

Demographic surveillance in the field to capture African population trends

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According to the United Nations, the population of sub-Saharan Africa should more than double by 2050. But statistical data are scarce and do not give a clear picture of trends or factors of change. To make up for this lack of information, demographic surveillance systems (DSS) have been set up in specific regions. Using examples of demographic surveillance projects in Senegal run by researchers of the Institut national d'études démographiques (INED) and the Institut de recherche pour le développement (IRD), Emmanuelle Guyavarch explains how they function and why they are useful to researchers.

The rapid population growth in sub-Saharan Africa is a source of concern. According to the United Nations, its population should more than double within fifty years, rising from 750 million in 2005 to 1.8 billion in 2050. This projection is based on the assumption that, like the other continents, sub-Saharan Africa will experience the major demographic transition that began more than two centuries ago and has since spread across the planet. For a long time, it was assumed that change in sub-Saharan Africa would follow the same pattern as in other Southern countries—i.e. Asia, Latin America, North Africa—but with a certain time lag. But many believe today that change will be much slower in this region. After a period of decline from the 1950s, mortality has levelled off or started rising again over the last 15 years in many countries due to the AIDS epidemic, to a resurgence of endemic diseases (malaria, tuberculosis, cholera) and ineffective health care systems. The fertility decline that began in the 1980s in several countries of southern and eastern Africa is spreading slowly elsewhere and affects cities rather than the rural areas where most people in these countries live.

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Yet we have little precise data to monitor and understand these patterns of change. Though the number of inhabitants can be obtained from census data, births and deaths are difficult to count since not all are officially registered. Regular demographic and health surveys are organized to remedy this situation by providing data on demographic levels and trends. But at best they

Figure 1 – Location of the three demographic surveillance sites in Senegal run by INED (Bandafassi and Mlomp) and IRD (Niakhar)



(E. Guyavarch, *Population & Societies*, 433, Ined, April 2007)

capture only three or four points in time and give little information on the factors of change. Moreover, few reliable health statistics are available in Africa, and hospital records give a biased image of the health status of a population, since many people never go to hospital, or only very rarely.

◆ Long-term observation of village groups

To address this need for information, a new method of observation, known as a “demographic surveillance system” (DSS) was developed and applied widely from the late 1980s, notably in Africa. DSSs are demographic data collection systems in which the entire population of a defined set of villages are observed over several years or decades. Data on all demographic events in these villages, such as births, deaths, marriages and migration, are collected on a regular basis (see Box).

Even if the DSS data are of local relevance only, the in-depth study of a small region over a long period provides a means to measure and understand the determinants of major demographic trends, and to improve knowledge of health through studies conducted within the general population. If the DSS is continued over many years or decades, it can serve as a sentinel for the health care systems of the region. It also provides an excellent framework for testing and assessing new vaccines, treatments or health care strategies.

We will illustrate the positive role of DSSs via the

example of Senegal. It has three rural DSS sites—Bandafassi, Mlomp and Niakhar—whose populations have been observed for more than twenty years by INED and IRD [1, 2, 3] (Figure 1). In 2006, the sites had 12,000, 8,000 and 35,000 inhabitants respectively (Table). Situated in different regions of the country, they reflect the wide range of rural living conditions in Senegal. In particular, health care provision varies substantially, with Mlomp benefiting from the widest range of services and Bandafassi the most limited. A new hospital opened in the heart of Bandafassi in 2002 has improved the situation however. One of its main aims is to reduce maternal mortality, and it offers emergency obstetrical care, usually only available in large urban hospitals.

◆ How can maternal mortality be reduced?

Different demographic surveillance sites can also be compared with each other, provided that the same data collection methods are applied. The three sites in Senegal all satisfy this criterion (see Box). Maternal mortality has been estimated in an accurate and comparable manner for each site. It is very high in all three, as is often the case in sub-Saharan Africa. There are nonetheless large differences between sites. In around 1990, the number of maternal deaths (1) per 100,000 live births was 436 in Mlomp, 516 in Niakhar and 826 in Bandafassi (Table). Mlomp and Bandafassi are quite representative of the range of maternal mortality levels observed in Senegal and in West Africa in general, and the average level for rural areas of this region most probably lies between these two extremes.

In the light of DSS data, the WHO, which had given an estimate of 1,200 maternal deaths for 100,000 live births in Senegal in 1995, practically halved its estimate for 2000, down to 690 per 100,000 [4, 5]. Though mortality may indeed have fallen during the period, such a large drop is implausible. In other words, the initial WHO estimate was clearly too high for an average figure covering not only rural areas but also urban areas where maternal mortality is certainly much lower. Given that it stood at between 400 and 900 per 100,000 in 1990 in the three rural areas studied—well below the WHO estimate of 1,200—its mean level, including urban areas, must have been even lower.

(1) Death of a woman during pregnancy or within 42 days of childbirth, from whatever cause. Accidents and deaths unrelated to the pregnancy are excluded (WHO definition).

Table - Population, health and mortality in the three rural DSSs in Senegal

	Site		
	Bandafassi	Niakhar	Mlomp
Population (2006)			
Size	12,000	35,000	8,000
Density (inhabitants per sq. km)	20	145	115
Life expectancy and mortality (1985-2003)			
Life expectancy at birth (years)	47	51	61
Risk for a newborn of dying before age 5 (%)	24%	21%	11%
Risk for a women aged 15 of dying before age 55 (%)	21%	15%	10%
Maternal health (1985-1998)			
Percentage of women giving birth in hospital (%)	3%	15%	99%
Distance from nearest hospital where caesarean births are performed (km)	250	25 or 60*	50
Maternal mortality rate (number of maternal deaths per 100,000 live births)	826	516	436
* Women can be directed to one of two local hospitals. Sources: Bandafassi, Niakhar and Mlomp DSS sites.			

(E. Guyavarch, *Population & Societies*, 433, Ined, April 2007)

As well as indicating the mean level of maternal mortality, the DSS sites in Senegal also provide a means to identify the factors involved, notably those which explain the two-fold differences between sites. Is high maternal mortality, as is often suggested, the consequence of inadequate perinatal care to detect high-risk pregnancies? Is it due to home births practiced without the assistance of qualified personnel? Or is the absence of local hospitals equipped for emergency care—caesarean births in particular—a more critical factor? In 1990, the proportion of women giving birth in hospital varied radically between populations: 99% in Mlomp, 15% in Niakhar and 3% in Bandafassi (Table). The systematic presence of a midwife or matron during birth is not as decisive as might be expected. The levels of maternal mortality, which vary by a factor of two between the sites, appear to be more closely linked to the ease with which women are transported to hospital for emergency care than to the proportion of hospital births. The current strategy is to install new surgical facilities for caesarean births and to develop emergency transport. The construction of a hospital in Bandafassi in 2002 is an example of this approach, though it has not yet reduced maternal mortality in the DSS. There were 18 maternal deaths in the study population in the three years prior to hospital opening (1999 to 2001), and the same number in the following three years (2003–2005). As the number of births over the two periods was similar, the maternal mortality rate remained unchanged. No doubt more time is needed for the hospital to make an impact, and new high-tech facilities are not a solution to every type of problem.

◆ Obstacles to the spread of contraception in Africa

Rapid population growth in Africa is due to a very high birth rate. Women marry young and contraceptive use is still limited, in rural areas especially. Is it because the population lacks knowledge about modern contraceptive methods that their use is spreading so slowly? Because people refuse to use them? Because they are difficult to get hold of? Because the health personnel responsible for their diffusion do not make enough effort? Or because the population is mistrustful? We will look at the example of Bandafassi, where the spread of contraception has been monitored since its first introduction and where the factors affecting its use have been studied in detail [2].

Fertility, which stood at 6.3 children per woman on average in the early 1980s, has not decreased since then. In fact, it has even increased slightly by around one-half a child per woman. Modern contraception is still not widespread at community level, with only 4% of

women aged 15–49 using it in 2000. But in two of the forty villages studied, its use spread very rapidly after a family planning programme was set up in the region. Whereas practically no women had used contraception prior to its introduction in 1993 by the nurse at the local dispensary, eight years later, almost half of all women of reproductive age had used contraception in the first village, where the dispensary was located, and a quarter of those living in the other village eight kilometers away. Though the distance from the dispensary is an important factor, for the second village, the impact of a particularly active and proficient community health

Box

The demographic surveillance method used in Senegal

The populations of the three rural sites of Bandafassi, Mlomp and Niakhar in Senegal have been followed by means of multi-round surveys for many years*. Since the initial census, the villages have been visited regularly by INED and IRD researchers, at annual or three-month intervals. During each visit, they note any changes in the number of persons present in each household and collect information on births, marriages, migrations and deaths since their previous visit. This observation method is used in a growing number of sites in developing countries, some of which—including those in Senegal—have grouped together to form a network (Indepth [6]).

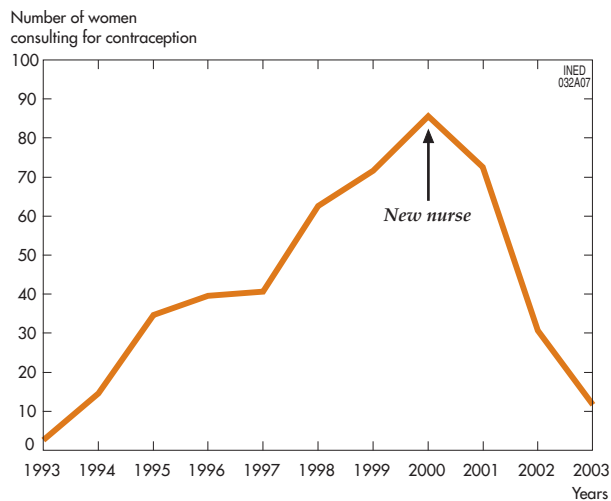
Alongside the regular collection of basic demographic data, specific one-off surveys are conducted on topics of particular interest concerning the population, the family or health. The population file serves as the sampling frame. These quantitative surveys are often associated with qualitative surveys on the same topic which serve to prepare the data collection process or examine certain issues in more depth.

The data on rural populations of Africa collected on these three sites are of high quality. As the coverage of events is practically exhaustive and accurately dated, the demographic measures obtained are very reliable, notably those concerning mortality levels and trends. Information is collected in the same way on all sites, so measures can be compared to assess the health of different rural populations in Senegal.

Mortality is very high in the three rural sites of Senegal, and life expectancy is around 50 years. But there are large variations between sites: over the period 1985–2003, Bandafassi had a life expectancy of 47 years, Niakhar 51 years and Mlomp 61 years (Table). The risk for a newborn of dying before age 5 also varies. It stands at 21%, 15% and 10% respectively on the three sites. The relatively low child mortality in Mlomp can be partly explained by well-managed health care and effective coverage of the population by the local dispensary [1]. Practically all children are vaccinated there, so mortality from infectious diseases is lower than on the other two sites.

* The Bandafassi and Mlomp sites were set up and are maintained by the Institut national d'études démographiques, and the Niakhar site by the Institut de recherche pour le développement (IRD)

Figure 2 – Change in annual number of women consulting for modern contraception at the Bandafassi dispensary



(E. Guyavarch, *Population & Societies*, 433, Ined, April 2007)

worker was crucial. The number of consultations for contraception at the dispensary doubled every two years between 1993 and 2000 (Figure 2).

This increase was followed by a rapid decline after 2000 when the nurse who had initiated the family planning programme was replaced. More than half the contracepting women who had regularly visited the dispensary stopped coming, and the others soon followed suit. The relations of trust built up with the women by the first nurse were broken. Personal factors are very important for developing such trust, as are continuity of service over the long term.

Contrary to common belief, contraceptive use can spread quickly across economically disadvantaged rural areas in Africa. But it can also decline equally fast, dropping to a very low level within one or two years. In the example presented here, the obstacles and failures are due not so much to lack of knowledge as to reluctance or difficulty of access. The quality of relations and the level of trust between health care personnel and the population are crucial factors.

The demographic surveillance sites give an accurate indication of trends in different specific regions of Africa and reveal the underlying causal factors. They show that demographic and health transitions can take place much faster than previously imagined. In our last example, that of contraception, the national and regional indicators show that its use is increasing, but slowly, giving the impression that change is a very lengthy process. But at the local level, things are quite different, and the situation may evolve very rapidly. The apparent inertia at the larger scale is due to a smoothing

effect when changes in different communities – i.e. some where nothing is happening, and others where a very rapid upward or downward change is occurring – are aggregated. We imagine that the phenomenon is intrinsically slow, that “mentalities” and “cultures” hostile to contraception must be changed, and that this necessarily takes time. Local observation shows that these are not the only obstacles. The fact that services are often disorganized and ineffective is another hindrance. More so than we imagine, the men and women of Africa are ready for change.

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ABSTRACT

Researchers have developed demographic surveillance systems in several specific regions of Africa. Their purpose is to provide accurate local data, in addition to that of national censuses and surveys, with a view to understanding the mechanisms behind demographic and health trends. This is notably the case in Senegal, where three rural populations have been observed for several decades. The research findings obtained have led to a downward adjustment of WHO maternal mortality estimates for the country and have shed new light on the causes of maternal death. They have also shown that the very slow overall diffusion of modern contraception is not the consequence of cultural resistance: when contraception is made available by strongly motivated health personnel, it can spread very rapidly, even in economically disadvantaged rural areas.