Socioeconomic Inequalities in Infant and Child Mortality among Urban and Rural Areas in Sub-Saharan Africa

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Studies on urban-rural mortality differentials in Sub-Saharan Africa show that overall mortality, and infant and child mortality in particular, is generally lower in urban than in rural areas (Akoto and Tabutin, 1989). Various factors account for this, including the high concentration of salaried workers (who generally have higher incomes) in urban centers, better education in urban areas, the concentration of public infrastructure in urban areas that provides sanitation services, including water supply, household waste and excreta removal and disinfection, and hospital infrastructure, with health conditions that are more favorable in urban than in rural areas. When observed, excess mortality in urban areas is often attributed to natural conditions in the physical environment, to seasonal and climatic conditions in particular, and the precariousness of living conditions in urban areas, caused mainly by the economic crisis.

This paper discusses the factors likely to explain the observed urban-rural differences in infant and child mortality in Sub-Saharan Africa. The paper addresses five points: the first two discusses the factors likely to be associated with excess urban mortality; the third assesses recent trends in infant and child mortality in a few selected countries in Sub-Saharan Africa; the fourth point deals with the determinants of infant and child mortality, with emphasis on the role of urban-rural residence as a differentiating factor. The last point provides the most salient results and a few recommendations.

1. Excess Urban Mortality due to Natural Conditions in the Physical Environment

Without neglecting the impact of socio-economic characteristics (standard of living, level of education, health infrastructure, access to drinking water, etc.), which are the main differentiating factors for mortality, several studies have shown that certain causes of infant death, such as measles, diarrhea, cerebral-spinal meningitis, etc., are associated with climatic conditions. Such conditions often act either directly by determining temperature control, or indirectly by promoting the proliferation of infectious agents or their vectors (pathogenic microorganisms) on the one hand, or by determining the type and quantity of food and water resources on the other hand (Akoto, 1985; Dackam, Gubry and Ngwe, 1993).

In Cameroon for example, observed regional infant mortality differentials have been found to be, to a great extent, associated with the country's considerable geographic diversity. Keuzeta and Merlin (1988) have shown that, in the arid or semi-arid areas in the far North of the country, children under the age of one died more of diarrheal diseases. As a result, infant mortality may be higher in an urban center located in this region of the country during the same period than in a village located in the Center-South region where the climate is not arid. Likewise, the Gaigbe Togbe's study (1988) of seasonal variations in infant deaths has shown that infant mortality in Yaoundé were

especially high during the period that overlaps the long dry season and the short rainy season due to the high prevalence of diarrhea and measles.

The issue of the homogeneity/heterogeneity of the urban setting shows that within a country, the fact that the urban and rural areas are combined at the national level, and that their mortality level is compared at that aggregate level, may mask certain differences (Akoto, 1991). Likewise, within a city, the study of cause of mortality by type of neighborhood or residence may show that in urban areas there are neighborhoods with higher mortality rates than rural areas; such differences are generally concealed by urban and rural aggregates (Kuaté, 1988; Colaço, 19__).

2. Excess urban mortality due to deteriorating living conditions

The notion that there is excess m excess mortality over rural areas supposes that urban populations are living in a more precarious situation than village dwellers. Among other factors such a situation may be attributed to the economic crisis. As shown by several studies, the effects of economic crisis are much more palpable in urban settings than in rural areas (Eloundou-Enyegue et al., 2000). Economic crisis has indeed fuelled youth unemployment in urban areas, and this has resulted in lower wages or job losses for many workers due to layoffs and/or the closing of businesses. In addition, it has been found that the rate of change in poverty was higher in urban areas than in rural areas (World Bank, 2001). The result is falling income and buying power of urban residents, who not only have difficulties in terms of food, but also have less and less access to health as well as social and economic infrastructure. The following statement (World Bank, 2001) from a women in a focus group discussion at the time of the banking crisis in Juncal, Ecuador, points to the severity of the situation: "*There is no work here. We get sick and we have no money to obtain care, not to mention the fact that medicines are too expensive. We have nothing to eat. Everything is so expensive.*"

Child mortality is especially sensitive to fluctuations in the standard of living. A study by the United States National Academy of Sciences (NAS) in 1993, quoted by Magali and Vallin, pointed out a highly significant statistical association between the likelihood of dying before age 5 and certain economic indicators in seven countries in Sub-Saharan Africa between 1970 and the late 80's (Botswana, Ghana, Kenya, Nigeria, Senegal, Togo and Uganda). This association is particularly clear with the GDP per inhabitant. When GDP per capita decreases the mortality of children under age 5 increases significantly, not just for the same year, but also for the next year and again for the following two years. The other economic indicators that are used, without showing systematic effects as high as GDP per inhabitant, show the same trend.

Given the effects of the economic crisis are felt much more in urban than rural areas, there is reason to expect that urban mortality will be higher than rural mortality or, at the very least, that the differences between urban and rural mortality will shrink. Several studies that bear out this fact may be cited.

In Luanda, Akoto and Tabutin (1989) found that child mortality has increased since independence (1975) with the war and the considerable deterioration in general living conditions until 1980. The mortality rate among children 0 to 2 years of age rose by nearly 20% in 5 years. Contrary to expectations, this increase in mortality has been much higher in modern neighborhoods than in poor ones, and higher in urban communities than in rural communities in this province. The authors estimate that this is due to the sharp deterioration in living conditions, which may have a much more significant impact in the monetary economy (where the wage-earners are found in central neighborhoods) than in the subsistence economy (rural or semi-rural areas in the outskirts and the ring). This demonstrates how fragile health is, especially children's health, in a very difficult economic and political context such as that of Luanda.

In Kenya (1978) and Ghana (1979-80), child mortality in medium-sized cities was substantially lower than that of large metropolitan areas; in Mauritius (1975-76), infant mortality in Port-Louis, the capital city, was higher than that of Plaines Wilhems (Akoto and Tabutin, 1989).

Dackam et al. (1986) found that in Cameroon (1978), child mortality was generally lower in medium-sized urban areas than in Douala and Yaoundé. According to Dackam et al. (1986), this is due in part to the fact that people put less pressure on health services in small cities, so that these services are better used. The data reported showed that The greatest difference between these other urban centers and Douala/Yaoundé was in the level of neo-natal mortality, which is more sensitive to conditions of delivery and antenatal care.

The study by Cantrelle (1980) in the middle valley of Senegal (1957) has shown that infant and child mortality rates were lower in rural than in urban areas. In the Central African Republic (1959-60), child mortality rates were the same in urban and rural areas.

Magali and Vallin (1996) noted that the short-term effects of the crisis did not seem to be very significant, and that there will be more pernicious effects in the long run. As indicated above, enrollment rates drop with the economic crisis. Yet, there is a very high association between maternal level of education and infant and child mortality. Thus, "if the current negative trend of the school systems continues, the decline in mortality brought about by better levels of education in the 60's and 70's may well slow once the girls of today in turn become mothers" (Magali and Vallin, 1996). Furthermore, according to the same authors, the crisis will undermine people's health, so that they will not be as prepared to withstand impacts from natural disasters, political crisis, wars, and the consequences of AIDS.

It is important to point out that excess urban mortality may to a lesser extent also be attributed to a rapid improvement in rural living conditions. The case of South Africa is significant in this respect.

Since most African countries were impacted by the crisis in the 80's, there is reason to wonder about mortality levels in these countries in the 90's, ten years after the crisis began. This topic is addressed in the following section.

3. Recent trends in infant and child mortality by urban-rural residence in several countries of Sub-Saharan African

Table 1 shows differential trends in infant and child mortality by urban-residence areas in a few countries of Sub-Saharan Africa where there have been at least two demographic and health surveys (DHS). From the data in this table, there appears three categories of countries.

The first consists of eight countries (out of fourteen) that experienced a significant improvement in their mortality levels. They are Ghana, Guinea, Mali, Niger, Nigeria, Senegal, Togo and Uganda. It's worth noting that while in Mali, Niger and Togo, the observed improvement was mainly due to change in child mortality, in the other countries this has been mostly the result of changes in both infant and child mortality.

The second group includes countries where both infant and child mortality has deteriorated a great deal. This has been seen in Burkina Faso, Tanzania and Zambia. In Burkina Faso, the overall trend is mainly the result of the increase in child mortality, whereas in Tanzania, this has been essentially due to infant mortality. In Zambia, both age groups (infant and child) have been impacted.

The third category consists of the countries where infant and child mortality, as well as the mortality of children under age 5, have been relatively stable over time. They are Cameroon, Kenya and Zimbabwe.

Except for Tanzania (1991-92), Table 1 shows that in all countries, regardless of the time period of reference, infant as well as child mortality are much lower in urban than in rural areas. However, three groups of countries may also be distinguished in terms of how the differences between rural and urban areas evolved:

- *Countries (Cameroon, Burkina Faso, Ghana, Kenya, Niger, Tanzania and Togo) where the gap in infant and child mortality between rural and urban settings has widened, generally in favor of the latter.* In Burkina Faso, Ghana, Kenya, Niger and Togo, this was true for both infant and child mortality. In Tanzania and Cameroon, the primary cause is infant mortality, while the gap in child mortality between urban and rural areas is somewhat smaller in Tanzania and stable in Cameroon.

- *Countries where the urban-rural differences in infant and child mortality have diminished.* These countries are Guinea, Mali, Nigeria, Zambia and Zimbabwe. In all the countries, this has occurred in both infant and child mortality.

- *Countries* such as Senegal and Uganda, *where the mortality gaps remained largely unchanged*. In both Uganda and Senegal, this was the result of the combined effect of an increase in infant mortality and a decrease in child mortality.

Table 2 presents estimates for infant and child mortality for medium-sized cities and major metropolitan areas. It shows that in Burkina Faso (1993) and Togo (1998), infant mortality levels were lower in medium-sized cities than in large ones. In Cameroon, between 1991 and 1998, the advantage remained with large cities. Due to a faster improvement in infant mortality in metropolitan areas than in mid-sized cities, the difference in favor of the former increased over time.

With regard to these facts, it is important to note that child mortality is much more sensitive to deteriorations in living conditions than infant mortality.

What factors may explain these urban-rural differences in infant and child mortality ins sub-Saharan Africa? We will attempt to answer this question by examining the determinants of infant and child mortality in five countries (Burkina Faso, Cameroon, Tanzania, Togo and Zimbabwe). The five selected countries experienced different trends in their levels of infant and child mortality: an improvement (Togo), a deterioration (Burkina Faso and Tanzania) and relative stability (Cameroon and Zimbabwe).

Table 1 here

Table 2 here

4. Determinants of infant mortality

Variable impact of urban-rural residence

The impact of urban-rural residence on infant mortality varies in the different countries under study. In some countries, urban-rural residence may be though as a proxy variable for socioeconomic conditions; it highlights their influence on mortality. This appears to be the case for Burkina Faso (1992) and Tanzania (1996) in particular. In both countries, urban residence has a positive (favorable) impact on child survival, but this advantage vanishes once other variables are controlled for (see appendix Table 1 and Table 3). In other words, it is not so much the fact living in urban setting that provides the advantage in terms of mortality to children born of urban mothers, but socioeconomic factors instead.

In some other countries, urban residence in and by itself appears to positively influence child survival. In Burkina Faso (1999), children born of urban mothers were exposed to the risk of dying under age 1 which was 48% lower than among those born of rural mothers. In Zimbabwe (1988), this risk was 64% lower, but this advantage disappeared ten years later. There is reason to believe that the political disturbances this country has been experiencing over past years, the implementation of structural adjustment programs, and the emergence of HIV/AIDS, have affected the urban population more than the rural population. Conversely, it can be said that in Burkina Faso, the standard of living among urban residents has improved faster than among their counterparts in rural areas. This explains the advantage observed in child mortality.

It should also be noted that, in Tanzania (1998), contrary to expectations, urban residence is associated with a higher risk of infant mortality. The risk of enfant death among urban children was 50% higher than among rural children. This may be a reflection of either the deterioration living conditions in urban settings as compared to rural areas, or the rapid improvement in socioeconomic conditions in rural areas as compared to urban areas.

The last example applies to countries such as Cameroon and Togo, where there appears to be no significant urban-rural differences in infant mortality. With regard to Cameroon, it is worth noting that in the late 70's, the urban-rural difference in infant mortality was very significant and in favor of urban areas. The effects of the economic crisis that had been ravaging the country until recently and that impacted urban dwellers more than rural inhabitants seem to be at stake here. Likewise, in Togo, the political crisis in which this country has been mired since the early 90's, and the socioeconomic consequences that have arisen out of it, which are probably more detrimental in the cities, may explain in part the lack of a relative advantage in infant mortality for urban, and for Lome in particular, over rural areas.

Age or the preponderance of maternal experience

More than living in a rural or urban environment, the mother's age emerges as an important differentiating factor in infant mortality. Contrary to the "U"-shaped relationship of mothers with the risk of infant death (in other words, the high risk for the extreme age groups: younger than 20 and older than 35, children of mothers at least 35 years old in Burkina Faso (1998-99) and Zimbabwe (1998) have a risk of infant mortality that is lower than that of children born of younger mothers. In both countries, maternal experience with care appears to prevail over the drawbacks related to the older age of mothers (maternal exhaustion syndrome and birth defects). In Cameroon (1991) and Tanzania (1999) on the other hand, there is the U-shaped relationship. In other words, children born of mothers 25 to 34 years of age run less of a risk of death (38% and 44% less respectively) than the others. In conclusion, it should be noted that this impact due to the mother's age is seen mainly in rural areas—Burkina Faso (1999), Cameroon (1991), Zimbabwe (1998)—except in Tanzania, where it is more perceptible in urban areas.

Medical coverage for pregnancy and delivery: another determining factor

In all the countries covered by this study, at least one of these two factors has considerable influence on infant mortality. Generally, good medical coverage during pregnancy—measured by early prenatal consultations (4 months before and from 4 to 6 months)—is associated with low infant mortality. In Burkina Faso (1998-99), children born of mothers who had either no prenatal consultations or late consultations (after 6 months of gestation) run a risk of infant death that is 36% higher than the risk for a child whose mother had her first prenatal consultation before the fourth month of her pregnancy. This risk is twice as high in Tanzania (1999) and 50% higher in Zimbabwe (1998). Thus, the fact that a mother has no prenatal consultations or late consultations increases the risk that her child will die.

Elsewhere, in Burkina Faso (1992) it should be noted that the impact of the duration of pregnancy at the time of the first prenatal consultation is not as expected. Actually, it was found that the risk of infant mortality drops by 31% if the mother begins her consultations between 4 and 6 months than if she begins before 4 months. This may be explained by the fact that those mothers who start their prenatal consultations early are in most cases also those who have a "risky" pregnancy, or those whose previous pregnancies "had an unhappy ending." This phenomenon is also observed in urban areas in Zimbabwe (1998).

As for pregnancy, the nature of the medical assistance the mother receives during delivery does impact child mortality. However, its effects are mitigated. In Burkina Faso (1992) and Tanzania (1999), as expected, the fact that a mother receives assistance at delivery solely from skilled medical personnel significantly lowers the risk of infant death. This drop is roughly between 35% and 40% respectively.

On the other hand, in urban Cameroon (1998), Togo (1998) and rural Zimbabwe (1998), the opposite trend is observed: medical coverage for deliveries is associated with a high risk of infant mortality. In urban areas in Cameroon, this risk is four times higher among children born of mothers who receive assistance exclusively from medical

personnel than for those born of mothers who obtain assistance from traditional medical personnel and/or a traditional birth attendant. This risk is 34% and 41% greater in Togo and rural Zimbabwe respectively. This outcome may be explained by the selection effect, in other words, that the exclusive use of skilled medical personnel is linked to cases with complications. Difficult deliveries are in fact routinely referred to skilled medical personnel.

Other than the above-mentioned factors, most of which are linked to reproductive health, there are three more that can be termed socio-economic: religion, the mother's education, and the mother's work status. In addition, there is the immediate environment, especially in urban Cameroon. The impact these factors have on infant mortality is generally less intense than the impact of the first factors. This is explained by the considerable weight of deaths during the first month of life in infant mortality, and these deaths are influenced essentially by medical coverage of pregnancy and delivery, and by the age of the mothers.

Table 3 here

Following the review of the factors that explain infant mortality, we will now address the impact of child mortality differentiation factors.

5. Determinants of child mortality

First of all, it should be noted that in this age category, most deaths among children are caused by external factors. Thus, it is to be expected that socio-economic factors and the immediate environment outrank those related to pregnancy and delivery.

The city as proxy for socio-economic conditions

In most of the countries studied here, except for Zimbabwe (1988) and Togo (1998), the city acts more as an intermediate variable than an explanatory factor on its own. Whereas on the gross level, urban residence is associated with a low risk of child mortality, this impact becomes insignificant when the other variables are tested, such as education, work status, religion and the mother's age, and the immediate environment. This is true in Burkina Faso (1992 and 1999), Cameroon (1991 and 1998), Tanzania (1996) and Togo (1988).

In Zimbabwe (1988) and Togo (1998) on the other hand, this turns out to be one of the principal factors in mortality among children aged 1 to 5. In these countries, the fact that a mother resides in a city lowers the likelihood that her children will die during their childhood by 63% and 34% respectively. The change in time (1988 – 1998) in the impact of the city results in diametrically opposed conclusions. In Togo, there is reason to believe that the period of economic and political crisis that followed the La Baule address

in (1990)[1] was inevitable in rural areas, even though urban/rural differences in infant mortality seemed to argue for the contrary. The health situation there deteriorated more rapidly than in cities. In Zimbabwe, the opposite appeared to occur.

Preponderance of the impact of the mother's education

In every country studied, and regardless of the period under consideration, the mother's education turned out to be one of the main determinants of the mortality of children from 1 to 5 years old. As expected, the higher the educational level of the mother, the less her children ran the risk of juvenile death. Also, in Burkina Faso, the fact that a mother had reached at least the secondary level lowered the risk of child mortality for her children by 81% and 72% respectively in 1992 and 1999, compared with an illiterate mother. This impact of education on mortality can also be perceived for the primary level in 1999, with a 33% decrease. In Cameroon, this influence of the mother's education is seen not only everywhere in the country, but also in both urban and rural living situations; it also applies to both the level of primary education (27% lower in 1998) and secondary education (55% lower in 1998). The same phenomenon was found in Togo (1998) and in Zimbabwe (1988).

The same is true for Tanzania (1999), where the effect of the mother's education is felt mainly in cities. In urban areas, the inequalities of children based on the mother's level of education in terms of child mortality are considerable. The child mortality risk for a child born of an uneducated mother living in the city is 6 and 250 times greater than a child born of a mother who has reached the primary level and a mother who reached at least the secondary level respectively[2].

These results confirm those of other studies conducted in Sub-Saharan Africa (Caldwell, 1979; Caldwell and McDonald, 1982; Akoto and Tabutin, 1989). This impact of education appears to be the result of better behavior by educated mothers than uneducated mothers in terms of hygiene, diet, care, decision-making in the household and "detachment" compared with certain cultural practices that are harmful to children's health. In addition, educated women have an advantage over the others in that they attract husbands with jobs that pay well, and thus they have relatively grater resources to meet their children's basic needs.

Mother's experience is critical

More than where they live and as important as education, the mother's age has a significant impact on child mortality. The knowledge of "care lavished on children" that the mother accumulates with successive births turns out to be crucial for the survival of

[1] At the France-Africa Summit in La Baule, President Mitterrand considered tying development aid to the democratization of regimes on the continent. In many countries, including Togo, this led to an institutional crisis with social and economic instability.

[2] This particularly high level of child mortality for children born of uneducated mothers compared with that of children born of more educated mothers (secondary or higher) caused us to wince. All the verifications indicated that this is not an error of calculation or the result of small samples. Other than the exorbitant nature of the differential we observed, the trend we found is as anticipated.

children from 1 to 5 years of age. In Burkina Faso (1992), the fact that a mother has a child before she turns 25 increases the risk of death during childhood by 81% compared to a mother who has her child when she is 35 years old or older. This risk is multiplied by 2 and 3 in Cameroon (1998) and Tanzania (1999) respectively. In Tanzania, this disadvantage is also perceptible when children born of relatively old mothers are compared with those born of mothers between 25 and 34 years of age. This phenomenon was also observed in Togo in 1998 and in Zimbabwe in 1988.

In conclusion, it should be underscored that the influence of the mother's age on child mortality applies only to rural areas. In other words, the risk of death during childhood due to the fact that the mother is young is greater in rural than in urban areas.

Though with mixed results immediate environment is another key determinant

The wholesomeness of the immediate environment in which the child lives certainly has an effect on child survival. Unwholesomeness[3] is generally associated with high child mortality. This is particularly true in Cameroon (1991), Togo (1988 and 1998) and Zimbabwe (1988).

In Cameroon (1991), the environment, along with the mother's education, is the principal factor for explaining child mortality. When the mother lives in a wholesome environment, the risk of having her child die between 1 and 5 years of age is lowered almost by half, compared to a mother who lives in an unwholesome environment. This impact is observed mainly in cities. It should be noted that, during this period, the country experienced intense political unrest, punctuated by what were called "dead cities" at the time. Health services in large cities were non-existent, so that household and other waste was not picked up and public health degenerated. This may explain the preponderant portion of child mortality that is intimately linked with the immediate environment in urban areas. In urban areas, the children of mothers who live in a wholesome environment have 59% less risk of dying between 1 and 5 years of age than those whose mothers live in an unwholesome environment.

In Togo, the immediate environment has proven to be the principal differentiating factor in child mortality. In this country, the fact that a mother lives in a healthy environment lowered the death risk factor from 1 to 5 years of age by 48% and 56% respectively in 1988 and 1998. And, contrary to Cameroon, this factor's impact was felt in both rural and urban areas; in rural areas in 1988 and in cities in 1998. The immediate environment also acts in the same way in Zimbabwe, where the risk of infant death fell by around 72% overall, and by 50% in rural areas.

In conclusion, it should be emphasized that in Tanzania, the impact of the immediate environment on child mortality did not turn out as expected. It was found that

[3] This unwholesomeness is measured by "the lack of toilets/others combined with drinking water supply from a spring, river or lake." "The lack of toilets/others combined with drinking water supply from a faucet/outside well and tank truck," or "traditional latrines combined with drinking water supply from a spring, river or lake."

the likelihood of a child dying between 1 and 5 years of age was twice as high if the mother lives in a wholesome environment than if she lives in an unwholesome environment. This result may be explained by the method used to create the variable (see annex); the groups obtained for Tanzania may have the drawback of being more heterogeneous than in the other countries.

Other than the factors already identified, there are two others whose impact on child mortality is significant in the countries studied. These factors are the mother's work and her religion.

Mother's employment experience or the preponderance of time spent on taking care of children

This variable's impact on mortality depends on the type and place of work. The mother's work often conflicts with the care given to children in terms of time. By definition, a working mother has little time to devote to her children. However, if the mother's job allows her to generate financial resources and to obtain the services of a nanny, that may help improve survival.

The impact of work has been shown to be significant in Tanzania (1999), Togo (1988) and in rural areas in Cameroon (1998). In rural Cameroon, the fact that a mother works in the agricultural sector (in a low-risk job) decreases the risk of child mortality for her children by 39%, compared with mothers who do not work. But, in both Tanzania and Togo, the fact that a woman works is associated with a high risk of child mortality. In Tanzania, it nearly doubles the likelihood that a child will die between 1 and 5 years of age. In Togo, the fact that a mother works raises the risk of child mortality by nearly 45%, especially in rural areas. Here, there is reason to believe that mothers who do not work spend more time taking care of their children than those who do have a job. The influence of the care given to children by nannies and other family helpers thus seems to be negative on children's health.

One final factor: the mother's religion

This factor often acts as a proxy of socio-economic variables, such as education and work (Akoto, 1990). According to the case, Christianity and/or Islam may be associated with low mortality, while traditional religions or atheism may be associated with high mortality. The impact of religion on child mortality proved to be significant in Cameroon (1998), Togo (1988) and Zimbabwe (1988). In all of these cases, religion may have a genuine impact on the risk of child death, and its impact is significant after the other variables are tested.

In Cameroon, children born of Muslim mothers and those born of mothers with no religion or traditional religion run a risk that is 51% and 57% higher respectively than Christian children. This advantage of "Christian" youth is perceptible mainly in rural areas. With regard to this last result, it is highly possible that the influence of religion reflects that of the region of residence. Most followers of traditional religions and Islam

do in fact reside in the Great North of Cameroon, known for its harsh climate and lack of infrastructure and public facilities, such as health units, water supply, etc. The Christians are concentrated in the more highly developed regions.

The advantage Christians have in terms of child mortality is also observed in Togo and Zimbabwe. However, there are a few slight differences compared to Cameroon. In Togo, only children born of mothers who practice traditional religions or who have no religion have a risk of death that is 54% higher than that of children born of Christians, and the difference in mortality between "Christians" and "Muslims" is not significant. In Zimbabwe, children of Muslims are at the greatest disadvantage in terms of mortality.

Table 4 here

Conclusion

Along with women and the elderly, children are a vulnerable segment of the population. Their health status is very sensitive to changes in living conditions. Moreover, their status is used as an indicator of the health status of the entire population.

The change in living conditions of the people of Sub-Saharan Africa over the past two decades has varied considerably. Even though most people saw a decline in their standard of living due to armed conflicts and/or economic crises, some have fared better than others. Within any given country, people living in urban areas may be more impacted than those in rural areas, or vice versa. Our paper has attempted to show the weight of the various socio-economic factors in "explaining" infant and child mortality in Sub-Saharan Africa.

Living in an urban or rural area has long been one of the key variables for differentiating child mortality (Akoto, 1985). Its impact has decreased or disappeared as other variables have superseded it. Although the positive impact of urban residence on the mortality of children under five years of age continued in some countries, such as Burkina Faso, this advantage has disappeared entirely in others, such as Cameroon, Togo and Zimbabwe; in Tanzania, the situation has even been reversed in favor of rural areas. But this situation appears to be temporary in our opinion because of the difficult period many African countries are going through at this time. We feel that the relative economic upturn observed in countries such as Cameroon and Burkina Faso will again generate imbalances in favor of urban areas, because things have not changed very much in terms of structure and organization. Cities continue to be in a better position than rural areas.

The study illustrated the importance of factors related to reproductive health in explaining mortality in children less than one year of age. Medical coverage of pregnancy and delivery has proven to be a decisive factor in infant mortality. The lack of prenatal consultations increases the risk of infant death, whereas a consultation, especially during the first four months of pregnancy, reduces this risk significantly (Burkina Faso,

Tanzania and Zimbabwe). Likewise, when the mother receives assistance during delivery by skilled medical personnel, this considerably lowers the risk of infant mortality. However, this impact is not universal; in some cases, early medical coverage of pregnancy and delivery assistance provided by skilled personnel is associated with high risk (urban Cameroon, Togo, and rural Zimbabwe). This may be a result of a practice that is widespread in many countries, consisting of referring serious cases to health units at the last minute. Based on the results, it is appropriate to recommend that in the context of safe maternity programs, *medical coverage of pregnancy and delivery should be made universal in the countries we studied. Universal medical coverage should significantly lower not just mortality before one year of age, but maternal mortality as well.*

The study provided another highly interesting outcome: the significant influence of the mother's age on her children's mortality during the first year after birth. Contrary to earlier findings (for example, Akoto and Hill, 1988), the relationship between the mother's age and infant mortality did not generate a U shape in all cases. The relatively advanced age of mothers was not associated with a high risk in Burkina Faso or Zimbabwe; conversely, it does lower infant mortality levels substantially compared with those of mothers less than 25 years of age. This advantage, related to relatively late maternity, was observed in all the countries we studied, but in rural areas only (Burkina Faso, Cameroon, Tanzania, Togo and Zimbabwe), when mortality between 1 and 5 years of age is considered. *Maternal experience in care given to children seems to prevail over the drawbacks of a mother's advanced age (maternal exhaustion syndrome, birth defects and eclampsia). Campaigns carried out to reduce early fertility should therefore be strengthened in these countries, particularly among Muslims and followers of traditional religions*.

On a different note, the study confirmed the preponderance of the mother's education in the explanation of child mortality. In every country, regardless of the period under consideration, the fact that a mother has had schooling lowers the risk of death for her children. The risk drops off sharply if the mother reaches at least the secondary level. If so, the difference in child mortality compared with illiterate women may be twice as high or even higher. It is important to reiterate a recommendation made hundreds of times: *the education of children and girls in particular, will bring about a dramatic fall in infant and child mortality in most countries in Sub-Saharan Africa.* If possible, the countries should strive to achieve the goal of universal primary education.

One final result pertains to the role of the immediate environment in which the child lives. In Cameroon in 1991, along with education, this is the main variable that explains child mortality. As expected, the unwholesomeness of the area of residence significantly increases the risk of death between 1 and 5 years of age. More particularly, the danger is water-borne diseases, as this indicator of the immediate environment is one composite variable that consists of two others: the source of the supply of drinking water and the type of toilet. Water from springs, wells or rivers is in fact a source of diseases such as diarrhea, cholera, typhoid, etc., and is one of the leading causes of death in children. Likewise, the fact that no high-quality toilets are available contributes

to environmental pollution and therefore to the persistence of certain illnesses that may prove to be fatal for children. *The establishment of health campaigns* as they exist in Cameroon at this time, sponsored by the Ministry of Territorial Administration and the Ministry of Urban Affairs, may prove to be effective in controlling high rates of infant and child mortality.

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Tableau 1 : Infant, child and under 5 mortality rates for the 10 years preceding the survey by residence in selected countries of sub-Saharan Africa.

Country	Survey year	Urban			Rural			Total			Rural-urban differential* (%)		
		$_1q_0$	$_4q_1$	$_5q_0$	$_1q_0$	$_4q_1$	$_5q_0$	$_1q_0$	$_4q_1$	$_5q_0$	$_1q_0$	$_4q_1$	$_5q_0$
Burkina Faso	1993 1998-99	76,4 67,4	78,0 66,2	148,4 129,1	113,0 113,2	114,4 137,1	214,4 234,7	107,6 108,6	108,7 129,5	204,5 224,1	47,9 67,9	46,7 107,1	44,5 81,8
Cameroon	1991 1998	71,7 61,0	52,3 53,0	120,3 110,7	86,1 86,9	79,7 80,2	158,9 160,1	80,5 79,8	69,2 72,3	144,1 146,3	20,1 42,5	52,4 51,3	32,1 44,6
Ghana	1988 1993	66,9 54,9	68,8 37,0	131,1 89,9	86,8 82,2	82,9 73,0	162,5 149,2	81,3 74,7	78,9 62,8	153,8 132,8	29,7 49,7	20,5 97,3	23,9 65,9
Guinea	1992 1999	107,8 7+9,2	75,9 75,5	175,5 148,7	167,1 115,8	130,5 107,2	275,8 210,6	153,1 106,6	116,9 99,0	252,1 195,1	55,0 46,2	71,9 42,0	57,7 41,6
Kenya	1989 1993	56,8 45,5	34,2 31,3	89,0 75,4	58,9 64,9	34,3 32,8	91,2 95,6	58,6 62,5	34,3 32,7	90,9 93,2	3,7 42,6	0,3 4,8	2,5 26,8
Mali	1987 1995-96	92,0 98,7	122,0 101,5	203,0 190,1	144,0 145,0	186,0 149,2	303,0 272,5	131,0 133,5	170,0 137,0	279,0 252,2	56,5 46,9	52,5 47,0	49,3 43,3
Niger	1992 1998	89,0 79,9	133,2 106,8	210,3 178,1	142,6 146,7	238,1 211,7	346,8 327,4	134,5 135,8	221,4 193,0	326,1 302,6	60,2 83,6	78,7 98,2	64,9 83,8
Nigeria	1990 1999	75,4 59,3	58,9 51,6	129,8 107,8	95,8 75,0	123,8 73,4	207,7 142,9	91,4 70,8	109,6 67,4	191,0 133,4	27,1 26,5	110,2 42,2	60,0 32,6
Senegal	1986 1992-93 1997	69,8 54,5 50,2	70,6 50,0 41,3	135,4 101,8 89,4	102,3 86,7 79,1	164,1 106,8 93,5	249,6 184,2 165,3	91,0 76,0 69,4	130,4 87,4 75,1	209,5 156,7 139,3	46,6 59,1 57,6	132,4 113,6 126,4	84,3 80,9 84,9
Tanzania	1991-92 1996 1999	108,3 83,1 87,3	57,1 42,6 59,6	159,2 122,2 141,6	97,2 97,1 113,0	61,0 59,6 59,7	152,2 150,9 165,9	99,4 94,1 107,8	60,2 55,9 59,7	153,6 144,8 161,1	- 10,2 16,8 29,4	6,8 39,9 0,2	-4,4 23,5 17,2
Togo	1988 1998	72,8 65,3	62,7 38,4	130,9 101,3	86,9 85,0	89,3 79,1	168,5 157,4	83,2 80,3	82,3 69,0	158,7 143,8	19,4 30,2	42,4 106,0	28,7 55,4
Uganda	1988-89 1995	103,1 74,4	67,6 63,8	163,7 133,5	106,6 87,6	94,0 78,4	190,6 159,1	106,3 86,1	91,6 76,7	188,2 156,2	3,4 17,7	39,1 22,9	16,4 19,2
Zambia	1992 1996	78,0 91,9	78,9 89,6	150,8 173,3	115,8 117,9	96,6 98,1	201,2 204,5	98,2 107,7	88,1 94,6	177,6 192,1	48,5 28,3	22,4 9,5	33,4 18,0
Zimbabwe	1988 1994 1999	37,8 44,3 47,2	17,8 19,5 22,8	54,9 63,0 69,0	64,5 53,6 65,3	36,4 28,2 36,7	98,6 80,3 99,7	57,4 51,2 59,7	31,3 26,0 32,5	86,9 75,9 90,3	70,6 21,0 38,3	104,5 44,6 60,9	79,6 27,5 44,5

Sources : DHS country reports

*: Rural-urban differentials are calculated with base equals 100 for urban area.

Tableau 2 : Infant, Child and under 5 Mortality Rates for the 10 years Preceding the Survey in Metropolitan and Medium Size Urban areas in Selected Countries in sub-Saharan Africa.

Country	Survey year	Metropolitan areas			Medium size urban areas			Difference between medium size urban areas and metropolitan areas* (%)		
		$_1q_0$	$_4q_1$	$_5q_0$	$_1q_0$	$_4q_1$	$_5q_0$	$_1q_0$	$_4q_1$	$_5q_0$
Burkina Faso	1993	82,8	73,7	150,4	68,1	83,5	145,9	-17,7	13,3	-3,0
Cameroon	1991	67,2	38,6	103,2	73,9	59,1	128,6	10,0	53,1	24,6
	1998	51,5	41,9	91,3	65,7	58,7	120,5	27,6	40,1	32,0
Mali	1995-96	83,9	71,2	149,2	108,0	120,5	215,5	28,7	69,2	44,4
Niger	1992	63,8	99,1	156,6	101,7	151,3	237,6	59,4	52,7	51,7
	1998	69,5	83,6	147,3	85,0	118,7	193,6	22,3	42,0	31,4
Togo	1998	74,1	36,4	107,8	57,1	40,4	95,2	-22,9	11,0	-11,7

Sources: Various DHS country reports

*: Differentials are calculated with base equals 100 for metropolitan areas.

Table 3: Major Determinants of Infant Mortality in selected sub-Sahara African Countries

Country	Total	Urban	Rural	Total	Urban	Rural
	1992			**1999**		
Burkina Faso	Residence (unadjusted) Age *** Delivery * Pregnancy **		Acc. *	Residence ** Religion ** Age * Pregnancy. **		Employment ** Age * Pregnancy **
	1991			**1998**		
Cameroon	Schooling * Age * Environment **		Schooling* Religion * Age **	Environment *	Environment ** Delivery ***	
	1996			**1999**		
Tanzania	Residence (unadjusted) Religion *** Age *	Age * Pregnancy	Pregnancy	Residence ** Employment ** Age * Delivery * Pregnancy *	Employment * Age *	Delivery * Pregnancy *
	1988			**1998**		
Togo	Religion ***	Instruct**	Religion **	Acc. **	Employment **	
	1988			**1998**		
Zimbabwe	Residence **		Schooling * Environment *	Instruct. ** Religion * Age * Environ ** Gross. ***	Religion ** Pregnancy **	Schooling ** Age * Environment * Delivery * Pregnancy ***

Legend: Pregnancy = Duration of pregnancy at the first prenatal care visit.
Delivery = Assistance at delivery
Environment = Immediate physical environment

Table 4: Major determinants of child mortality in selected sub-Saharan African Countries

Country	Total	Urban	Rural	Total	Urban	Rural
	1992			**1998-99**		
Burkina Faso	Residence (unadjusted) Schooling*** Age**	----	Schooling *	Residence (unadjusted) Schooling *** Age**	----	Age** Environment*
	1991			**1998**		
Cameroon	Residence (unadjusted) Schooling ** Environment*	Environ*	Schooling* Age*	Residence (unadjusted) Schooling* Age*** Religion**	----	Schooling* Age* Religion* Employment*
	1996			**1999**		
Tanzania	Residence (unadjusted) Schooling**	----	Schooling** Age*	Residence (unadjusted) Schooling** Age*** Employment** Environment**	Schooling*** Age***	Age***
	1988			**1998**		
Togo	Residence (unadjusted) Employment** Environ** Religion*	----	Age* Religion** Employment** Environment**	Residence (unadjusted) ** Schooling** Age* Environment***	Environment***	Schooling** Age**
	1988			**1998**		
Zimbabwe	Residence (unadjusted) ** Schooling** Religion** Environment**	----	Schooling** Age* Environment*	----	----	----

Legend: Environment = Immediate physical environment

ANNEX

How the "immediate environment" variable is constructed

We used the manual method for constructing this variable. It consisted of assigning a 1, 2 or 3 points to each modality of the two variables that constitute the indicator to be created, namely the type of toilet and supply of drinking water. Once the points were assigned, the next step consisted of adding them up. The modality:

- "Wholesome" (healthy) consists of all the combinations with a score less than or equal to 3;
- "Intermediate" consists of all the combinations with a score of 4;
- "unwholesome" (unhealthy) consists of combinations with a score greater than 5.

Step 1:

Variables	Points
Type of toilet (toil)	
- flush/upgraded latrines	1
- traditional latrines	2
- lack of toilets/others	3
Source of drinking water supply (water)	
- faucet/inside well	1
- faucet/well located elsewhere/tank truck	2
- spring/river/lake	3

Step 2:
Immediate environment (envim):

Toil = 1 and Water = 1 (score 2), Envim = 1
Toil = 1 and Water = 2 (score 3), Envim = 1
Toil = 2 and Water = 1 (score 3), Envim = 1
Toil = 1 and Water = 3 (score 4), Envim = 2
Toil = 2 and Water = 2 (score 4), Envim = 2
Toil = 3 and Water = 1 (score 4), Envim = 2
Toil = 3 and Water = 3 (score 6), Envim = 3
Toil = 3 and Water = 2 (score 5), Envim = 3
Toil = 2 and Water = 3 (score 5), Envim = 3

Envim = 1 is the "Wholesome" (or healthy) modality
Envim = 2 is the "Average" modality
Envim = 3 is the "Unwholesome" (or unhealthy) modality