model; its effect is taken into account in the non-parametric part of the model.

III. Results

1. Differences in all-cause and cause-specific mortality

For the period 2009-2013, the standardized mortality rates (ages 15-74) are higher on the Nouna site than on that of Ouagadougou, for both sexes and for all ages (Table 1). For example, among male adults aged 15-24, mortality

(1) A robustness test was performed on a limited sample that excluded the semi-urban population of Nouna. The results obtained are generally similar to those presented here where the entire zone followed by the Nouna DSS is taken into account in the analysis.

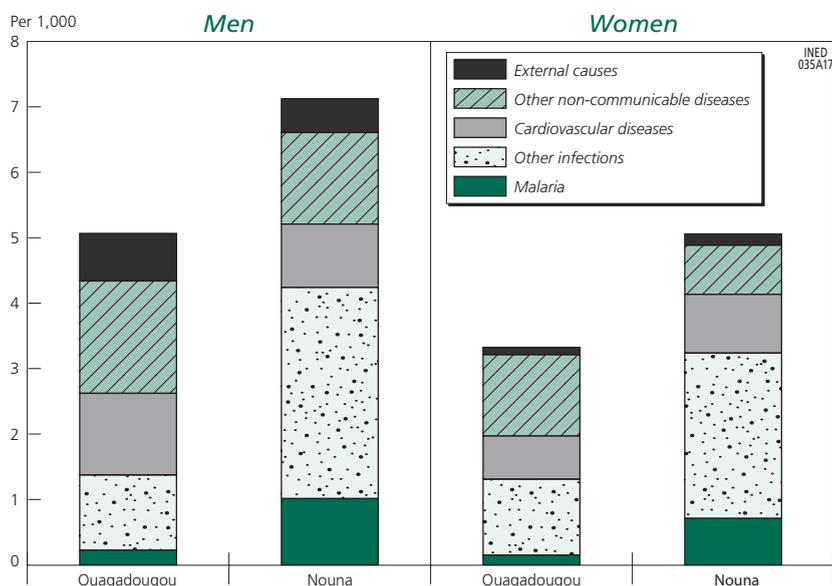
rates are, respectively, 1.1 per 1,000 in Ouagadougou and 2.1 per 1,000 in Nouna. This health disadvantage in Nouna can be partly explained by the different epidemiological profiles of the two sites (Figure 2). Mortality there is predominantly infectious; malaria and other infectious diseases such as pneumonia, HIV/AIDS, diarrhoea, meningitis, tuberculosis, typhoid fever, etc.,

Table 1. Adult mortality rate, per 1,000, all causes, Ouagadougou and Nouna, by sex and age group, 2009-2013

Age group	Men		Women	
	Ouagadougou	Nouna	Ouagadougou	Nouna
15-24 years	1.1 (0.8-1.5)	2.1 (1.7-2.6)	1.1 (0.8-1.4)	1.8 (1.4-2.2)
25-34 years	1.9 (1.5-2.4)	3.0 (2.4-3.7)	2.3 (1.8-2.8)	2.5 (2.0-3.1)
35-44 years	3.6 (2.9-4.5)	5.2 (4.2-6.4)	2.9 (2.2-3.9)	4.3 (3.4-5.3)
45-54 years	9.2 (7.6-11.1)	12.4 (10.5-14.5)	4.1 (3.0-5.6)	7.0 (5.8-8.6)
55-64 years	20.0 (16.3-23.6)	24.2 (21.0-28.0)	8.8 (6.6-11.8)	16.4 (14.0-19.3)
65-74 years	35.6 (28.8-44.1)	52.0 (46.0-59.0)	25.6 (20.0-32.6)	34.3 (30.0-39.3)
Standardized rates (15-74 years)	5.0	7.1	3.3	5.0

Note: 95% confidence intervals in parentheses.
Sources: Ouagadougou and Nouna DSSs (authors' calculations).

Figure 2. Standardized mortality rates (ages 15-74) by sex and by group of causes on the Ouagadougou and Nouna sites, 2009-2013



are the leading causes of death for both sexes. This situation suggests that the epidemiological transition has hardly begun in this area. In contrast, it seems to be more advanced in Ouagadougou, where cardiovascular diseases and other non-communicable diseases (cancers, diabetes, etc.) are the leading causes of death. Deaths from external causes are not infrequent on the two sites, particularly among men.

2. Migration

On the two demographic surveillance sites, the majority of the resident population are permanent residents (Tables 2 and 3). They represent 75.5% of the adults aged 15-74 on the Ouagadougou site and 56.3% on that of Nouna. The differences in sex distribution are more visible on the Nouna site, where the proportion of permanent residents among women (50.8%) is smaller than among men (62.2%). Migration to the cities is predominantly of rural origin. Table 2 shows that 71.8% of the migrants in Ougadougou come from rural areas and

Table 2. Sample characteristics by migration status in Ouagadougou, 2009-2013

Migration status		Men	Women	Total
Permanent residents	Person-years	82,074.1	75,151.4	157,225.5
	Proportion (% of person-years)	78.4	72.5	75.5
	Number of deaths	365	230	595
Recent migrants from rural areas	Person-years	4,777.4	8,174.5	12,951.9
	Proportion (% of person-years)	4.6	7.9	6.2
	Number of deaths	6	18	24
Long-term migrants from rural areas	Person-years	10,877.3	12,774.3	23,651.6
	Proportion (% of person-years)	10.4	12.3	11.4
	Number of deaths	29	23	52
Other migrants*	Person-years	6,965.4	7,514.5	14,479.9
	Proportion (% of person-years)	6.6	7.3	6.9
	Number of deaths	26	10	36
Total	Person-years	104,694.2	103,614.7	208,308.9
	Proportion (% of person-years)	100	100	100
	Number of deaths	426	281	707

* Côte d'Ivoire-urban migrants (57%) and urban-urban migrants (39%).
 Source: Ouagadougou DSS (authors' calculations).

Table 3. Sample characteristics by migration status in Nouna, 2009-2013

Migration status		Men	Women	Total
Permanent residents	Person-years	67,193.4	58,212.1	125,405.5
	Proportion (% of person-years)	62.2	50.8	56.3
	Number of deaths	611	438	1,049
Recent urban-rural migrants	Person-years	2,603.2	3,606.2	6,209.4
	Proportion (% of person-years)	2.4	3.1	2.8
	Number of deaths	14	13	27
Long-term urban-rural migrants	Person-years	888.4	1,154.6	2,043
	Proportion (% of person-years)	0.8	1	0.9
	Number of deaths	7	8	15
Recent rural-urban-rural return migrants	Person-years	847.6	766.4	1,614
	Proportion (% of person-years)	0.8	0.7	0.7
	Number of deaths	3	5	8
Long-term rural-urban-rural return migrants	Person-years	446.4	375.9	822.3
	Proportion (% of person-years)	0.4	0.3	0.4
	Number of deaths	3	4	7
Rural-rural migrants	Person-years	31,560.9	46,773.1	78,334
	Proportion (% of person-years)	29.2	40.8	35.2
	Number of deaths	152	183	335
Other migrants*	Person-years	4,510.5	3,809.5	8,320
	Proportion (% of person-years)	4.2	3.3	3.7
	Number of deaths	37	19	56
Total	Person-years	108,050.4	114,697.8	222,748.2
	Proportion (% of person-years)	100	100	100
	Number of deaths	827	670	1,497
* Principally migration from rural Côte d'Ivoire (73%). Source: Nouna DSS (authors' calculations).				

that the majority are long-term migrants. In comparison to men, the proportion of recent migrants is higher among women. Migration to the Nouna site is also of rural origin; migrants make up 35.2% of the resident population and they are predominantly women. Urban-rural migrants, all categories combined, represent only 4.8% of the resident population. Among this group, the proportions of long-term migrants and of rural-urban-rural return migrants are very small.

3. Effect of migration status on mortality

Table 4 summarizes the results of the multivariate analysis, which tests the net effect of migration status on all-cause mortality. For each model, the results are presented with different reference categories of migration status in order to test the hypotheses formulated earlier. In the first column (Hypotheses 1 and 4, Model 1), rural permanent residents are the reference group for migration status, while in the second column (Hypotheses 2 and 3, Model 2) urban permanent residents are the reference category. For the control variables, the reference group is unchanged. First of all, we observe that rural permanent residents have a significantly higher mortality risk than their urban counterparts, other things being equal. The risk of death is 40% higher in the rural setting than in the urban one when only permanent residents of the two places of residence are considered (Model 2). For the other control variables, the results are as expected. Notably, women have lower risks of death than men. A higher level of education, particularly secondary and above, is associated with a lower risk of mortality. Living in union proves to be protective. On the other hand, and less expected, being Christian translates to a higher risk of death than being Muslim (even if the result is only significant at the 10% level). An analysis by site shows that this excess mortality of Christians is observed only in the Nouna site, which suggests a reporting bias, most likely animists reporting themselves to be Christian.

We will now examine the specific effect of migration on mortality, considering, respectively, rural permanent residents (Model 1) and urban permanent residents (Model 2) as the reference categories for migration status. The risk of death is 50% lower among recent rural-urban migrants than among rural permanent residents (Model 1). This confirms a positive selection of migrants. Their risk of death is also 30% lower than that of urban permanent residents. The results are similar among long-term urban migrants, but with a smaller advantage than that of recent migrants (Model 1). For recent rural-urban-rural return migrants, the relative mortality risk is not significantly different from that of rural permanent residents. The situation is similar for long-term rural-urban-rural return migrants, even if the associated coefficient (1.2) is greater than that of recent rural-urban-rural return migrants (Model 1). A statistical comparison of the mortality levels of the two categories of return migrants (recent and long-term) indicates that they are not significantly different at the 10% level. Finally, the hazard ratio associated with the variable measuring duration of urban residence, pertinent only for return migrants,

Table 4. Relative risks (hazard ratios) of death at ages 15-74, 2009-2013

Variables	Test of H1 and H4 (Model 1)	Test of H2 and H3 (Model 2)
Migration status	HR	HR
Rural		
Permanent residents (reference group column 1)	1	1.4*** (0.081)
Recent urban-rural migrants	1.2 (0.238)	1.7*** (0.348)
Long-term urban-rural migrants	1.5 (0.378)	2.1*** (0.551)
Recent rural-urban-rural return migrants	0.8 (0.300)	1.2 (0.438)
Long-term rural-urban-rural return migrants	1.2 (0.468)	1.8 (0.682)
Rural-rural migrants	1.0 (0.067)	1.5*** (0.107)
Other migrants	1.2 (0.175)	1.8*** (0.261)
Urban		
Permanent residents (reference group column 2)	0.7*** (0.038)	1
Recent rural-urban migrants	0.5*** (0.104)	0.7* (0.152)
Long-term rural-urban migrants	0.6** (0.086)*	0.8 (0.126)
Other migrants	0.7** (0.121)	1.0 (0.178)
Period of urban residence (return migrants)		
< 5 years	1	1
≥ 5 years	2.6*** (0.782)	2.6*** (0.782)
Level of education		
None		
Primary		
Secondary or higher		
Don't know ^(a)		
Sex		
Male	1	
Female	0.6*** (0.029)	
Union status		
In union		
Not in union		
Don't know ^(b)		
Religion		
Muslim	1	
Christian	1.1* (0.052)	
Other	1.6*** (0.131)	
Number of individuals	140,087	
Person-years	430,268.5	
Number of deaths	2,165	
(a) Data on education were missing in 7% of cases in Nouna and in 1.5% of cases in Ouagadougou. (b) Information on union status was missing in 0.7% of cases in Nouna. Statistical significance: *** p < 0.01; ** p < 0.05; * p < 0.1. Standard deviations are in parentheses. Sources: Ouagadougou and Nouna DSSs (authors' calculations).		

suggests that a long period of urban residence is accompanied by a higher risk of death for these migrants (HR 2.6 in Model 1).

The health advantage of recent rural-urban migrants is also visible in the urban setting; they have a 30% lower risk of dying than urban permanent residents. This result is only significant at the 10% level, however (Model 2). This advantage disappears for long-term rural-urban migrants, whose risk of death is almost the same as that of urban permanent residents, all other things being equal (Model 2). Urban-rural migrants, both recent and long-term, have a higher risk of death than urban permanent residents (Model 2).

Finally, in terms of mortality, recent and long-term rural-urban-rural return migrants are not significantly different from urban permanent residents. To check that this result was not due to the small number of return migrants in the sample, we combined the two categories of return migrants (recent and long-term), and their mortality was compared to that of urban permanent residents. The results remained unchanged; return migrants and urban permanent residents have the same levels of mortality, all other things being equal. In other words, there is no selection effect (either negative or positive) among return migrants in terms of risk of death.

IV. Discussion

In a context where rural-urban migration still contributes strongly to the process of urbanization in Burkina Faso, this research uses data from demographic surveillance sites in urban and rural areas to highlight the net effects of migration on the adult mortality differential between these two settings. The data are collected prospectively (longitudinal follow-up) and cover a recent period. Moreover, they can be used to compute migration status and other independent variables as time-varying covariates. Finally, the approach consisting of disaggregating the migration flows by origin and combining the data from two DSSs allowed us to better test the different hypotheses suggested by the literature. In particular, by comparing the mortality of recent rural-urban migrants with that of rural permanent residents, we better verified the hypothesis of positive selection.

The results on the mortality differential between urban and rural permanent residents confirm the rural health disadvantage, even after controlling for certain classic determinants of mortality such as sex, level of education, religious affiliation, and marital status. These results thus suggest that the two residential settings present different contextual risks (health environment, access to care), and this finding is consistent with earlier studies on the possible sources of excess rural mortality (Van de Poel et al., 2009). The various hypotheses tested were confirmed for new migrants (Hypotheses 1 and 2) but not for return migrants (Hypotheses 3 and 4).

1. Positive selection and adaptation of rural-urban migrants

Rural-urban migrants are positively selected in terms of health, as found in with earlier research on rural-urban migration in developing countries (Lu and Qin, 2014; Nauman et al., 2015). Ginsburg et al. (2016) arrive at the same results for men on the urban demographic surveillance sites of Ouagadougou and Nairobi, although their focus was on migration from all origins combined. Over the long run, migrants adapt to their urban environment and present levels of mortality similar to those of permanent residents. This is consistent with the findings of Ginsburg et al. (2016), who demonstrate that the selection effect is generally followed by an adaptation effect. Different mechanisms explain urban migrants' declining health status over time. First, in cities like Ouagadougou, rural migrants with limited economic resources – and as a strategy to access a formal plot – tend to settle in informal districts where health conditions are more precarious than elsewhere in the city (Rossier and Ducarroz, 2012; Rossier et al., 2011). Informal districts are poorly served by public services, and the populations who live there have more limited access to drinking water, electricity, public schools, and health infrastructure (Rossier et al., 2011) than in formal districts. Of the three informal districts covered by the Ouagadougou DSS, only one, Polesgho, has a health centre (Lankoande et al., 2016). Moreover, in addition to their unfavourable health conditions, and as observed in other African cities, rural-urban migrants rapidly adopt typically urban behaviours such as alcohol consumption, smoking, and high-fat diets (Sobngwi et al., 2004; Sodjinou et al., 2008). For example, migrants who have lived in Ouagadougou for more than 10 years have higher blood pressure than permanent residents (Rossier et al., 2013). Their exposure to non-communicable diseases increases with their duration of residence in the city. On the other hand, in parallel to these unhealthy behaviours, these rural-urban migrants may develop a more proactive attitude to their health by consulting health professionals more frequently in case of illness; but affordability may be an obstacle here.

Finally, for the specific case of Burkina Faso, higher rural migrant mortality in the cities may also be linked to urban road traffic mortality. As public transport is limited, many people own a motorbike, not only as an essential means to travel around the city, but also as a sign of upward social mobility. For the specific case of rural migrants, the risk of accidents may be higher because they do not know or respect the traffic regulations.

2. No negative selection of rural-urban-rural return migrants

The hypotheses relative to return migrants were not confirmed by the results. These migrants are not negatively selected in the urban setting, so we cannot validate the hypothesis of re-adaptation. Both short-term and long-term return migrants and rural permanent residents have similar levels of mortality.

The absence of negative selection of return migrants in Burkina Faso contrasts with evidence from South Africa, where return migrants affected by chronic diseases such as tuberculosis or HIV, return home in the hope of finding support (Clark et al., 2007). The vulnerability of migrants to chronic diseases could also explain the negative selection of return migrants in eastern Africa (Ginsburg et al., 2016). In contrast to the countries of southern and eastern Africa, which were hit hard by the HIV epidemic, HIV prevalence in Burkina Faso among adults aged 15-49 has never exceeded 4% (UNAIDS, 2016). While it is known that migrants settle in informal districts, principally in Ouagadougou, the general context does not expose them to disproportionate risks of chronic diseases (Rossier et al., 2011; Soura et al., 2014). Even if they do fall ill, those with the necessary means may deliberately choose to remain in the city, given that Burkina Faso is a poor country where access to health care is clearly better in urban than in rural settings (Haddad et al., 2004). Poor migrants, for their part, may count on their social capital in the city, particularly the extended family, to ensure better access to care. In the context of Burkina Faso, return migration because of ill-health after a period of residence in the city may be perceived as a failure, by both the migrants and their families (Rossier et al., 2012). In a country where traditional beliefs are strong, city dwellers of rural origin with chronic diseases may return to their community of origin to inquire about the natural or mystical character of their malady, but these migrations are probably temporary.

3. Limitations of this research

It is important to point up certain limitations of this research. First, because of the limited sample size (random variation of the number of deaths from one age group to another, for example) it is practically impossible to test the different hypotheses on specific age groups and by sex. For example, it would have been interesting to test the hypothesis of positive selection among the young, since they are more likely to migrate to the city in search of better living conditions. Next, the data used in this work, while of a longitudinal nature, does not allow us to follow the health status of individual migrants by duration of urban or rural residence. The different categories of migrants, recent and long-term migrants for example, may not have exactly the same characteristics. Finally, this work is based on the assumption that the Ouagadougou and Nouna demographic surveillance sites are representative of the urban and rural settings in Burkina Faso. The results would undoubtedly be strengthened by using samples that cover larger areas of the two environments.

Conclusion

Despite these limitations, our research has allowed us to examine the role of migration in the urban-rural health inequalities observed in sub-Saharan Africa. Alongside composition and contextual effects, positive selection of rural-urban migrants contributes to the rural health disadvantage. In a setting where health conditions are already unfavourable, it is those in better health who migrate to the cities, thereby widening, over the short term, the urban-rural mortality gap. The adaptation of migrants after several years of urban residence is probably holding back the mortality transition at the national level, given that these migrants were in better health in their place of origin. With regard to return migrants, the absence of a negative selection effect in Burkina Faso again reflects the diversity of links between migration and health. Rural Burkina Faso is not only a source of rural-urban migration, but also of international migration to Côte d'Ivoire. The potential health effects of this international migration must also be analysed to gain a better understanding of health in rural areas.

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Bruno LANKOANDE, Ali Sié • SELECTIVE ADULT MIGRATION AND URBAN-RURAL MORTALITY DIFFERENTIALS IN BURKINA FASO

Taking the example of Burkina Faso, where massive rural exodus continues to drive the urbanization process, this study tests the net effects of migration on urban-rural mortality differentials among adults aged 15-74. It is based on information collected at two demographic surveillance sites, one in a rural area (Nouna) and one in the city (Ouagadougou). The longitudinal data cover a recent period (2009-2013) and are analysed using a semi-parametric Cox model. In a rural environment with poor health conditions, it is the healthy individuals who migrate to the city, thereby strengthening the urban health advantage over the short term. While rural-urban migrants are positively selected in terms of health, they tend to lose their advantage over time as they adapt to life in the city. This deterioration after several years of urban residence is probably holding back the mortality transition at national level, given that these migrants were in better health in their environment of origin. For return migrants (rural-urban-rural), the absence of a negative selection effect in Burkina Faso again reflects the complex interplay between migration and health. Beyond compositional and contextual effects, the positive selection of rural-urban migrants is accentuating the health disadvantage of rural areas.

Bruno LANKOANDE, Ali Sié • MIGRATION SÉLECTIVE DES ADULTES ET INÉGALITÉS FACE AU DÉCÈS ENTRE MILIEUX URBAINS ET RURAUX AU BURKINA FASO

En prenant l'exemple du Burkina Faso, où les migrations du milieu rural vers le milieu urbain continuent d'alimenter abondamment le processus d'urbanisation, cette recherche teste les effets nets de la migration sur le différentiel de mortalité entre milieux urbains et ruraux chez les adultes de 15 à 74 ans. Elle s'appuie sur les informations recueillies dans les observatoires de population situés à la campagne (Nouna) et en ville (Ouagadougou) sur une période récente (2009-2013). Les données longitudinales sont exploitées avec un modèle semi-paramétrique de Cox. Dans un milieu rural où les conditions sanitaires sont peu favorables, ce sont les individus en bonne santé qui migrent en direction des villes, renforçant ainsi à court terme l'avantage sanitaire urbain. Malgré cette sélection d'abord positive en termes de santé, ils perdent leur avantage sanitaire au fil du temps avec la résidence en milieu urbain, ce qui constitue probablement un frein à la transition de la mortalité à l'échelle du pays, dans la mesure où ces derniers étaient en meilleure santé dans leur milieu d'origine. Pour les migrants de retour (rural-urban-rural), on n'observe pas d'effet de sélection. Au-delà des effets de composition et de contexte, la sélection positive des migrants rural-urban contribue à exacerber le désavantage sanitaire du milieu rural vis-à-vis du milieu urbain.

Bruno LANKOANDE, Ali Sié • MIGRACIÓN SELECTIVA DE LOS ADULTOS Y DESIGUALDADES ANTE LA MUERTE ENTRE LOS MEDIOS URBANOS Y RURALES EN BURKINA FASO

Tomando el caso de Burkina Faso, donde las migraciones del medio rural hacia el medio urbano continúan alimentando fuertemente el proceso de urbanización, esta investigación estudia los efectos netos de la migración sobre las diferencias de mortalidad entre medio rural y medio urbano, en los adultos de 15 a 74 años. El análisis se apoya en los datos recogidos por los observatorios de población situados en el campo (Nouna) y en la ciudad (Ouagadougou), sobre un periodo reciente (2009-2013). Los datos longitudinales son explotados con un modelo semi-paramétrico de Cox. En un medio rural en el que las condiciones sanitarias son poco favorables, son los individuos en buena salud los que emigran a la ciudad, reforzando así, a corto plazo, la ventaja urbana en términos de salud. Después, a medida que transcurre su estancia en medio urbano, los migrantes pierden progresivamente su ventaja sanitaria, lo que constituye probablemente un freno a la transición de la mortalidad del conjunto del país, pues los migrantes estaban en mejor salud en su medio rural de origen. Para los migrantes de retorno (rural-urbano-rural) no se observan efectos de selección. Más allá de los efectos de composición y de contexto, la selección positiva de los migrantes rural-urbano contribuye a exacerbar la desventaja sanitaria del medio rural respecto al medio urbano.

Keyword: Burkina Faso, migration, adult mortality, positive selection, rural, urban.

Translated by David Shapiro.