

## NIAKHAR DSS, SENEGAL

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### Site description

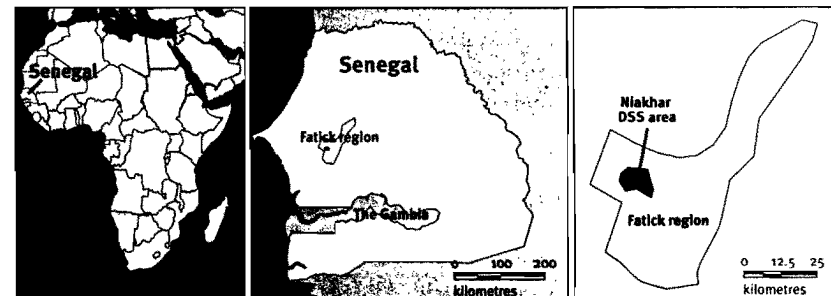
#### Physical geography of the Niakhar DSA

The study zone of Niakhar is in Senegal, at latitude 14.5°N and longitude 16.5°W (Figure 26.1). It is in the Département of Fatick, region of Fatick (Sine-Saloum), 135 km east of Dakar. The study zone is about 15 km × 15 km and covers 230 km<sup>2</sup>. The climate is continental Sudanic sahelian, with temperatures ranging from 24°C in December–January to 30°C in May–June. For 30 years, the region has suffered from drought. Rainfall decreased from 808 mm a year in 1921–67, to 520 mm in 1968–87, and to 463 mm in 1988–98.

#### Population characteristics of the Niakhar DSA

From 1962 to 1966, sixty-five villages were surveyed annually. The study zone was then reduced to 8 villages until 1983, when it was extended to include 22 more villages, forming the current study zone of 30 villages. Eight of these have been under demographic surveillance for 38 years; and 22, for 17 years. The Niakhar area had a population of 30 215, as of 1 January 2000, with a high population density of about

Figure 26.1. Location of the Niakhar DSS site, Senegal (monitored population, 29 000).



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131 inhabitants/km<sup>2</sup>. Demographic surveillance covers 30 villages of varying sizes: 60 individuals in Darou (the smallest) and 3150 in Toucar (the biggest); three other villages have more than 2000 individuals. The area is rural, but the three largest villages are more “urbanized,” with health facilities, weekly market, daily buses to Dakar, and several shops. The Sereer ethnic group constitutes 96.5% of the population. Other ethnic groups are Wolof (1.4%), Toucouleur (1.1%), and Laobe (0.6%), with Peuhl, Moorish, Soce, and Diola making up the remainder (0.5%). Islam is the most-declared religion (74.5%); Christians constitute 22.4% of the population (19.9%, Roman Catholic; 2.6%, Protestant); and indigenous religion is declared by only 2.6%, although indigenous practices are very prevalent and observed in each family. The dominant language is Sereer, but many people speak Wolof.

The population lives traditionally on one food crop (millet), one cash crop (groundnuts), and cattle-raising. To cope with the agricultural crisis in Sahel and the demographic pressure (85 people/km<sup>2</sup> in 1966, 131 people/km<sup>2</sup> in 2000), new activities arose: predominantly, meat production and temporary migration to urban centres. Participation in formal education is very low: 59% of men and 80% of women 15–24 years old have no education. The first school opened in 1951, and the area now has nine public and two private schools.

The residential unit is the compound, which comprises one or more households, together with some members of the extended, patrilineal family. Traditional houses are huts (one for each ever-married woman and additional huts for unmarried adults). Modern structures, using concrete and corrugated iron, tend to replace traditional houses (43% of households have at least one corrugated iron roof). The availability of boreholes and drinking fountains has increased over the past several decades: 60% of the households now have access to tap water. The use of latrines is more recent: only 22% of the households have access to sanitation. The area has no electricity. The only paved roads are 15–30 km away from the villages, but several daily bus or taxi services to Dakar are available.

There are three health dispensaries within the study zone (the first opened in 1953, the last in 1983) and two outside it, providing basic services to the study population. These services include curative care, immunization, prenatal care, delivery, oral-rehydration therapy, and malnutrition management. The expanded program on immunization started between 1982 and 1984. At the department level, the proportion of fully immunized children among those 12–23 months old was 33%, and this was only 23% in January 2000. At the regional level, this coverage reached 61% in 1990 and decreased to 51% in 1991. Measles- and pertussis-vaccine trials resulted in a significant increase in immunization coverage within the study zone between 1987 and 1997.

Outbreaks of cholera occurred in 1985, 1987, and 1996, and a large meningococcal meningitis outbreak hit the population in 1998. Roughly half of the under-five mortality is due to diarrheal diseases, acute respiratory illness, and malnutrition; a quarter, to malaria.

## Niakhar DSS procedures

### Introduction to the Niakhar DSS site

The original objective of the Niakhar DSS site, in 1962, was to obtain reliable demographic and epidemiological data on a rural African population. Current objectives

are to obtain a long-term assessment of demographic indicators, a basis for biomedical and social-sciences research, and continuous epidemiological surveillance. The Niakhar DSS has institutional affiliation with the Institut de recherche pour le développement (IRD, institute for development research; formerly ORSTOM).

The DSS has had several periods:

- 1962–66 — 65 villages had yearly surveys;
- 1967–83 — 8 villages had yearly surveys;
- 1984–86 — 30 villages had yearly surveys;
- 1987–97 — 30 villages had weekly surveys; and
- Since 1997 — 30 villages have had quarterly surveys.

Surveys are now conducted in February, May, August, and November every year. Between successive rounds, collected data are entered, checked, and used for updating the database. Migration data are probably the most difficult to collect, as they depend on the rule for residence used in the registry system. In- and out-migrations are counted after 6 months of presence or absence. Exceptions to this general rule concern temporary-work migrants, who are resident if they come back to the village for at least 1 month in the year; absent workers, who have their family (wife and children) in the village; and absent scholars who are considered resident within their family. Verbal autopsies (VAs) were completed for all deaths registered until 1997 and for deaths of those <55 years old thereafter.

The DSS routinely measures information on pregnancies, births, abortions (spontaneous), stillbirths, weaning, migrations, changes of marital status, immunizations, and cases of measles and whooping cough. Economic variables are measured using specific surveys on education, household equipment, and breeding and agricultural activities. Specific studies have been conducted on fertility, health-seeking behaviour, malaria, sexually transmitted diseases–HIV, anthropometric measures, and maternal mortality.

The project has five fieldworkers, three supervisors, three data-entry clerks, and two computer scientists. The Niakhar DSS system is geographically distributed between Niakhar and Dakar. Five fieldworkers visit the compounds, and two supervisors collect the completed questionnaires and bring them to the office in Niakhar on a daily basis, where they are checked. Questionnaires are then sent to Dakar for coding, data entry, updating, tabulation, and analysis. Main consumers of the Niakhar DSS data are researchers. However, results from demographic and epidemiological surveillance are regularly fed back to the local authorities, and in case of a potential disease outbreak the Ministry of Health is immediately alerted.

### Niakhar DSS data collection and processing

#### Field procedures

**INITIAL CENSUS** — The initial census was conducted of 8 villages in 1962 and a further 22 villages in 1983. It comprised identification of the resident population and an abridged birth history for women (number of live births and deaths of children).

**CONTINUOUS SURVEILLANCE** — Data are currently collected on a quarterly basis. The local team involved in the data collection comprises five fieldworkers, two supervisors, and one head of station. They visit each compound every 3 months. Complete lists of people resident in the household and compound are produced each year. This list contains information on absence (date and reason), pregnancy if not terminated, illnesses, etc. Specific spaces are provided to record information on the events occurring since the last visit. Spaces for three visits are available. Fieldworkers use these lists to ask questions about pregnancy, birth, stillbirth, death, migration, weaning, change in marital status, vaccination, measles, and whooping cough. To obtain accurate answers, concerned persons are interviewed personally; if they are absent or too young, a well-informed relative is interviewed. Until 1997, VAs were conducted for all deaths, and since then only for the deaths of people <55 years old. When a death occurs, the fieldworker interviews relatives of the deceased and completes a questionnaire with the identification of the person and the history and symptoms of the illness. The questionnaire is then read by two physicians, who each attribute a diagnosis. If the two physicians disagree, a group of physicians gather to reach agreement on a diagnosis. The World Health Organization's ICD-9 is used for coding the most likely underlying cause of death.

**FIELD SUPERVISION AND QUALITY ASSURANCE** — After each day of data collection, the supervision team does consistency controls and registration of information. To make sure that all compounds were actually visited, some of them are revisited at random.

*data management*

In Dakar, lists of people resident are checked, and some information is coded. An application program is used to enter, check, and save data in permanent files, which are processed to calculate all relevant statistics on the population. A menu is presented with these choices: data entry, data-checking, file-updating, browsing through files, or production of statistics.

Errors that appear in the data-processing step are corrected where possible; otherwise not, the questionnaires are returned to the field.

Depending on the needs of epidemiologists and demographers, file extractions are done to present data according to a specific format for analysis. Reports on demographic and epidemiological data are produced for the local and national authorities. An analysis report is produced every 3 years.

### Niakhar DSS basic outputs

On 1 January 2000, the population of the study area was 30 215. The population is very young: 46% are <15 years old (16.7% are 0–4 years old; 29.0%, 5–14 years old) (figure 26.2). Children <1 year old constitute 3.9% of the population; the elderly, 1%. The age-dependency ratio is 1.04, and the sex ratio is 0.98 : 1.

In 1997, the average household size was 10.4, and the average compound size was 15.8. Although unusual in this society, 6.1% of households had a woman as head.

Table 26.1 shows age- and sex-specific all-cause mortality for 1995–98, and table 26.2 compares these data with those for 1984–88 and 1989–94. Demographic indicators for all three periods are presented in Table 26.3.

Figure 26.2. Population pyramid for person-years observed at the Niakhar DSS site, Senegal, 1995–98.

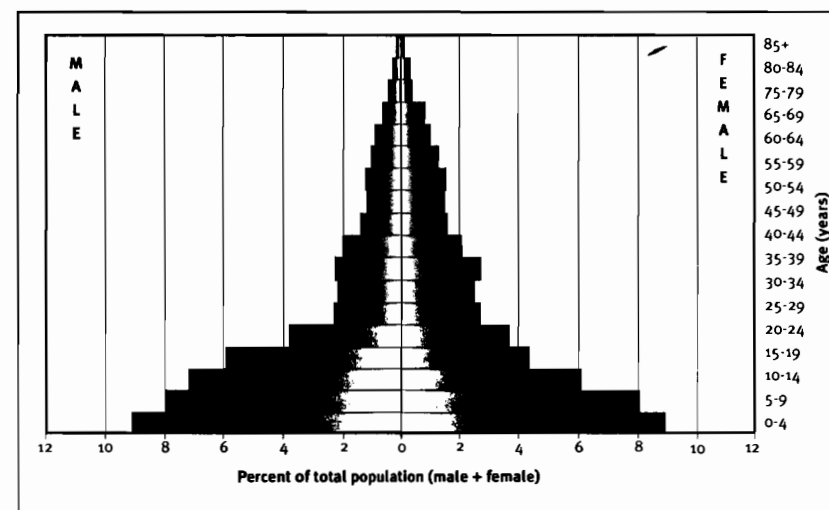


Table 26.1. Age- and sex-specific mortality at the Niakhar DSS site, Senegal, 1995–99.

Age (years)	Deaths ( ${}_nD_x$ )		Person-years observed ( ${}_nPY_x$ )	
	Male	Female	Male	Female
<1	271	208	2 920	2 826
1–4	393	337	10 205	10 155
5–9	91	80	11 549	11 664
10–14	36	27	10 304	8 771
15–19	25	19	8 330	6 253
20–24	20	18	5 216	5 192
25–29	18	17	3 319	4 028
30–34	10	13	3 165	3 731
35–39	24	13	3 304	3 977
40–44	19	17	2 789	2 995
45–49	18	23	1 998	2 371
50–54	29	20	1 698	2 263
55–59	31	27	1 768	2 275
60–64	51	36	1 499	1 893
65–69	57	44	1 242	1 506
70–74	53	60	875	1 210
75–79	48	44	582	603
80–84	43	59	375	472
≥85	47	50	192	308
Births	5 997			
CDR	16.66			
CBR	41.70			
CRNI	2.5			

Note: CBR, crude birth rate (actual number of births per 1000 population); CDR, crude death rate (actual number of deaths per 1000 population); CRNI, crude rate of natural increase (CBR minus CDR per 100; does not take into account migration);  ${}_nD_x$ , observed deaths between ages  $x$  and  $x+n$ ;  ${}_nPY_x$ , observed person-years between ages  $x$  and  $x+n$ .

Table 26.2. Historical age- and sex-specific all-cause mortality at the Niakhar DSS site, Senegal, 1984-98.

Age (years)	1984-88				1989-93				1994-98									
	Males		Females		Males		Females		Males		Females							
	PY	Death rate	PY	Death rate	PY	Death rate	PY	Death rate	PY	Death rate	PY	Death rate						
<1	2 791	369	132.2	2 757	306	111.0	2 815	262	93.1	2 757	205	74.4	2 920	271	92.8	2 826	208	73.6
1-4	9 115	436	47.8	8 877	402	45.3	9 983	350	35.1	10 103	333	33.0	10 205	393	38.5	10 155	337	33.2
5-9	9 747	48	4.9	9 485	46	4.8	11 105	68	6.1	10 921	52	4.8	11 549	91	7.9	11 664	80	6.9
10-14	7 476	19	2.5	6 859	14	2.1	9 579	19	2.0	7 722	16	2.1	10 304	36	3.5	8 771	27	3.1
15-19	5 248	15	2.9	4 631	8	1.7	7 268	19	2.6	5 325	16	3.0	8 330	25	3.0	6 253	19	3.0
20-24	4 032	12	3.0	4 618	20	4.3	4 165	21	5.0	4 329	18	4.2	5 216	20	3.8	5 192	18	3.5
25-29	3 847	26	6.8	4 590	23	5.0	3 189	16	5.0	4 021	9	2.2	3 319	18	5.4	4 028	17	4.2
30-34	3 490	25	7.2	3 597	15	4.2	3 271	9	2.8	4 942	19	4.7	3 165	10	3.2	3 731	13	3.5
35-39	2 414	15	6.2	2 679	18	6.7	3 257	20	6.1	3 558	15	4.2	3 304	24	7.3	3 977	13	3.3
40-44	1 944	20	10.3	2 450	12	4.9	2 273	10	4.4	2 560	20	7.8	2 789	19	6.8	2 995	17	5.7
45-49	1 991	20	10.0	2 517	29	11.5	1 836	18	9.8	2 324	16	6.9	1 998	18	9.0	2 371	23	9.7
50-54	1 817	32	17.6	2 299	27	11.7	1 807	18	10.0	2 359	16	6.8	1 698	29	17.1	2 263	20	8.8
55-59	1 597	39	24.4	1 920	37	19.3	1 720	28	16.3	2 444	26	12.1	1 768	31	17.5	2 275	27	11.9
60-64	1 266	30	23.7	1 667	37	22.2	1 506	29	19.3	1 779	35	19.7	1 499	51	34.0	1 893	36	19.0
65-69	1 057	52	49.2	1 170	48	41.0	1 134	40	35.3	1 478	45	30.4	1 242	57	45.9	1 506	44	29.2
70-74	805	56	69.6	986	56	56.8	867	52	60.0	978	52	53.2	875	53	60.6	1 210	60	49.6
75-79	509	50	98.2	630	48	76.2	546	43	78.8	660	48	75.7	582	48	82.5	603	44	73.0
80-84	287	50	174.2	414	39	94.2	315	40	127.0	435	49	112.6	375	43	114.7	472	59	125.0
85	207	54	260.9	342	59	172.5	198	39	197.0	320	75	234.4	192	47	244.79	308	50	162.3
CDR (s.e.)	59 690	1 368	22.9	62 458	1 244	19.9	66 834	1 101	16.4	67 815	1 065	15.7	71 330	1 284	18.0	72 493	1 112	15.3
ASDR (Sego) (s.e.)			20.6			17.2			15.4		13.9			17.7		14.0		14.0

Note: ASDR (Sego), age-specific death rate adjusted using the standard world population of Segi (1960); CDR, crude death rate (actual number of deaths per 1000 population); PY, person-years.

Table 26.3. Trends in demographic indicators at the Niakhar DSS site, Senegal, 1984-98.

Demographic indicator	1984-88	1989-93	1994-98
Total fertility rate	7.9	7.7	7.0
Neonatal mortality rate per 1000 live births	57	38	31
Infant mortality rate	122	86	79
Under-five mortality rate	282	196	200
Annual birth rate	47	46	42
Annual death rate	17	16	15
Annual out-migration rate	59	51	47
Annual in-migration rate	40	37	36
Natural annual population growth rate	3.22	2.98	2.61
Real annual population growth rate	1.28	1.64	1.51
1984-97			
Maternal mortality ratio (maternal deaths per 100 000 live births)	516 (ICD-9 definition)		575 (ICD-10 definition)

Note: ICD, International Classification of Diseases.

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