The ‘urban penalty’ in adult mortality in Burkina Faso: in search of the evidence

Abstract

BACKGROUND

Considerable attention has been devoted to the emergence of an “urban penalty” in child health in Sub-Saharan Africa, but little is known on how adults living in urban areas far as compared to their rural counterparts. Urban living in developing countries is commonly associated with the spread of chronic diseases, mental disorders, injuries and AIDS that disproportionately affect adults. However, the lack of data hampers research on adult mortality differentials between urban and rural areas.

OBJECTIVE

Using Burkina Faso as a case study, this paper aims to establish a comprehensive, coherent and critical view on differences in adult mortality rates between ages 15 and 60 according to urban/rural residence. The study covers approximatively the period 1989 to 2006.

METHODS

Adult mortality rates, by sex and according to place of residence, were estimated from DHS data, census data and a national survey on migration dynamics, urban integration and environment (EMUIB). The study relied heavily on indirect techniques of mortality estimation: the growth balance method, the orphanhood method and estimation of mortality from sibling survival data.

RESULTS

Indirect mortality estimates indicate that adults living in urban areas in Burkina still benefit from a health advantage compared with their rural counterparts. However, this paper warns against the misinterpretation of urban/rural mortality gap that may be wrongly impacted by data quality issues and internal migration flows.

CONCLUSIONS

Additional efforts to collect data on the place of residence of close relatives are required to better understand recent trends in spatial inequalities in adult mortality in general, and particularly differences between urban and rural areas in Sub-Saharan Africa.

Key words: Adult mortality, Burkina, Indirect techniques, Sub Saharan Africa, Siblings, Urban penalty.

Introduction

Unlike European cities that were long characterized by an over-mortality (the "urban penalty"), cities in Sub-Saharan Africa have long benefited from a comparative advantage, due to colonial health policies that were very favorable to large urban centers (Leon, 2008). As many health determinants such as education, sanitation, access to health services, and wealth, are better on average in urban areas, it is generally assumed that urban dwellers have better health conditions compared with their rural counterparts in Africa (Leon, 2008; Montgomery, 2009). However, recent studies tend to question this urban advantage because of the development of slums associated with rapid, unplanned and uncontrolled urbanization in Sub-Saharan Africa (Fink, Günther, & Hill, 2014; Kimani-Murage et al., 2014). Yet, because of the prevalent unsanitary conditions in slums, the focus in these studies is put on child health with less attention devoted to adult survival.

Available evidence shows that urbanization is also a threat to adult health. Residence in the cities of developing countries is commonly associated with the spread of chronic diseases, mental disorders, injuries and AIDS that affect adults particularly (Agyei-Mensah & de-Graft Aikins, 2010; Dyson, 2003; Kobusingye, Guwatudde, & Lett, 2001). These diseases are linked to life style (smoking, alcohol consumption, physical inactivity), and inadequate diet habits (diets rich in sugar, salt, fat) that are typical of urban life (Agyei-Mensah & de-Graft Aikins, 2010; Rossier, Soura, Duthé, & Findley, 2014). Therefore, it may not be relevant anymore to consider the urban environment as a “safe place” for adults. Poor sanitary and living conditions experienced by rural dwellers may be offset by health problems related specifically to urban residence.

Research on urban/rural differentials in adult mortality in Sub Saharan Africa is mainly limited by the scarcity of data. While much is known about child mortality, the measurement of adult mortality is really hampered by the lack of data. In to the absence of civil registration data, estimates derived from surveys and censuses can be very erratic (Reniers, Masquelier, & Gerland, 2011).

Census reports on the number of household members who died in the last 12 months are a common source of data on adult mortality by place of residence. However, these data are subject to many errors such as omissions of deaths due to household dissolutions after a death of an adult, fieldworkers related errors, coverage errors, and errors on the reference period (Timaeus, 1991). Adult mortality rates published in census official reports are sometimes also inferred from child mortality rates combined with model life tables, but this practice is not recommended because mortality in children and adult do not always conform to standard age patterns (B. Masquelier, Reniers, & Pison, 2014). Regarding estimates of adult mortality by place of residence, it could be very misleading to assume that urban/rural differentials are invariant by age, because child mortality rates are dominated by infectious diseases which are more prevalent in rural areas, while chronic conditions that disproportionately affect adults are typical of urban areas.

Apart from the census estimates, it is possible to derive mortality rates from survey reports on the survival of close relatives, such as parents or siblings. For instance, sibling survival data collected in the "maternal mortality module" of Demographic and Health Surveys (DHS), can be used to estimate adult mortality. But, these estimates are also not exempt of problems (Helleringer, Pison, Kanté, Duthé, & Andro, 2014; Reniers et al., 2011). Few studies have used such data to explore urban/rural differences in adult mortality in sub Saharan Africa and their findings are not consistent. De Walque and Filmer (2013) concluded to a slightly higher mortality in rural areas of Sub Saharan Africa by pooling sibling survival data collected in 84 DHS surveys from 46 countries (33 of which were in Sub Saharan Africa). The datasets covered the period 1975 -2004 and adult mortality was measured as the risk of dying between age 15 and 55. However, the aggregated analysis conducted by the authors will hide cross-country variations in the urban/rural disparities in adult mortality. Based also on sibling survival data of DHS datasets, Günther and Harttgen (2012) documented urban/rural mortality differences at the country level in 14 Sub Saharan countries. The risk of dying between age 15 and 45 was used as a measure of adult mortality and analysis was restricted to siblings reported by women who spent their entire life in an urban (rural) area. They found that out of 14 countries, in the 2000s, urban adult mortality rates were higher than rural mortality rates for 11 countries. For example, In Burkina Faso, urban/rural adult mortality ratio rose from 1.09 during 10 years before the 1998 DHS to 1.33 during also ten years before the 2003 DHS. These results were totally opposed to estimates published in Burkina Faso's census reports where an excess mortality in rural areas was documented in 1984, 1995 and 2005 (INSD, 1989, 2000a, 2009).

With Burkina Faso as my case study, this paper provides a comprehensive, coherent and critical view on differences in adult mortality rates according to urban/rural residence. The study covers approximatively the period 1989-2006, and relies on multiple data sources and on indirect techniques of mortality estimation. Like most countries in Sub Saharan Africa, Burkina Faso is experiencing a rapid and uncontrolled urbanization. It is expected that more than 50% of the population will live in urban areas in 2050 (United Nations, 2014).

In a first step, I will compute urban and rural adult mortality rates using available sources of adult mortality in Burkina Faso which are mainly census data and DHS data. I will also take advantage of a specific survey conducted in Burkina Faso in 2000 on migration and employment (EMUIB) to refine the way place of residence is captured. Second, these estimates will be discussed and reconciled to offer a coherent picture of urban/rural adult mortality differences in Burkina Faso. Lastly, I discuss technical issues related to adult mortality estimation by place of residence in Sub Saharan Africa in general and propose ideas of data collection.

Data and methods

Data

Adult mortality was measured as the probability of dying between 15 and 60 years of age ($_{45}q_{15}$). Three types of data sources were used in this paper to estimate mortality levels:

Census reports on recent household deaths

To date, four censuses have been conducted in Burkina Faso to monitor demographic trends and track progress in the country development (1975, 1985, 1996 and 2006). But, in this paper, because of the unavailability of data, only the census of 2006 was used to estimate adult mortality. First, because of archiving issues, data of the 1975 census are no longer available. Second, samples data of censuses conducted in 1985 and 1996 are freely available online in IPUMS (integrated public use microdata series), but the urban/rural status is missing. Estimates derived from the 2006 census were based on data collected on the number of deaths in each household in the twelve months preceding the census.

Data on sibling and parental survival from Demographic and Health Surveys (DHS)

I also used data from DHS conducted in Burkina Faso in 1993, 1998/1999, 2003 and 2010. Funded by the U.S. Agency for International Development (USAID), these surveys are now a corner stone to assess population dynamics and their health in countries lacking vital registration systems. The data are freely available online and are representative at the urban/rural level. In the 1993, 2003 and 2010 surveys, children aged less than 15 years were asked about the survival status of their parents (mothers and fathers). In surveys conducted in 1998/1999, 2003 and 2010, each woman interviewed was also asked to list all her siblings born to the same mother and their survival status. Information collected included for each sibling: date of birth, sex, survival status, current age for those who were alive, age at death and number of years since death for those who died.

Orphanhood data from the Migration Dynamics, Urban Integration and Environment Survey (EMUIB)

Finally, I take the opportunity of the EMUIB survey conducted in Burkina Faso in 2000 by the Demography department of the University of Ouagadougou (now ISSP[1]) to complement estimates of adult mortality. The survey was representative at the national and urban/rural levels. In total 9188 individuals aged between 15 and 64 years were interviewed. The overall objective was to provide reliable and relevant information on urban planning in Burkina Faso and topics such as migration and employment were covered (for a full description of the survey design, see Poirier, Piché, Le Jeune, Dabiré, and Wane (2001)). Regarding mortality, a set of questions were asked to individuals on their parental survival status and, unlike other surveys, the place of residence at the time of survey or at the time of death of parents was also collected. This is an added value compared with DHS data where information on parents' place of residence at the time of the survey or at the time of death is not usually collected.

Method

In this section, the different techniques used to estimate differences in urban/rural mortality levels in Burkina Faso are reviewed. The choice of these particular methods was mainly guided by the availability of data. For each method, adult mortality rates were computed according to urban/rural residence and by sex.

Estimating adult mortality from the Growth Balance Method

Data collected on the number of deaths in each household were discarded by the national institute of statistics in the process of mortality estimation. Estimates of adult mortality published were derived from child mortality combined with model life tables. Even though not clear in the official report, child mortality seems to have been estimated indirectly from the number of children ever born and those who were still alive, reported by women (INSD, 2009).

However, as mentioned above, trends in child and adult mortality do not evolve always in the same direction in Sub Saharan Africa. In Burkina Faso, child mortality has declined substantially in recent decades, while adult mortality rates seem to stagnate (B. Masquelier et al., 2014).

[1] Institut Supérieur des Sciences de la Population

To move away from the child-mortality matching approach used by the INSD, I estimated for each place of residence adult mortality using the Growth Balance Method (GBM) developed by Brass. The principle of the method is to estimate the completeness of the reporting of deaths relative to an estimate of the population under the assumptions that the population is stable, is closed to migration and that the completeness of under reporting of deaths is constant above a certain age limit. This estimate is then used to compute mortality rates adjusted –upwards - for incompleteness of death reporting (Moultrie et al., 2013). To resolve the issue raised by internal migration that can be a great concern in a country such as Burkina Faso, the computation of completeness was restricted to individuals aged 35 and higher, because they are less likely to migrate.

Estimating adult mortality from orphanhood data

The rationale behind the orphanhood method is to convert proportions of respondents of a five-year age group whose mother (father) is still alive into survivorship ratios using a set of coefficients. The mean age at childbearing of women (men) is needed to control for variations in the fertility schedule, which affects the exposure time. Survivorship ratios are then converted into summary indices of adult mortality using 1 parameter of a relational logit model table (Moultrie et al., 2013). Finally, estimates are located in time under the assumption of the linearity in mortality trends. Coefficients used in this paper to convert proportions into survivorship ratios are those proposed by I. M. Timæus (1992), and the time location procedure is the method developed by Brass and Bamgboye (1981).

The estimates derived from DHS and EMUIB data were based on the survival of parents of young children (5-9, 10-14 years old), and young adults (15-19, 20-24,25-29 years old) respectively. Let me also point out that, I applied the orphandhood method on data collected during the 2006 census and the multiple indicator cluster survey (MICS) conducted in 2006. Estimates from the census data were based on survival of children and young adults (5-9,10-14,15-19,20-24,25-29 years old), and those from the MICS were derived from children (5-9,10-14 years old). Results from these estimations (appendix 1) are not commented in the paper because there are in line with estimations derived from EMUIB and DHS data.

While the orphanhood method does not assume a population closed to migration, a major issue in applying the method for each place of residence is the lack of data on the urban/rural status of parents. In DHS surveys, only the place of residence of children at the time of the survey is known. I used this information as a proxy for the parents' place of residence at the time of the survey or at the time of death. Fortunately, the EMUIB survey could correct for this and assess the impact of misclassification of parent's place of residence on differences in urban/rural adult mortality.

Estimating adult mortality from sibling survival data

Unlike the two methods presented above, sibling survival data provide an opportunity to estimate "directly" adult mortality rates. With the information provided by each interviewed woman (15 to 49 years) on her siblings, it is possible to compute mortality rates by dividing the number of deaths by the population at risk for a given period. However, because adult mortality is a relatively rare event, and sample sizes in DHS are too small to derive age- and period-specific estimates without smoothing, mortality rates were derived from a quasi-poisson model for this analysis. The data file was reshaped in person-periods and the dependent variable was the number of deaths. Variables used as explanatory were age group, sex, and place of residence (urban/rural). This approach experimented by other authors (I. Timæus & Jasseh, 2004), also allowed me to have 95% confidence interval of each estimate, which is an added value compared with methods presented above. To the best of my knowledge, no method exists to generate confidence intervals from orphanhood method and the GBM. As suggested by Bruno Masquelier (2013), no attempt was made to weigh the data by sibship size.

Although the sibling survival method does not rely on many assumptions, the quality of data is an issue, particularly the underreporting of deaths due to recall biases. Evidence abounds of a decay in the completeness of death reporting among siblings when the time interval between the death and the survey increases (B. Masquelier et al., 2014; Obermeyer et al., 2010). To account for this, my estimates were restricted to the 6 years prior to each survey. At the same time, the choice of this timeframe also helped to keep the sampling errors at acceptable level for the analysis and to attenuate the effect of heaping for five years prior the survey (Bicego, 1997; B. Masquelier et al., 2014).

A major drawback also related to the estimation of adult mortality by place of residence using sibling survival data is the difficulty to apprehend siblings' place of residence. The DHS surveys do not collect information on the place of residence of women's siblings at the time of survey or at the time of death. To address this issue, the place of residence of interviewed women was tested as proxy for the place of residence of their siblings. It should be borne in mind that misclassification of siblings' place of residence may lead to misinterpretation of differences in urban/rural mortality levels, particularly when migrations flows are important (Bicego, 1997).

Results

Growth Balance Method (GBM)

Estimates of adult mortality obtained by place of residence and by sex in 2005 from the GBM, and from the census official report are presented in Table 1. The completeness of death reporting was higher in urban areas compared with rural areas (80.5% and 73.5% respectively). My estimates were higher than those published in the census report (except for women in rural areas). Disregarding these methodological differences, the value of ${}_{45}q_{15}$ was higher in rural areas than urban areas according to both sources. In my estimates, the urban-rural differentials in mortality were lower among men with a ratio of urban to rural mortality of 0.7. This ratio rose to 0.9 in women. As expected, the level of male mortality was higher than those of female mortality in both series.

Table1: Estimates of ${}_{45}q_{15}$ (per 1000) from the GBM and results published in the census' official report by sex and according to urban/rural residence in Burkina in 2005.

	Men			**Women**		
	Urban	**Rural**	**Ratio urban/ rural**	**Urban**	**Rural**	**Ratio urban/ rural**
GBM	270.2	366.1	0.7	215.2	248.6	0.9
Census report	220.0	321.5	0.7	183.6	280.3	0.7

Source: Census 2006

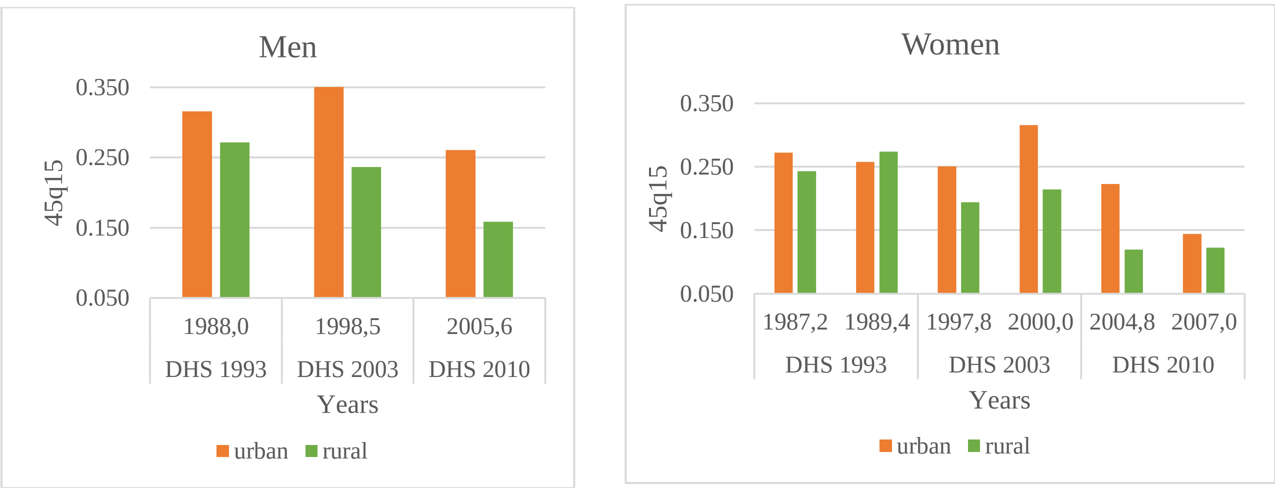
Orphanhood method

Figure 1 presents trends in adult mortality obtained from orphanhood data collected in the 1993, 2003 and 2010 DHS according to place of residence and sex of parents. For men, only one estimate was obtained from each dataset (because the estimation of male mortality requires that reports from two adjacent age group be combined). For women two estimates were derived from each dataset (based on 5-9 and 10-14 years-old).

Overall, in urban as well in rural areas, adult mortality rates seem to have fallen from 1988 to 2005 for men, and from 1987 to 2007 for women. Urban residents seem to have experienced a slight mortality increase in the late 1990s and early 2000s.

Over the whole period considered, values of ${}_{45}q_{15}$ were on average higher in urban areas compared with rural areas. In men, this gap of mortality between the two types of residence seems to have widened over time in favor of the rural settings. In women, the gap of urban/rural mortality was mainly pronounced in the first half of the 2000s. However, it is important to remember that this picture of urban/rural mortality differentials was obtained by using children's place of residence as proxy for their parent's place of residence.

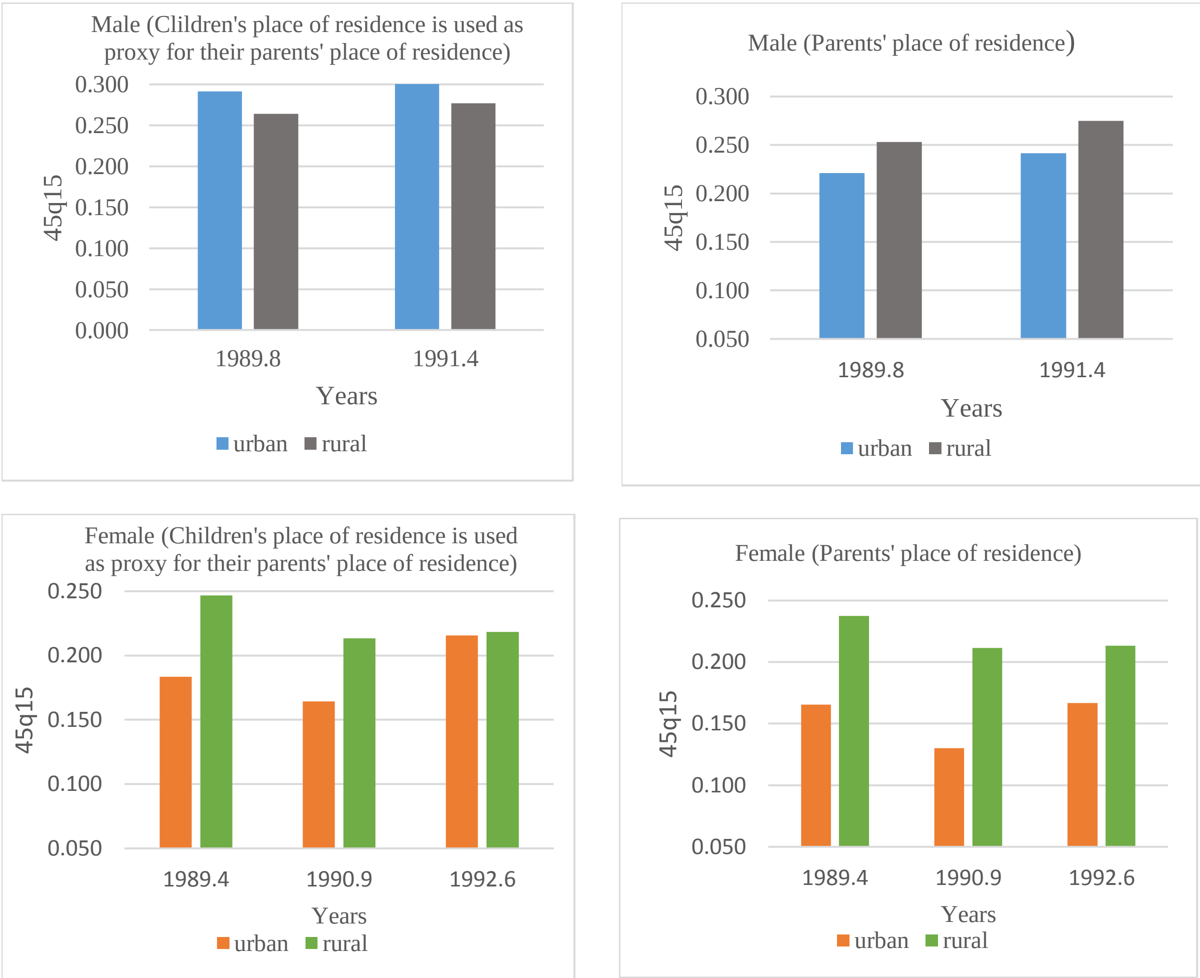
Figure 1: Estimates of adult mortality by sex and according to place of the residence (DHS orphanhood data)



Source: DHS 1993, 2003, 2010

By changing the way the respondents are classified thanks to data collected in the EMUIB survey (Figure 2), the mortality levels were reversed in favor of the urban areas in men, and the gap widened in favor of urban areas as well in women. In men, when children's place of residence is used as proxy for their parent's place of residence, values of ${}_{45}q_{15}$ were far higher in urban areas than in rural areas. However, a slightly lower mortality in urban areas was obtained when parents' place of residence at the time of the survey or at the time of death is used to assess the gap in mortality. In women, estimates obtained by using children's place of residence yielded a slight urban advantage. This advantage was reinforced when parent's place of residence were taken into account. In summary, these results suggest that information on children's place of residence is not a good proxy for their parents' place of residence. In addition, misclassification errors seem to have operated differentially according to the sex.

Figure 2: Estimates of adult mortality by sex and according to place of the residence (EMUIB orphanhood data).

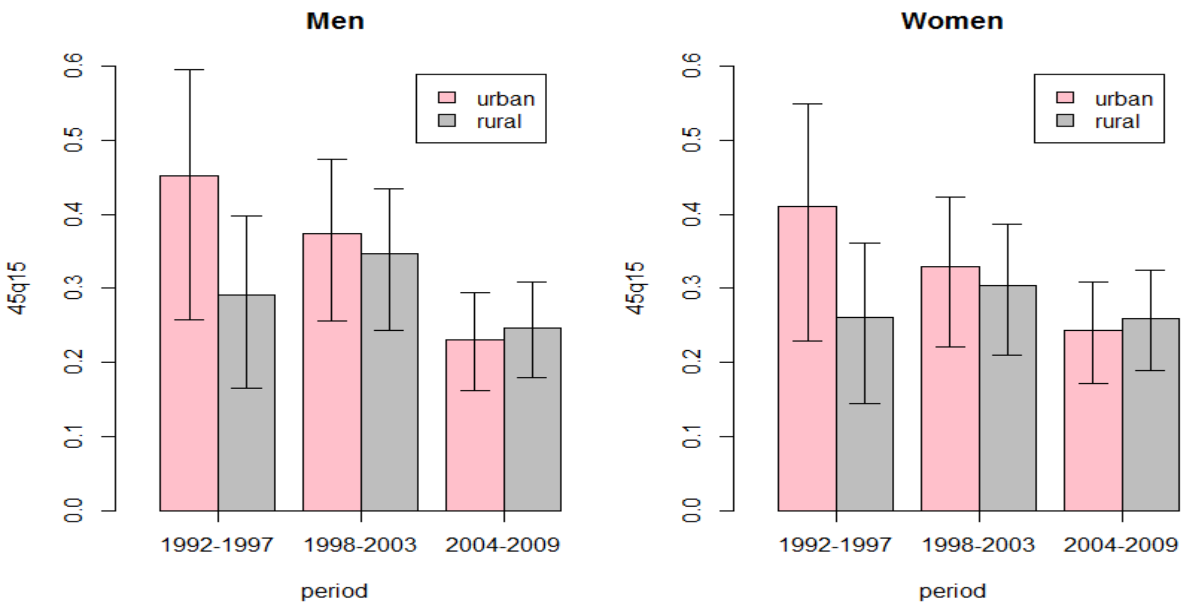


Source: EMUIB 2000

Sibling's survival

Estimates of adult mortality based on sibling histories are presented in figure 3 for both types of residence. The dating procedure is more precise here (compared to orphanhood estimates) and the availability of three surveys allowed me to have an idea on the trend in mortality. On the one hand, adult mortality seems to have decreased from 1990s to 2000s in urban areas. This mortality decline was more marked among men. On the other hand, rural areas seem to experience stalls, sometimes reversals, in adult mortality trend. Overall, rural areas tend to have an advantage in terms of adult mortality that fades over time. In the period 1992-1997, for men as well women, the value of $_{45}q_{15}$ in urban areas was around 400‰ while this value was less than 300‰ in rural areas. An inverse situation was observed in the period 2004-2009, with higher mortality in rural areas. However, for each period, confidence intervals largely overlap, indicating that DHS sample sizes are too small to detect any significant differential. Again, I should reiterate that the place of residence of interviewed women was used as a proxy for their sibling's place of residence.

Figure 3: Estimates of adult mortality with 95% confidence interval, by sex and according to place of the residence based on siblings survival data from 1992 to 2009.



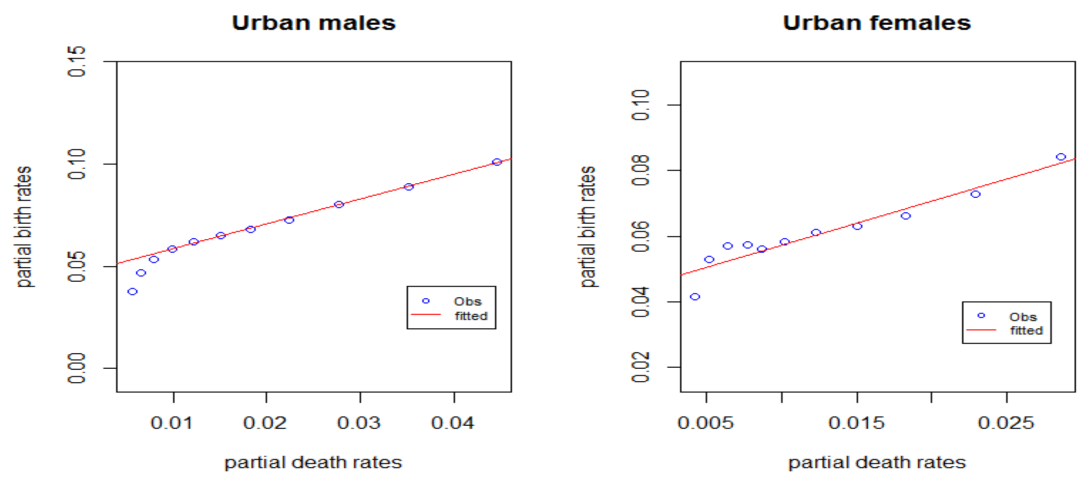
Source DHS 1998/1999, 2003, 2010

Discussion

At first glance, the picture of differentials in urban/rural mortality derived from the different methods is inconsistent. While the orphanhood method produced mixed results, the GBM tend to conclude to an urban advantage in the recent period, and sibling histories data suggest that the gap in the levels of urban/rural mortality evolved in favor of the rural areas. However, none of these methods is exempt from serious issues of data quality and selection effects.

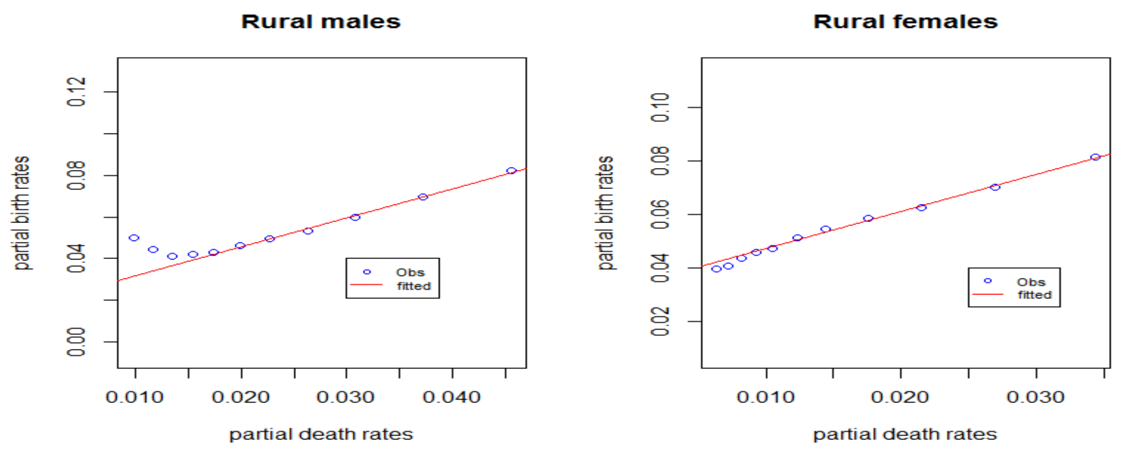
A common limitation of the application of the GBM to measure adult mortality in sub geographical units of a country is the issue of migration. The method could be adjusted to take into account internal migration flows between urban and rural areas, but such data are rarely available (Bhat, 2002; Hill & Queiroz, 2010). Nevertheless, the estimates presented here do not seem to be affected by migration since it is possible to get a straight line in each case by plotting the partial births against the partial deaths for people of 35 years and more (Figure 4 and 5). In addition, the completeness of death registration was high enough, more than 70%, and this limits the effect of adjusting for completeness on the final mortality estimates (Moultrie et al., 2013). In summary, estimates derived from the GBM are rather acceptable.

Figure 4: Diagnostic plots from GBM, by sex in urban areas, census 2006.



Source: Census 2006

Figure 5: Diagnostic plots from GBM, by sex in rural areas, census 2006.



Source: Census 2006

The EMUIB survey allowed me to bypass a major problem of applying the basic orphanhood method in sub-national geographic units since respondents and parents do not always share the same place of residence (Moultrie et al., 2013). Indeed, the urban penalty obtained from this method with DHS data (based on reports from children), is likely due to the effect of the practice of child fostering in Burkina Faso. A common practice in the country is to move children from one family to another for schooling or house works (Dabiré, 2001; Serra, 2009). Based on the definition[2] adopted by Grant and Yeatman (2012), I computed from the DHS data, the prevalence of child fostering according to place of residence in Burkina Faso. The percentage of fostered children remains high in urban areas compared with rural areas. For example, in 2010, only 7.6% of children under 15 were fostered in rural areas whereas this figure rose to 17.2% in urban settings. In addition, orphanhood prevalence was higher in fostered children compared with non-fostered ones in both urban and rural areas. By using children's place of residence as a proxy for their parent's place of residence, a fraction of deaths occurring in rural areas was therefore transferred to urban areas, and those of the urban areas were allocated to rural areas. The problem raised by the misclassification of parent's place of residence is likely to play against urban areas because flows from rural to urban areas are more important. It is therefore likely that mortality levels were overestimated in urban areas, and underestimated in rural areas, yielding a spurious urban penalty.

When data on the survival of young adult's parents, were used to estimate the difference in mortality between urban and rural areas, the fallacious urban penalty was induced by rural exodus, as showed in figure 2. A great share of urban growth in Burkina is still explained by internal migration (Guengant, 2009).

In summary, the picture of urban/rural mortality differentials derived from data on young adults collected during the EMUIB survey is probably the most reliable even though estimates are related to the past.

Most previous attempts to assess the gap in urban/rural mortality have been based on sibling histories (Bicego, 1997; De Walque & Filmer, 2013; Günther & Harttgen, 2012). Different approaches have been adopted by the authors, but all of them have faced the challenges raised by the lack of data on sibling's place of residence. Bicego (1997) and De Walque and Filmer (2013) made the assumption that siblings and the interviewed woman share the same place of residence. We tested the same assumption in this paper. While De Walque and Filmer (2013)

[2] A fostered child is a child living with none of his biological parents

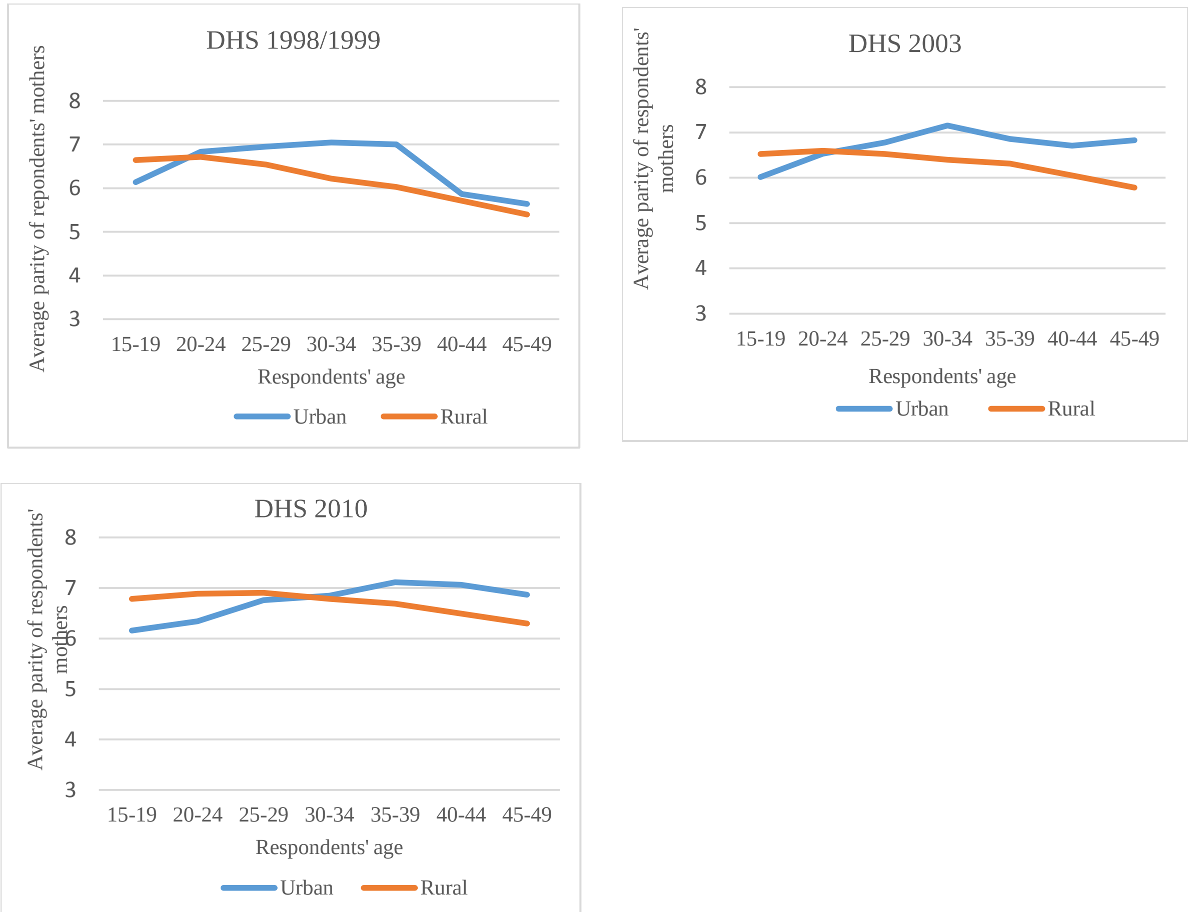
overlooked this potential bias, Bicego (1997) was cautious in interpreting differentials in urban/rural mortality, when migration flows are important. To resolve the problem, Günther and Harttgen (2012) limited their analysis on siblings of interviewed women who had never migrated before the survey, and then concluded that urban residence in most Sub Saharan Africa is positively associated with adult mortality. The authors also argued that their analysis may have underestimated differentials in urban/rural mortality.

I strongly argue that neither of these approaches are likely to resolve the potential bias generated by migration. First of all, the interviewed women could have stayed where they were raised, while all of their siblings migrate, or interviewees could have migrated while most siblings stay. For instance, the 2003 DHS showed that around 30% of women interviewed in urban areas had lived in rural areas during their childhood. The magnitude of flows was less important from rural to urban areas, with 10% of rural dwellers who spent their childhood in urban areas.

Second, the approach taken by Günther and Harttgen (2012) may lead to a selection bias if siblings of migrant women are affected by lower or higher mortality compared with siblings of non-migrant women. In summary, the extent to which the problem of misclassification affected the gap in urban/rural mortality is difficult to predict. However, from the experience I have drawn from the orphanhood method applied on data collected during EMUIB survey, in my contention, adult mortality is overestimated in urban areas and underestimated in rural areas.

Another potential problem downplayed by authors who studied differentials in urban/rural mortality based on sibling histories is the issue of data quality and its variation by place of residence. For each round of DHS survey, figure 6 shows for each place of residence the average parity of respondent's mothers by five-year age group of respondents. Two major observations stand out from these plots. First, the average parity is globally higher in urban areas compared with rural areas in 1999 and 2003. The same pattern is observed in the 2010 DHS among older respondents (30-49 years). Second, one could conclude from figure 6, that fertility has risen over time in rural areas, and has stalled or declined in urban areas, over 35 years before each survey. However, fertility is higher in rural areas in Burkina Faso, and over the years, it has declined both in urban and rural areas (Shapiro & Gebreselassie, 2009). The inversed results found here are likely caused by rural exodus of women or a pronounced omission of women's siblings in rural areas. As reported by Stanton, Abderrahim, and Hill (2000) and Bruno Masquelier and Dutreuilh (2014), it is likely that older respondents omitted to report all of their siblings. These omissions seem to be more marked in rural areas, and if related to adult death, it is likely that adult mortality be underestimated, particularly in these settings. This situation is mainly explained by the low level of education among interviewed women and misunderstanding of local language by fieldworkers in rural areas (Johnson Kiersten et al., 2009). In summary, the trend in differentials in urban/rural mortality in Burkina Faso derived from sibling survival data tend to be much affected by the issue of migration and data quality. The urban penalty that appeared in early periods is probably spurious and generated by the misclassification of sibling's place of residence, and by the poor data quality, including a more pronounced underreporting of siblings in rural areas.

Figure 6: Average parity of respondents' mothers by respondents' age and place of residence according to each round of survey.



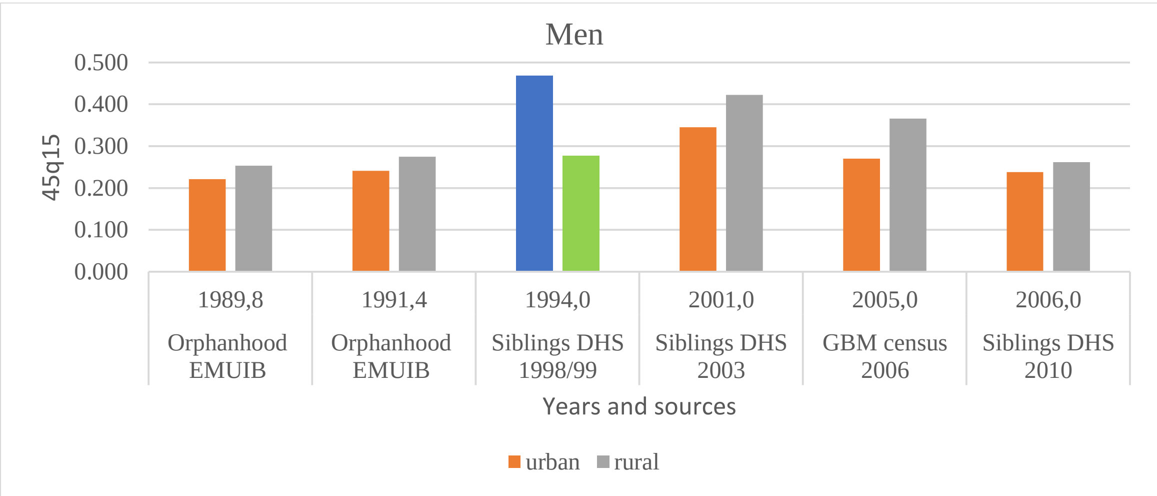
Source: DHS 1998/99, 2003, 2010

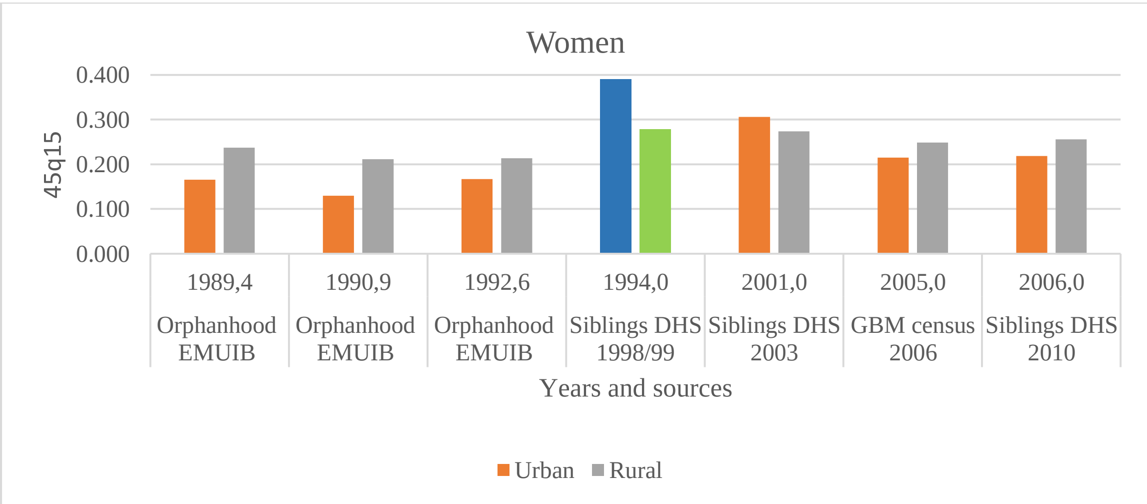
The overall picture

Figure 7 presents estimates of differentials in urban/rural mortality derived from the different sources and methods. Since I were able to correct misclassification of place of residence with data from EMUIB survey, estimates derived from orphanhood method applied on DHS, are discarded from this plot.

Among men, except in 1994 (average year of the period 1992-1997), adult mortality appears to be lower in urban areas compared with rural areas. The only case where mortality is higher in urban areas, is when estimates are derived from the sibling survival data of DHS conducted in 1998/1999. For women, differentials in urban/rural mortality are also in favor of the urban areas, if we ignore mainly estimates derived from sibling survival data of DHS conducted in 1998/1999. A summary evaluation of data quality indicates that this survey is not too much reliable. In fact, the percentage of death which were reported without any information on "age at death" and "years since death" was respectively 2.7%, 0.2% in 2003 and 2010 respectively, while it was 8.5% in 1998/1999 (INSD, 2000b, 2004, 2012).

Figure 7: Estimates of adult mortality in Burkina Faso by place of residence and sex according to different sources and methods, from 1989 to 2006.





Source: EMUIB 2000, DHS 1998/99, 2003, 2010 and census 2006.

By analyzing carefully the case of Burkina Faso, the results presented in this paper showed that an urban penalty in adult mortality, as concluded by Günther and Harttgen (2012) is improbable. Such a conclusion is reinforced by estimates derived from the different Demographic Surveillance Systems (DSS) located in Burkina. By taking the DSS of Ouagadougou as a proxy for the urban areas and the others DSS located in the country (Nouna, Nanoro, Kaya) as proxies for rural areas, one could conclude that adult mortality (45q15) is lower in urban areas (for the period 2009-2001) (Sié et al., 2014). Furthermore, with the stall of adult mortality level in Burkina, it is likely that differentials in urban/rural mortality has not evolved too much. As reported by Howson, Harrison, and Law (1996), the gap in urban-rural levels seems to narrow, with the decline of adult mortality at national level. Taken together, these results do not support the argument made by Günther and Harttgen (2012) that urban adults in Burkina suffer from a penalty that tends to increase over time. Although the dynamic of differentials in urban/rural mortality is still somewhat erratic and difficult to depict based on the available evidence, the urban environment continues to be negatively associated with adult mortality in Burkina.

The paper also highlighted the crucial role played by migration flows in the understanding of differentials in urban/rural mortality. Future research on differentials in urban/rural health in Sub-Saharan Africa, should pay more attention to the issue of migration. Finally, beyond the urban/rural dichotomy, this analysis shed the light on the discouraging lack of data needed to estimate spatial inequalities in mortality. One promising step would be to systematically collect data on sibling's and parent's place of residence.

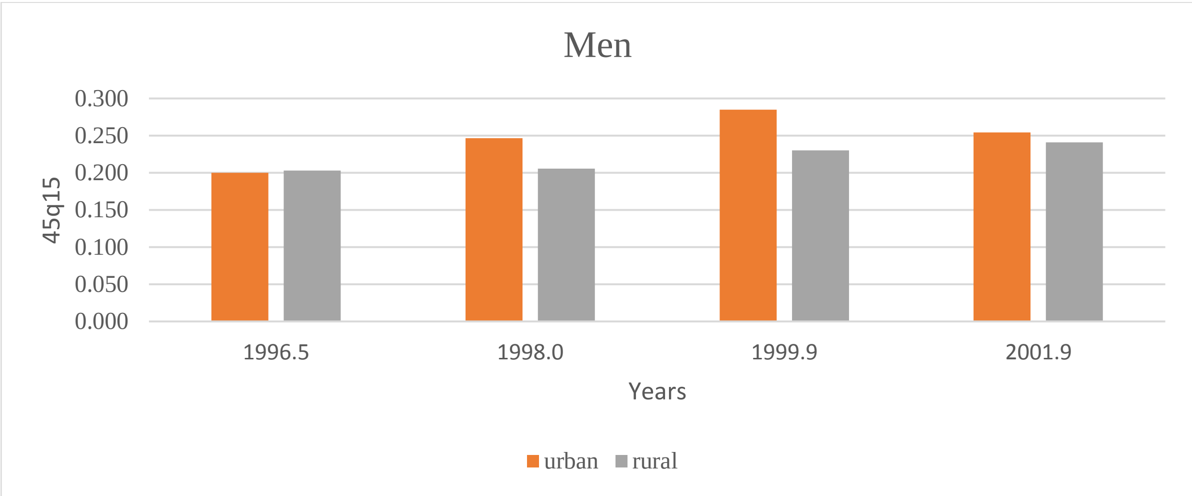
Appendix

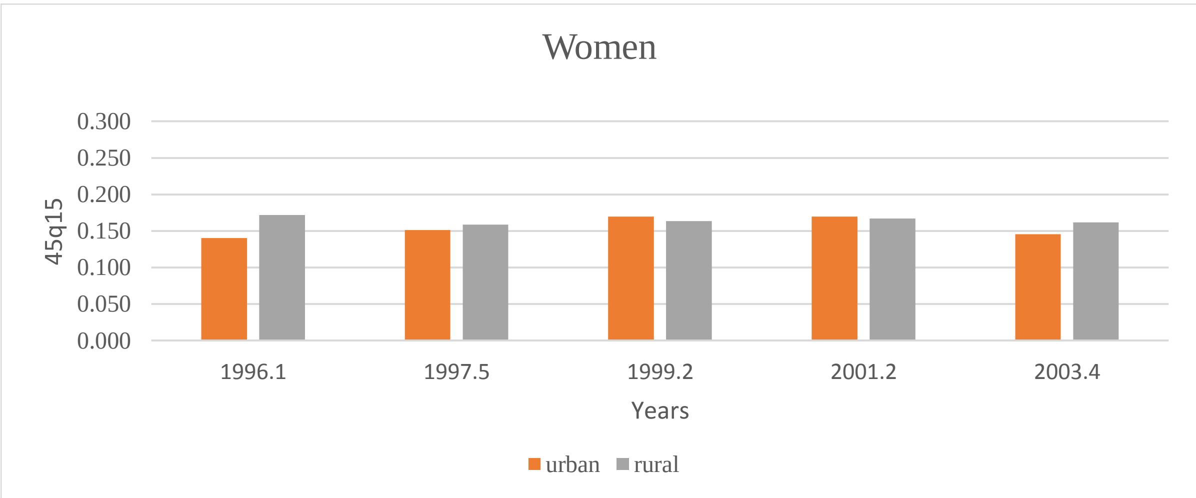
Table A1: Estimated of adult mortality (per 1000) by sex and according to place of residence (MICS orphanhood data)

Men			Women		
Date	Urban	Rural	Date	Urban	Rural
2001.3	243.2	231.1	2002.7	206.4	133.1
			2000.6	149.0	141.7

Source: MICS 2006

Figure A1: Estimated of adult mortality by sex and according to place of residence (Census orphanhood data)





Source: Census 2006

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