Brief introduction to Niakhar HDSS

The study zone of Niakhar is located in Senegal, at 14.5° North latitude and 16.5° West longitude. It is located in the Department of Fatick, Region of Fatick (Sine-Saloum), 135 km East of Dakar. The Niakhar study zone is about 15 km long by 15 kilometers wide and covers 230 square kilometers. The climate is continental sudan-sahelian, with temperatures ranging from 24°C in December-January to 30°C in May-June. For thirty years the region has suffered from drought. Rainfall decreased from 808 mm per year for the period 1921-67 to 520 mm for 1968-87, 463 mm for 1988-98 and 450 mm in 2010.

From 1962 to 1966, 65 villages were surveyed annually. The study zone was then reduced to eight villages until 1983, when it was extended to include 22 villages, forming the current study zone, gathering 30 villages. Hence, eight villages have been under demographic monitoring for almost 50 years and 30 villages for 28 years. The Niakhar area has a population of 44,006 inhabitants as of 1st January 2012, and a high population density with about 173 inhabitants per km². Demographic monitoring covers 30 villages of varying size (106 in Darou and 4789 in Toucar). The area is rural but the three largest villages are more "urbanised" with health facilities, weekly market, daily buses to Dakar and several shops.

The Sereer ethnic group comprises 96.7% of the population. Other ethnic groups represented are Wolof (1.0%), Toucouleur (1.0%) and Laobe (0.5%), with 0.8% are Peuhl, Moorish, Soce and Diola making up the remainder. Islam is the most declared religion (77.3%), Christians are represented by 19.6% of the population (17.9% are Catholic, 1.7% Protestant). And animism is declared by only 2.6% although traditional practices are very prevalent and observed in each family. The dominant language used is Sereer but many people speak Wolof.
The population lives traditionally on one food crop (millet), one cash crop (groundnuts) and cattle rearing. To cope with the agricultural crisis in Sahel and the demographic pressure (85 person per km$^2$ in 1966, 131 in 2000 and 173 in 2010), new activities arose: predominantly meat production and temporary migration to urban centers. Formal education is very low: 59% of men and 80% of women between 15 and 24 years have no school education. The first school opened in 1951, and there are now twenty six public and two private schools.

The residential unit is the compound which consists of 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 adult). Modern constructions, made of concrete and corrugated iron, tend to replace traditional houses. The availability of bore holes and drinking fountains increased over the past several decades: 60% of the households now have access to tap water (inside or outside the house). The use of latrines is more recent: only 22% of the households have access to sanitation. Electricity is now available in three villages (Diohine since 2003, Toucar since 2005 and Ngayokhem since 2006. Paved roads are 15 to 30 km away from the villages, yet several daily bus or taxi services to Dakar are offered.

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 include curative care, immunization, prenatal care, delivery, oral rehydration therapy and malnutrition management. The Expanded Program on Immunization started between 1982 and 1984.

Outbreaks of cholera occurred in 1985, 1987 and 1996, and a large meningococcal meningitis outbreak hit the population in 1998. The decrease of mortality was progressive during the entire observation period, except during 1990–2000, when a plateau and then an increase was observed. Malaria-attributable mortality in under-5 children decreased from 13.5% during 1992–1999 to 2.2% in 2010. During this period, all-cause mortality among children aged under 5 years decreased by 80%. Direct and indirect effects of new malaria-control policies, introduced in 2003 and completed during 2006–2008, are likely to have been the key cause of the recent dramatic decrease in child mortality.
Population pyramid of observed population for Niakhar HDSS, January 1st 2010
### Demographic characteristics

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total population</strong></td>
<td>4455</td>
<td>4663</td>
<td>4667</td>
<td>23824</td>
<td>25743</td>
<td>28412</td>
<td>30863</td>
<td>35582</td>
<td>40687</td>
</tr>
<tr>
<td><strong>Male:female ratio per 100</strong></td>
<td>93.2</td>
<td>93.3</td>
<td>91.0</td>
<td>95.6</td>
<td>97.5</td>
<td>98.6</td>
<td>98.4</td>
<td>98.1</td>
<td>98.5</td>
</tr>
<tr>
<td><strong>Population density</strong></td>
<td>101</td>
<td>106</td>
<td>106</td>
<td>117</td>
<td>127</td>
<td>140</td>
<td>152</td>
<td>175</td>
<td>200</td>
</tr>
<tr>
<td><strong>Population growth /100</strong></td>
<td>0.91</td>
<td>0.21</td>
<td>0.91</td>
<td>1.57</td>
<td>1.65</td>
<td>1.94</td>
<td>2.13</td>
<td>3.44</td>
<td>3.47%</td>
</tr>
<tr>
<td><strong>Crude birth rate / 1000 py</strong></td>
<td>46.8</td>
<td>48.4</td>
<td>49.5</td>
<td>50.4</td>
<td>46.0</td>
<td>41.8</td>
<td>41.9</td>
<td>41.1</td>
<td>40.1</td>
</tr>
<tr>
<td><strong>Crude death rate / 1000 py</strong></td>
<td>36.7</td>
<td>33.6</td>
<td>30.6</td>
<td>23.2</td>
<td>16.4</td>
<td>16.8</td>
<td>14.2</td>
<td>9.5</td>
<td>6.2</td>
</tr>
<tr>
<td><strong>Crude in-migration rate / 1000 py</strong></td>
<td>40.8</td>
<td>31.0</td>
<td>26.5</td>
<td>37.1</td>
<td>37.6</td>
<td>37.3</td>
<td>29.0</td>
<td>26.0</td>
<td>23.4</td>
</tr>
<tr>
<td><strong>Crude out-migration rate / 1000 py</strong></td>
<td>51.3</td>
<td>45.4</td>
<td>57.1</td>
<td>49.0</td>
<td>51.0</td>
<td>43.4</td>
<td>35.5</td>
<td>23.6</td>
<td>23.1</td>
</tr>
<tr>
<td><strong>Total Fertility Rate</strong></td>
<td>6.9</td>
<td>6.9</td>
<td>6.8</td>
<td>7.9</td>
<td>7.7</td>
<td>7.0</td>
<td>6.9</td>
<td>6.7</td>
<td>6.4</td>
</tr>
<tr>
<td><strong>Neonatal Mortality /1000 live births</strong></td>
<td>22.2</td>
<td>26.9</td>
<td>38.7</td>
<td>56.9</td>
<td>37.8</td>
<td>30.1</td>
<td>23.9</td>
<td>11.6</td>
<td>7.9</td>
</tr>
<tr>
<td><strong>Early Neonatal Mortality /1000 births</strong></td>
<td>29.4</td>
<td>23.4</td>
<td>23.4</td>
<td>18.5</td>
<td>17.6</td>
<td>9.3</td>
<td>6.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Infant Mortality /1000 live births</strong></td>
<td>223</td>
<td>214</td>
<td>182</td>
<td>122.5</td>
<td>86.1</td>
<td>79.2</td>
<td>72.3</td>
<td>31.9</td>
<td>31.2</td>
</tr>
<tr>
<td><strong>Child Mortality /per 1000 py</strong></td>
<td>340</td>
<td>342</td>
<td>291</td>
<td>182.2</td>
<td>122.2</td>
<td>132.3</td>
<td>113.6</td>
<td>53.3</td>
<td>46.4</td>
</tr>
<tr>
<td><strong>Under Five Mortality /per 1000 live births</strong></td>
<td>485</td>
<td>480</td>
<td>421</td>
<td>282.4</td>
<td>198.8</td>
<td>201.0</td>
<td>177.7</td>
<td>83.5</td>
<td>76.2</td>
</tr>
<tr>
<td><strong>Life expectancy at birth (males)</strong></td>
<td>28.9</td>
<td>30.2</td>
<td>31.4</td>
<td>45.5</td>
<td>52.2</td>
<td>47.5</td>
<td>56.7</td>
<td>62.3</td>
<td>68.2</td>
</tr>
<tr>
<td><strong>Life expectancy at birth (females)</strong></td>
<td>30.4</td>
<td>30.4</td>
<td>36.3</td>
<td>49.0</td>
<td>55.6</td>
<td>52.6</td>
<td>60.8</td>
<td>66.1</td>
<td>69.1</td>
</tr>
</tbody>
</table>
Vision
Our vision is to provide an interdisciplinary research platform useful for public health as for social sciences, environmental research and professionals. Results from this platform should inform public policies and programs on demographic and epidemiologic trends, on social and economical changes and on critical health, development and environment challenges. It should be seen as decision help and a health monitoring system at the national level. It should also enable to produce international comparisons with other DSS.

Main objectives

- To provide data and long-term indicators on demographic trends: mortality (child, adult and maternal); fertility (intensity, pace, non-marital); migration (circular, temporary, out and in-migration); marriage (marital patterns, divorce, polygyny)
- To alert researchers and policy makers in case of rapid change in any trend;
- To alert public health decision makers in case of emerging pathologies;
- To develop and test methodological issues;
- To develop and test interventions targeting critical problems affecting the health and wellbeing of children and adults;
- To implement effective procedures and policies for requesting/releasing data to other scientists.
- To develop a clinical platform

Priority Research Areas

- Epidemiological studies of emerging pathogens
- Malaria (epidemiological studies, malaria intervention studies);
- Meningitis (epidemiological studies, meningitis vaccines trials)
- Influenza (epidemiological studies, influenza vaccines trials)
- Infant and child mortality (trends and causes)
- Fertility trends (total fertility, birth intervals, premarital fertility, fostered children)
- Migration (circular migration and their roles in economic and familial organization)

Funders

- Agence Nationale de la Recherche (ANR)
- Institut de Recherche pour le Développement
- LSHTM
- MenAfricar
- NIH
- Path
- Wellcome Trust
• WHO

Collaborators
Senegal:
• Agence Nationale de la Statistique et de la Démographie (ANSD)
• Institut Pasteur de Dakar
• Ministère de la santé et de l’Action Sociale
• Université Cheikh Anta Diop de Dakar (UCAD)
• Université Gaston Berger de Saint-louis (UGB)

International:
• Aix-Marseille Université (AMU)
• CDC Atlanta
• Columbia University
• INDEPTH Network
• Institut de Recherche pour le Développement (IRD)
• Institut National d’Etude Démographique (INED)
• Institut National de la Santé Et de la Recherche Médicale (INSERM)
• London School of Hygiene and Tropical Medicine
• Maryland University
• McGill University
• PATH
• WHO

Key Publications 2008-2011
