Chapter 26

NI AKHAR 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 km². 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 29,000.

Figure 26.1. Location of the Niakhar DSS site, Senegal (monitored population, 29,000).
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/km² in 1966, 131 people/km² 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 huts (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 much 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 1983, the last in 1988) 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 36%, and this was only 28% in January 2000. At the regional level, this coverage reached 61% in 1990 and increased 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 — 36 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 residents 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).
INTENSIVE SURVEILLANCE — Data are currently collected on a quarterly basis. The
call team involved in the data collection comprises five fieldworkers, two supervisors,
of 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,
homeless, etc. Specific spaces are provided to record information on the events occur­
ing since the last visit. Spaces for four visits are available. Fieldworkers use these lists
ask questions about pregnancy, birth, stillbirth, death, migration, weaning, change
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, VA's were conducted for all
children, concerned persons are interviewed personally; if they are absent or too
old, a diagnosis. The World Health Organization's ICD-9 is used for coding the most
likely underlying cause of death.

SUPERVISION AND QUALITY ASSURANCE — After each day of data collection, the
persister 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

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 pre­
vented 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, 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 demo­
graphic and epidemiological data are produced for the local and national authorities.
A analysis report is produced every 3 years.

Niakhar DSS basic outputs

At the end of 1996, the population of the study area was 30,215. The population is
quite 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
dicators for all three periods are presented in Table 26.3.

Table 26.1. Age- and sex-specific mortality at the Niakhar DSS site,
Senegal, 1995–98.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Male</th>
<th>Female</th>
<th>Person-years observed (PYO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–4</td>
<td>278</td>
<td>208</td>
<td>2,950</td>
</tr>
<tr>
<td>5–9</td>
<td>393</td>
<td>337</td>
<td>10,293</td>
</tr>
<tr>
<td>10–14</td>
<td>367</td>
<td>377</td>
<td>10,294</td>
</tr>
<tr>
<td>15–19</td>
<td>25</td>
<td>19</td>
<td>2,830</td>
</tr>
<tr>
<td>20–24</td>
<td>20</td>
<td>16</td>
<td>2,261</td>
</tr>
<tr>
<td>25–29</td>
<td>17</td>
<td>17</td>
<td>3,220</td>
</tr>
<tr>
<td>30–34</td>
<td>13</td>
<td>13</td>
<td>2,763</td>
</tr>
<tr>
<td>35–39</td>
<td>13</td>
<td>13</td>
<td>2,395</td>
</tr>
<tr>
<td>40–44</td>
<td>13</td>
<td>13</td>
<td>2,189</td>
</tr>
<tr>
<td>45–49</td>
<td>13</td>
<td>13</td>
<td>1,982</td>
</tr>
<tr>
<td>50–54</td>
<td>13</td>
<td>13</td>
<td>1,760</td>
</tr>
<tr>
<td>55–59</td>
<td>13</td>
<td>13</td>
<td>1,662</td>
</tr>
<tr>
<td>60–64</td>
<td>13</td>
<td>13</td>
<td>1,558</td>
</tr>
<tr>
<td>65–69</td>
<td>13</td>
<td>13</td>
<td>1,499</td>
</tr>
<tr>
<td>70–74</td>
<td>13</td>
<td>13</td>
<td>1,415</td>
</tr>
<tr>
<td>75–79</td>
<td>13</td>
<td>13</td>
<td>1,361</td>
</tr>
<tr>
<td>80–84</td>
<td>13</td>
<td>13</td>
<td>1,262</td>
</tr>
<tr>
<td>85+</td>
<td>13</td>
<td>13</td>
<td>1,150</td>
</tr>
</tbody>
</table>

Births 5,097
CDR 8.66
CBR 4.10
CRN 1.5

Note: CBR, crude birth rate (actual number of births per 1000 population); CDR, crude death rate (actual number of deaths per 1000 population); CRN, crude rate of natural increase (CBR minus CDR per 100; does not take into account migration); PYO, observed person-years between ages x and y.

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

Figure 26.2. Population pyramid for person-years observed at the Niakhar DSS site, Senegal, 1995–98.
Table 26.3. Trends in demographic indicators at the Niakhar DSS site, Senegal, 1984–98.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total fertility rate</td>
<td>7.9</td>
<td>7.7</td>
<td>7.0</td>
</tr>
<tr>
<td>Neonatal mortality rate per 1000 live births</td>
<td>57</td>
<td>38</td>
<td>31</td>
</tr>
<tr>
<td>Infant mortality rate</td>
<td>122</td>
<td>86</td>
<td>79</td>
</tr>
<tr>
<td>Under-five mortality rate</td>
<td>282</td>
<td>196</td>
<td>206</td>
</tr>
<tr>
<td>Annual birth rate</td>
<td>47</td>
<td>46</td>
<td>42</td>
</tr>
<tr>
<td>Annual death rate</td>
<td>17</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>Annual out-migration rate</td>
<td>59</td>
<td>51</td>
<td>67</td>
</tr>
<tr>
<td>Annual in-migration rate</td>
<td>60</td>
<td>37</td>
<td>36</td>
</tr>
<tr>
<td>Natural annual population growth rate</td>
<td>3.22</td>
<td>2.08</td>
<td>2.11</td>
</tr>
<tr>
<td>Real annual population growth rate</td>
<td>1.28</td>
<td>1.04</td>
<td>1.06</td>
</tr>
</tbody>
</table>

Maternal mortality rate (maternal deaths per 100 000 live births) 516 (ICD-9 definition) 525 (ICD-10 definition)

Note: ICD, International Classification of Diseases.

Acknowledgments

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