International Journal of Epidemiology, 2015, 87–97
doi: 10.1093/ije/dyu221
Advance Access Publication Date: 29 November 2014
Health & Demographic Surveillance System Profile

Health & Demographic Surveillance System Profile

Health & Demographic Surveillance System Profile: The Taabo Health and Demographic Surveillance System, Côte d'Ivoire

Siaka Koné,[1]* Nahoua Baikoro,[1] Yao N'Guessan,[1] Fabienne N Jaeger,[1,2,3] Kigbafori D Silué,[1,4] Thomas Fürst,[2,3,5,6] Eveline Hürlimann,[1,2,3] Mamadou Ouattara,[4] Marie-Chantal Y Séka,[1] Nicaise A N'Guessan,[4] Emmanuel LJC Esso,[1] Fabien Zouzou,[1,7] Louis I Boti,[1] Prosper T Gonety,[8] Lukas G Adiossan,[8] Daouda Dao,[1] Andres B Tschannen,[1] Thomas von Stamm,[7] Bassirou Bonfoh,[1] Marcel Tanner,[2,3] Jürg Utzinger[2,3] and Eliézer K N'Goran[1,4]

[1]Centre Suisse de Recherches Scientifiques en Côte d'Ivoire, Abidjan, Côte d'Ivoire, [2]Department of Epidemiology and Public Health, Swiss Tropical and Public Health Institute, Basel, Switzerland, [3]University of Basel, Basel, Switzerland, [4]Unité de Formation et de Recherche Biosciences, Université Félix Houphouët-Boigny, Abidjan, Côte d'Ivoire, [5]Centre for Health Policy, and [6]Department of Infectious Disease Epidemiology, Imperial College London, London, UK, [7]Fairmed, Bern, Switzerland and [8]Hôpital Général de Taabo, Taabo Cité, Côte d'Ivoire

*Corresponding author. Centre Suisse de Recherches Scientifiques en Côte d'Ivoire, 01 BP 1303, Abidjan 01, Côte d'Ivoire. E-mail: kone_siaka0@yahoo.fr

Accepted 24 October 2014

Abstract

The Taabo Health and Demographic Surveillance System (HDSS) is located in south-central Côte d'Ivoire, approximately 150 km north-west of Abidjan. The Taabo HDSS started surveillance activities in early 2009 and the man-made Lake Taabo is a key eco-epidemiological feature. Since inception, there has been a strong interest in research and integrated control of water-associated diseases such as schistosomiasis and malaria. The Taabo HDSS has generated setting-specific evidence on the impact of targeted interventions against malaria, schistosomiasis and other neglected tropical diseases.

The Taabo HDSS consists of a small town, 13 villages and over 100 hamlets. At the end of 2013, a total population of 42 480 inhabitants drawn from 6707 households was under surveillance. Verbal autopsies have been conducted to determine causes of death. Repeated cross-sectional epidemiological surveys on approximately 5–7% of the population and specific, layered-on haematological, parasitological and questionnaire surveys have been conducted.

The Taabo HDSS provides a database for surveys, facilitates interdisciplinary research, as well as surveillance, and provides a platform for the evaluation of health interventions. Requests to collaborate and to access data are welcome and should be addressed to the secretariat of the Centre Suisse de Recherches Scientifiques en Côte d'Ivoire: [secretariat@csrs.ci].

Key words: Côte d'Ivoire, demographic surveillance, health intervention, malaria, neglected tropical diseases

Key Messages

- The Taabo HDSS is the first of its kind in Côte d'Ivoire and is built on three main pillars: demographic surveillance, health interventions and evaluation, and scientific research to strengthen local evidence-bases.
- The Taabo HDSS is located in a diverse social-ecological system and spans both rural and urban areas, providing a unique platform to study infectious and chronic diseases and the dynamics of nutritional and lifestyle issues.
- The specialty of the Taabo HDSS is its focus on neglected tropical diseases such as lymphatic filariasis, schistosomiasis, soil-transmitted helminthiasis and general water-borne diseases.

Why was it set up?

The Health District of Tiassalé was selected to establish the Taabo HDSS, specifically the area around the man-made Lake Taabo and downstream the Bandama River (Figure 1a, b). Prior research in this diverse social-ecological system revealed a substantial rise of urogenital schistosomiasis caused by chronic infection by the blood fluke *Schistosoma haematobium* in school-aged children living in close proximity to Lake Taabo after construction of the dam.[1,2] Rapid reinfection was observed after the administration of praziquantel, calling for community-based, integrated control approaches.[2,3] Moreover, infections with soil-transmitted helminths (particularly hookworm), intestinal protozoa (e.g. *Entamoeba histolytica* and *Giardia intestinalis*) and *Plasmodium falciparum* (the causative agent of malaria) were highly prevalent, yet health infrastructures to deal with these public health issues were insufficient.[3,4] Together, malaria and the so-called neglected tropical diseases (NTDs) are estimated to account for 17% of the total health loss [almost 2.5 million disability-adjusted life years (DALYs)] among the Ivorian population in 2010.[5]

The Health District of Tiassalé provided an old maternity building that became the headquarters of the site (Figure 1c). In mid-2008 the Taabo HDSS team was complete and field operations were launched (Figure 1d).

The Taabo HDSS was established to serve as a platform for evaluating interventions and health systems strengthening, with the ultimate goal of reducing mortality and morbidity, especially due to malaria and NTDs. The specific objectives of the Taabo HDSS are as follows:

- to establish high-quality data on the demographic, epidemiological and socioeconomic characteristics of the communities in the Taabo area and to monitor changes over time;
- to generate evidence which can guide community-level interventions and monitoring of integrated control approaches targeting malaria and NTDs in the Taabo area, and subsequently other parts of Côte d'Ivoire and sub-Saharan Africa;
- to conduct interdisciplinary research and foster capacity building in clinical, ecological, entomological, epidemiological, malacological, nutritional, public health, social sciences and health systems research; and
- to create a platform that provides high-quality data for multi-site comparative analysis within the INDEPTH network.

The initial focus on research and control of infectious diseases pertained to malaria and five NTDs, namely schistosomiasis, soil-transmitted helminthiasis, lymphatic filariasis, onchocerciasis and Buruli ulcer. Thus some of the most important NTDs in terms of local, national and regional prevalence, incidence and burden of disease are considered.[6–10] Other issues of public health importance, such as the aetiology of anaemia and new approaches to community participation to improve sanitation and hygiene, have also been investigated.[11,12]

Where is the HDSS area?

The Taabo HDSS is located in the Agnéby-Tiassa region in south-central Côte d'Ivoire, about 150 km north-west of the economic capital Abidjan and 60 km south of Yamoussoukro. The Taabo HDSS covers a surface area of approximately 980 km^2 located between latitude 6°0' and 6°20' N and between longitude 4°55' and 5°15' W. The area is predominantly rural, with 13 main villages and more than 100 small hamlets. There is one urban setting; a small town, Taabo-Cité, with a population of 7514 under surveillance at the end of 2013.

The Taabo HDSS is located in the V-Baoulé, where the rainforest in the south meets the savannah in the north (Figure 2). There are two rainy seasons: the long rains last from April to July and shorter rains occur in September and October. A key eco-epidemiological characteristic of

Figure 1. Photo-panel of Taabo HDSS: (a) sunset at Lake Taabo; (b) human water contact activities at Bandama River; (c) old maternity building kindly provided by the Health District of Tiassalé for construction of site headquarters; (d) core team of Taabo HDSS at onset of activities in late 2008; (e) household interview; (f) collection of stool samples during a cross-sectional epidemiological survey; and (g) mass drug administration for the control of neglected tropical diseases.

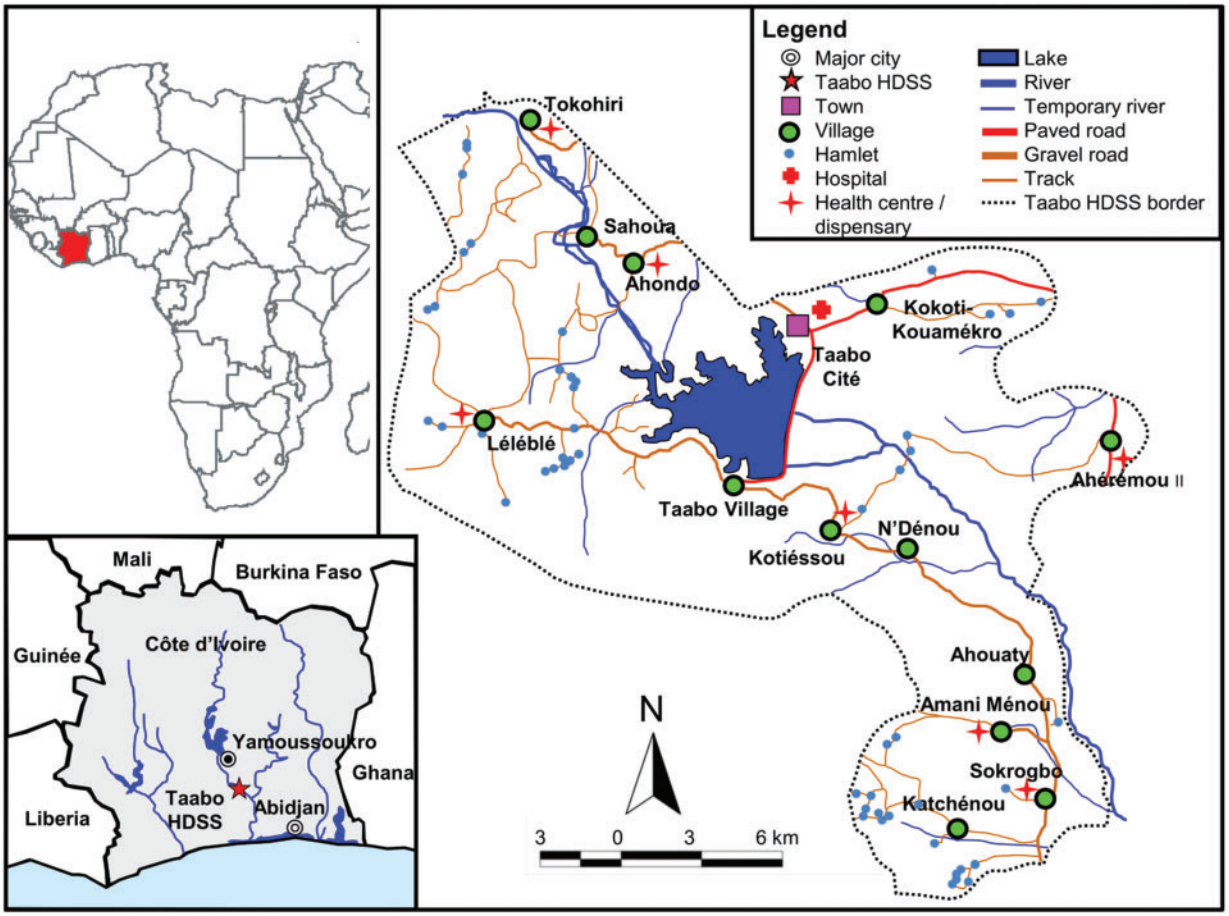

Figure 2. Map of the Taabo HDSS, located in south-central Côte d'Ivoire.

the Taabo HDSS is a large embankment dam (maximum length: 7.5 km) constructed across the Bandama River in the late 1970s, which forms a reservoir with a surface area of approximately 69 km^2. The dam has been constructed for hydroelectric power production.[1,13]

The population is composed of Ivorians (72%) and non-Ivorians (28%). According to the initial surveillance round in 2009, the main Ivorian ethnic groups are the Akan (85.6%, mainly Baoulé), followed by Gur (5.5%), Krou (4.2%), Northern Mandé (3.3%) and Southern Mandé (1.4%). The non-Ivorian population is mainly composed of Burkinabe (70.6%) and Malians (23.3%). Within the study zone there are eight health facilities, including seven health centres and dispensaries in the rural area, and a 12-bed hospital located in Taabo-Cité.

Who does the Taabo HDSS cover and how often have they been followed up?

The Taabo HDSS covers the residents of a distinct geographical area that corresponds to the sub-district of Taabo. A resident is defined as any person who lives in the Taabo HDSS area and expects to stay for at least 4 months. A person who has spent the night preceding the interview in the household is considered a present resident, whereas a person who normally resides in the household and did not spend the night preceding the interview at that household is considered an absent resident. An absent resident is accounted as having left the area after 4 months duration of absence.

As of December 2013, the population under surveillance in the Taabo HDSS comprised 42 480 inhabitants living in 6707 households with an average of 6.3 persons per household. The large majority of inhabitants are rural (82%) and 18% are considered urban. Approximately 72% of the population above the age of 6 years are illiterate: 64% for men vs 80.4% for women. Slightly less than a quarter (23.9%) of literate males attended secondary school, but only 15.7% of literate females reached this level of education. Among residents, almost half of the population is younger than 15 years (45.5%), whereas only 4.6% are aged 60 years and above. The male:female ratio is 109:100, mainly explained by stronger out-migration among women compared with men (Taabo HDSS follow-up survey in 2012: 82 per 1000 for men vs

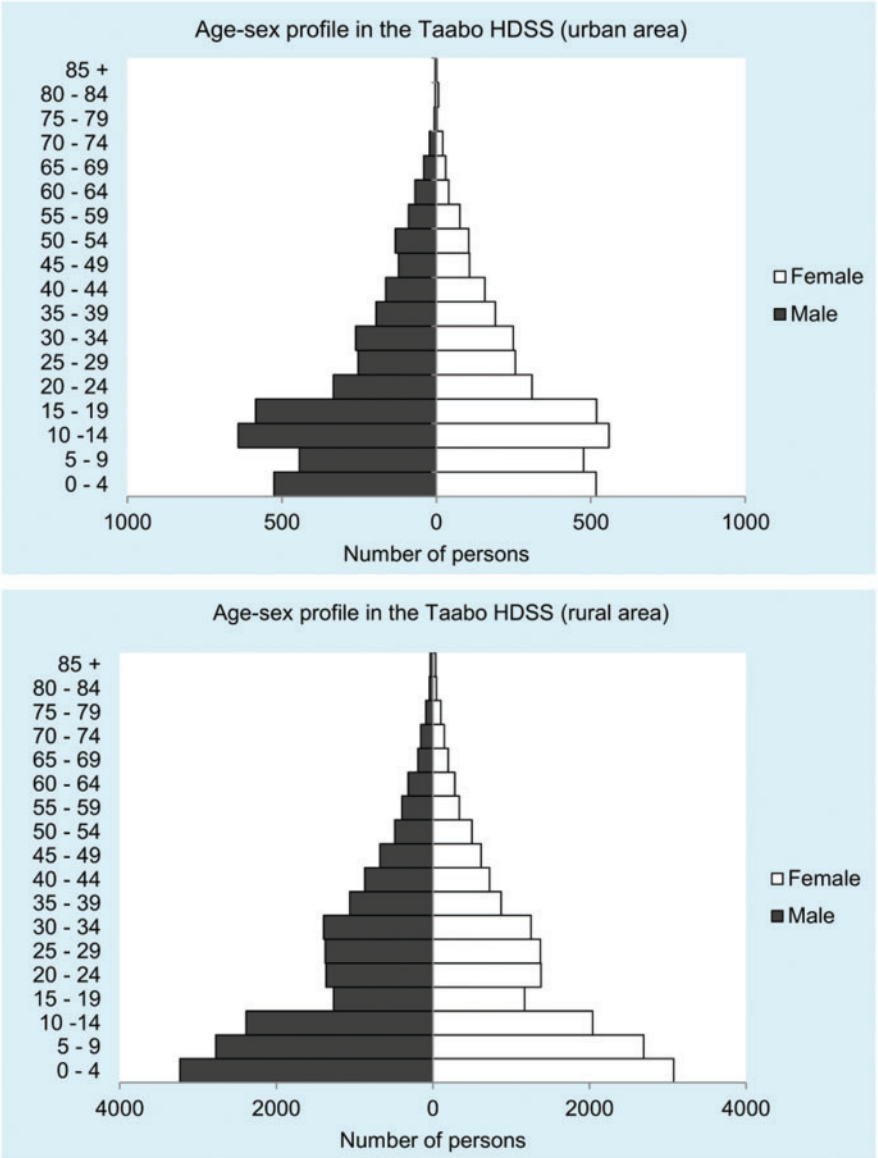

Figure 3. Static population pyramid of Taabo HDSS (urban and rural areas), as of December 2013 (y-axis, age in years).

101 per 1000 for women). The average household size is slightly higher in rural than in urban areas (6.5 vs 5.8). The age pyramid differs slightly between urban and rural areas (Figure 3). Of note, there is some irregularity with relatively low numbers of people aged 10–24 years for both sexes, denoting the flux of migrants from rural areas.

Since the second half of 2009, field-enumerators have been visiting all the households within the Taabo HDSS, usually every 4 months to record vital events such as pregnancies, births and deaths and also migration. For each registered member, field-enumerators verify presence, relocation within the Taabo HDSS or out-migration. The field-enumerators also record the joining of new members by relocation or in-migration. Individual demographic and house construction characteristics and asset ownership are recorded every 2 years by means of a new census (Table 1, Figure 1e). The routine data collection is complemented by weekly reports of events from key informants who have been selected by community leaders and by mutual agreement with local authorities from Taabo-Cité, the main 13 villages and a subset of hamlets. The mechanisms for continuous update of demographic data are shown in Figure 4.

What has been measured and how have the Taabo HDSS databases been constructed?

To prepare the initial census, a map of the area was drawn in late 2008 (between 10 November and 4 December 2008). The HDSS conducted its first population census

Table 1. Data collected in the Taabo HDSS

Data	Frequency of follow-up	Information
Household	Every 2 years	Geographical coordinates for new household, construction type, material of walls and floors, number of rooms, location of facilities (i.e. inside or outside the main housing and exclusive or shared use), type of toilet, sources of drinking water, light sources, solid waste and wastewater management, energy source for cooking, ownership of the housing; if relevant rent and relations, ownership, dependency of and with other households, duration of existence of the household, household equipment/socioeconomic information (possession of cistern, fridge, freezer, fan, air conditioning system, radio, landline telephone, mobile phone, television, satellite dish, computer, hand barrow, bicycle, moped, car, tractor, pirogue)
Individuals	Every 2 years	Name and individual ID, residential status, relation with the head of household, educational attainment, main occupation and occupational status (e.g. self-employed, employed, unemployed), individuals $\geq$ 12 years old: civil status, current pregnancy
Births	Every 4 months	Name and individual ID of mother and newborn' date and place of birth, vital status, sex, birthweight for children born at a clinic, vaccinations and tests completed, child survival, morbidity in relation to pregnancy and birth, pregnancy-related costs, pregnancy outcome and morbidity
Pregnancies	Every 4 months	Name and individual ID of pregnant woman, probable date of conception, gestational age, course of pregnancy
Deaths	Every 4 months	Name and individual ID of deceased, date and place of death, sex of deceased, cause of death through verbal autopsy, females 12–55 years old: pregnancy or delivery-related death
Migrations	Every 4 months	Name and individual ID of migrant, immigration: date of immigration, type of and reason for immigration, place of previous and new settlement, all aforementioned information as applicable, emigration: date of emigration, type and reason for emigration, place of previous and new settlement, all aforementioned information as applicable
Epidemiology	Every year (rainy season) [in 2009, 2010 and 2011]	Name and individual ID of examined individuals, clinical and parasitological tests, including clinical examinations by physicians, anthropometric measurements, blood, stool and urine examinations for the assessment of haemoglobin values and infections with neglected tropical diseases and malaria

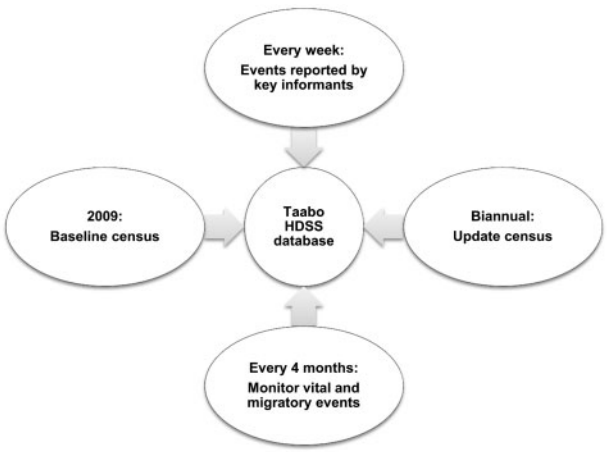

Figure 4. Mechanisms for updating demographic data in the Taabo HDSS.

from 20 January to 20 March 2009. The initial census sheet contained information such as household and individuals' characteristics. Additionally, every resident was assigned a unique identifier to facilitate adequate follow-up. This information was used to create the initial database of the Taabo HDSS.

Based on the information collected, the Taabo HDSS team initiated a continuous follow-up of the population. Follow-up data collection through individual household visits initially took place every 3 months. This was subsequently reduced to once every 4 months, starting from 2011. During the standard follow-up demographic surveys, additional specific questions or questionnaires might be added to address emerging research topics (see Table 2 for an overview).

The Taabo HDSS relies on verbal autopsy (VA) to obtain population estimates of likely causes of death. Before 2012, the interpretation of data to determine

Table 2. Overview of additionally collected data within the Taabo HDSS between 2009 and 2012

Topic	Year			
	2009	2010	2011	2012
Cross-sectional clinical and parasitological surveys	✓	✓	✓	
Vaccination (poliomyelitis)		✓		✓
Distribution of insecticide-treated nets		✓		✓
Prevalence of Buruli ulcer		✓		✓
Wastewater treatment and drinking water supply			✓	
Living conditions of internally displaced people during crisis			✓	
Investigation of new schistosomiasis foci				✓

probable causes of death was performed by two independent physicians. However, the formulation and confirmation of diagnoses by multiple doctors has proven to be costly and slow, and sometimes the causes of death were not consistent between two independent physicians, thus requiring a third outside view and discussion until agreement was reached.[14] Since July 2012, the Taabo HDSS therefore has used the validated InterVA-4 to determine probable causes of death.[15–17]

An important feature of the Taabo HDSS is to monitor the impact of specific interventions to reduce the mortality and morbidity due to malaria and NTDs. NTDs in the Taabo HDSS primarily cause morbidity rather than mortality,[18,19] therefore annual cross-sectional epidemiological surveys were conducted in 2009, 2010 and 2011. Each year, a random sample of 5–7% of the households were invited to participate (participation rate: 47–50%).[20–22] Household members were subjected to a full clinical examination and finger-prick blood samples were taken for malaria diagnosis and haemoglobin measurements (a proxy for anaemia), and stool and urine samples were obtained for diagnosis of helminth infections (Figure 1f).

In addition, the Taabo HDSS has taken keen interest in pursuing specific research questions, such as in-depth studies to deepen the understanding of the aetiology of anaemia and local concepts of anaemia-related illnesses,[11,23,24] access to, and use of, health services, and the interrelationship between NTDs, malaria and socioeconomic status, water, sanitation and hygiene behaviours.[12,25,26] In order to determine and follow-up epidemiological indicators pertaining to malaria and NTDs, the surveys include self-reported signs and symptoms, perceived health-related quality of life and physical examinations. The studies employed standardised, quality-controlled haematological and parasitological procedures (Table 2).[11,12,20–26]

A data management system has been used to manage the Taabo HDSS databases (DSS-ALES). Derived from the Household Registration System 2 (HRS2) software, it has been implemented on Windev 12 and the database is running on a Windows operating system using SQL server 2005.[27]

Key findings and publications

The demographic indicators of the Taabo HDSS for the year 2012 are summarized in Box 1. The mortality rate is estimated at 8.2 per 1000 population, which is slightly below the national average all-cause mortality (11.5 per 1000 in 2010).[5] Life expectancy for males and females is 61 and 65 years, respectively, and exceeds the general national life expectancy at birth (56 years) in 2011.[28] In reproductive age (15 to 49 years), the total fertility rate (TFR) in the Taabo HDSS is 4.6 children per woman in urban and 5.6 per woman in rural areas. For comparison, in 2012 the national TFR was 3.7 in urban and 6.3 in rural areas.[29] The mean age when a woman has her first child is 19.6 years. Malaria (18.1%), acute respiratory infections (16.9%), HIV/AIDS (11.4%) and pulmonary tuberculosis (6.8%) ranked among the most important causes of death in all age groups. Malaria (24.3% of all deaths in the <5 years age group) and acute respiratory infections (16.6% of all deaths in the <5 years age group) are of particular relevance in this youngest population. HIV becomes the most prominent cause of death among people aged between 15 and 49 years (16.2% of all deaths in this age group are attributed to HIV). Individuals aged 15 years and above show high rates of death due to pulmonary tuberculosis; 13.1% in people aged 15–49 years and 12.0% in people aged >15 years).

The first series of publications that stem from specific research projects carried out in the Taabo HDSS focused on the epidemiology and control of malaria and NTDs, including associations between these diseases and socioeconomic status, clinical indicators and underlying risk factors. In brief, a preliminary study conducted in Léléblé, one of the 13 main villages in the Taabo HDSS, revealed that the threadworm *Strongyloides stercoralis*

Box 1. Demographic characteristics of the Taabo HDSS in 2012

Crude birth rate	33.9 per 1000 population
Total fertility rate	4.8 children per woman
Sex ratio at birth (male:female)	104:100
Maternity average age at first birth	19.6 years
Crude death rate	8.2 per 1000 population
Life expectancy at birth (male)	61 years
Life expectancy at birth (female)	65 years
Neonatal mortality rate[a]	14.5 per 1000 live births
Post-neonatal mortality rate	28.3 per 1000 live births
Infant mortality rate	43.1 per 1000 live births
Under-five mortality rate	92.0 per 1000 live births
In-migration rate	136.9 per 1000 population
Out-migration rate	160.1 per 1000 population
Population growth rate[b]	2.5 per 1000 population

[a]This relatively low neonatal mortality rate may result from underreporting of very early deaths.
[b]Defined as: birth rate − death rate + in-migration rate − out-migration rate.

is endemic.[25] Subsequently, a cross-sectional epidemiological survey determined the extent of intestinal helminth infections in a random sample of 292 individuals in Léléblé. The prevalences of hookworm and *S. stercoralis* were 51.0% and 12.7%, respectively. The two infections were strongly associated with each other (adjusted odds ratio, 6.7; 95% confidence interval, 2.5–18.1). Clinical examination showed a trend towards worse health conditions in helminth-infected individuals, particularly in those with *S. stercoralis*.[20]

Using a mixed methods approach, local concepts of causes of anaemia-related illnesses were investigated. Key findings included differences in perceptions that were based on two logical frameworks (i.e. biomedical and sociocultural). However, distinctions between the two were often blurred. Local perceptions of malaria and nutritional issues revealed important differences in definitions and recommendations provided by the health system, which has ramifications for how malaria and nutritional disorders are managed.[24] In a 14-month prospective longitudinal study, parasitological, haematological and micronutrient data were obtained during repeated cross-sectional surveys. Significant associations between anaemia and *P. falciparum* infections in infants (6–23 months old), inflammation in school-aged children (6–8 years) and cellular iron deficiency in both school-aged children and non-pregnant women (15–25 years) were found.[11] Young age, *Plasmodium* and *Schistosoma* infections, cellular iron deficiency and stunting showed significant negative associations with haemoglobin concentrations.[23]

A health-related quality of life questionnaire was administrated to 187 adults who were concurrently examined for helminth and *Plasmodium* infections. In comparison with their non-infected counterparts, individuals infected with *S. mansoni* and *Trichuris trichiura* reported 13- and 16-point lower health-related quality of life, respectively, on a scale from 0 (worst possible) to 100 points (best possible).[21]

More recently, a study on the impact of community-led total sanitation (CLTS) and health education on the incidence of helminth and intestinal protozoa infections, implemented alongside preventive chemotherapy, was launched in the Taabo HDSS. Inadequate sanitation and hygiene were associated with soil-transmitted helminths and intestinal protozoa infections.[12]

In 2011, a study was conducted to assess the effect of an armed conflict and war, which resulted in important numbers of people seeking shelter in the Taabo HDSS. Indeed, 5.6% of the residential households reported that they provided refuge for internally displaced people. Interestingly, fecundity increased in 2011 (Figure 5). More generally, this socio-political conflict in Côte d'Ivoire resulted in changing patterns of in- and out-migration (between 2009 and 2011 the rate of immigration remained stable at 152–156 per 1000 people and emigration decreased considerably from 206 to 147 per 1000 people).

What are the main strengths and weaknesses of the HDSS?

The Taabo HDSS provides continuously updated socio-demographic information for more than 40 000 inhabitants in a primarily rural area of south-central Côte

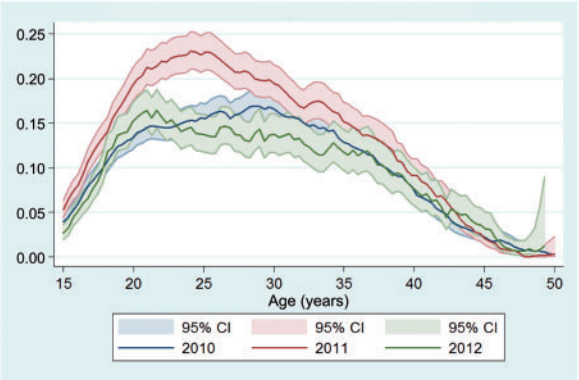

Figure 5. Age-specific fertility rates, stratified by year (2010–12) in the Taabo HDSS.

d'Ivoire. The Taabo HDSS commands an interdisciplinary team of demographers, statisticians, database managers, field-enumerators and data entry clerks. The participation rate in the Taabo HDSS for the routine surveillance is very high, usually above 95%. A strong link to the health system not only allows efficient interventions but also facilitates the feedback of results to health authorities. Furthermore, existing and productive partnerships grant the Taabo HDSS access to the laboratory of the Taabo-Cité Public Hospital and well-equipped laboratories at the Centre Suisse de Recherches Scientifiques en Côte d'Ivoire (CSRS) and the Université Félix Houphouët-Boigny in Abidjan and the Swiss Tropical and Public Health Institute in Basel.

The Taabo HDSS can be utilised for implementing clinical trials to assess the efficacy and safety of anthelminthic drugs[4,30] and monitoring the cost-effectiveness of control interventions, not only targeting NTDs and malaria, but also broader public health issues. It is important to highlight that the Taabo HDSS remained active during a prolonged socio-political crisis that was occurring in Côte d'Ivoire until 2012,[31] which allowed detailed study of the effects of this on internally displaced people.

The Taabo HDSS provides a unique platform for research, as well as teaching and training of MSc, MD, PhD and postdoctoral fellows from various backgrounds, disciplines and cultures. Quality control mechanisms are in place and are adhered to. Supervisors pursue regular checks of data obtained by field-enumerators. Data are entered twice by independent clerks and there is a series of in-built quality control steps for internal consistency checking.

However, challenges remain. First, long-term financial sustainability has to be ensured, and this will require continuous new research funding through competitive bidding. Second, the database of the Taabo HDSS is currently underused, for both setting-specific analyses and cross-site comparisons with other demographic surveillance sites of the INDEPTH network.

The team encountered some difficulties regarding the collection of blood samples for specific research projects. Specific information campaigns have helped to overcome these challenges. Often parents mistakenly attributed their children's illnesses to participation in a survey. Consequently, the HDSS—in line with national policies—had to ensure free treatment at health facilities for all children who were sick after an epidemiological survey (Figure 1g). Experiences and lessons learned are that regular feedback and dissemination of key findings to local residents is essential.

The Taabo HDSS requires an elaborate data-sharing policy and there is scope for further extending the current network of partnerships and collaborations with different institutions and researchers. An identified priority is the collection of data using tablets rather than paper copies.[32]

Future analysis plans

Three representative cross-sectional epidemiological surveys have been conducted in 2009, 2010 and 2011, during the main rainy season (June and July), focusing on anaemia, malaria and NTDs (most importantly schistosomiasis and soil-transmitted helminthiasis). The data are currently being analysed, readily linking with the existing Taabo HDSS database to determine interrelationships with socioeconomic status and educational attainment, among other issues.

Verbal autopsy data regarding causes of death are being analysed in greater detail and will be presented elsewhere. Specifically, analysis and a comparison of physician vs InterVA-4 diagnoses are under way. Moreover, the analysis of public health factors influencing child morbidity, mortality and health services utilisation and the introduction of a social autopsy tool are in advanced planning stages.

Data sharing and collaboration

Data sharing and the expansion of partnership and collaboration with national and international institutions remain a priority for the Taabo HDSS. Although the data-sharing policy has not been finalised, the data of the Taabo HDSS are potentially available to scientists and organisations who take an interest in specific topics and the improvement of health and well-being of communities. In March 2012, the Taabo HDSS became a full member of the INDEPTH network. Hence, the key indicators of the Taabo HDSS will soon be available on the INDEPTHStats

website, and a micro database will be shared on the INDEPTH Data Repository [www.indepth-ishare.org].

Funding

Start-up funding for the establishment and the first 2 years of running of the Taabo HDSS was provided by Fairmed. From inception, the Health District of Tiassalé provided infrastructure and other in-kind support. In mid-2010, the Taabo HDSS became a resource centre of the Centre Suisse de Recherches Scientifiques en Côte d'Ivoire (CSRS), and hence, running costs were mainly covered through institutional core funding to CSRS, mainly through the State Secretariat for Education, Research and Innovation (SERI) and the Swiss Tropical and Public Health Institute (Swiss TPH). Additional funding for specific research and intervention projects has been obtained from Fairmed, the Swiss National Science Foundation (project nos. PDFMP3-123185, IZ70Z0_123900, PBBSP3-146869, and P300P3-154634) and UBS Optimus Foundation (project nos. 3254 and 3254.01). Financial support for continuous capacity building and exchange of information and expertise, and funding for participation at the profile-writing workshop held in March/April 2014 in Accra, were provided by the INDEPTH Network.

Acknowledgements

We are deeply grateful to Fairmed, Swiss TPH, CSRS, the Université Félix Houphouët-Boigny, the Health District of Tiassalé and the Taabo-Cité Public Hospital, which facilitated the establishment of the Taabo HDSS. We thank to Prof. Matthias Egger for helpful comments and suggestions on the structure and content of the current piece, kindly provided during a manuscript-writing workshop in Accra in March/April 2014. We are indebted to colleagues from national diseases control programmes for their interest and support. We particularly thank the administrative and local authorities, the communities and populations and the HDSS teams in Taabo and Abidjan. Sincere thanks are addressed to INDEPTH and AfriqueOne for their support and capacity building. We also thank Mrs Leila Probst for translation of an initial draft of this manuscript from French into English.

Conflict of interest: None declared.

References

1. N'Goran EK, Diabate S, Utzinger J, Sellin B. Changes in human schistosomiasis levels after the construction of two large hydroelectric dams in central Côte d'Ivoire. *Bull World Health Organ* 1997;**75**:541–45.
2. N'Goran EK, Utzinger J, N'Guessan AN *et al*. Reinfection with *Schistosoma haematobium* following school-based chemotherapy with praziquantel in four highly endemic villages in Côte d'Ivoire. *Trop Med Int Health* 2001;**6**:817–25.
3. N'Goran EK, Utzinger J, Gnaka HN *et al*. Randomized, double-blind, placebo-controlled trial of oral artemether for the prevention of patent *Schistosoma haematobium* infections. *Am J Trop Med Hyg* 2003;**68**:24–32.
4. Keiser J, N'Guessan NA, Adoubryn KD *et al*. Efficacy and safety of mefloquine, artesunate, mefloquine-artesunate, and praziquantel against *Schistosoma haematobium*: randomized, exploratory open-label trial. *Clin Infect Dis* 2010;**50**:1205–13.
5. Institute for Health Metrics and Evaluation (IHME). *The Global Burden of Disease: Generating Evidence, Guiding Policy*. Sub-Saharan Africa Regional Edition. Seattle, WA: Institute for Health Metrics and Evaluation, 2013.
6. Adjami AG, Toé L, Bissan Y *et al*. The current status of onchocerciasis in the forest/savanna transition zone of Côte d'Ivoire. *Parasitology* 2004;**128**:407–14.
7. Tchuem Tchuenté LA, N'Goran EK. Schistosomiasis and soil-transmitted helminthiasis control in Cameroon and Côte d'Ivoire: implementing control on a limited budget. *Parasitology* 2009;**136**:1739–45.
8. Acka C, Raso G, N'Goran EK *et al*. Parasitic worms: knowledge, attitudes, and practices in western Côte d'Ivoire with implications for integrated control. *PLoS Negl Trop Dis* 2010;**4**:e910.
9. Raso G, Schur N, Utzinger J *et al*. Mapping malaria risk among children in Côte d'Ivoire using Bayesian geo-statistical models. *Malar J* 2012;**11**:160.
10. Yapi RB, Hürlimann E, Houngbedji CA *et al*. Infection and co-infection of helminths and *Plasmodium* among school children in Côte d'Ivoire: results from a national cross-sectional survey. *PLoS Negl Trop Dis* 2014;**8**:e2913.
11. Righetti AA, Koua A-YG, Adiossan LG *et al*. Etiology of anemia among infants, school-aged children, and young non-pregnant women in different settings of south-central Côte d'Ivoire. *Am J Trop Med Hyg* 2012;**87**:425–34.
12. Schmidlin T, Hürlimann E, Silué KD *et al*. Effects of hygiene and defecation behavior on helminths and intestinal protozoa infections in Taabo, Côte d'Ivoire. *PLoS One* 2013;**8**:e65722.
13. Sellin B, Simonkovich E. Schistosomiases et barrages en Côte d'Ivoire. In: *De l'Épidémiologie à la Géographie Humaine*. Paris: Agence de Coopération Culturelle et Technique (ACCT), Centre d'Études de Géographie Tropicale, 1983.
14. Lozano R, Lopez AD, Atkinson C *et al*. Performance of physician-certified verbal autopsies: multisite validation study using clinical diagnostic gold standards. *Popul Health Metr* 2011;**9**:32.
15. Lozano R, Freeman MK, James SL *et al*. Performance of InterVA for assigning causes of death to verbal autopsies: multisite validation study using clinical diagnostic gold standards. *Popul Health Metr* 2011;**9**:50.
16. World Health Organization (WHO). *Verbal Autopsy Standards: The 2012 WHO Verbal Autopsy Instrument*. Geneva: World Health Organization, 2012.
17. Leitao J, Chandramohan D, Byass P *et al*. Revising the WHO verbal autopsy instrument to facilitate routine cause-of-death monitoring. *Glob Health Action* 2013;**6**:21518.
18. Murray CJL, Vos T, Lozano R *et al*. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2012;**380**:2197–223.
19. Utzinger J, Becker SL, Knopp S *et al*. Neglected tropical diseases: diagnosis, clinical management, treatment and control. *Swiss Med Wkly* 2012;**142**:w13727.
20. Becker SL, Sieto B, Silué KD *et al*. Diagnosis, clinical features, and self-reported morbidity of *Strongyloides stercoralis* and hookworm infection in a co-endemic setting. *PLoS Negl Trop Dis* 2011;**5**:e1292.

21. Fürst T, Silué KD, Ouattara M *et al*. Schistosomiasis, soil-transmitted helminthiasis, and sociodemographic factors influence quality of life of adults in Côte d'Ivoire. *PLoS Negl Trop Dis* 2012;**6**:e1855.
22. Fürst T, Silué KD, Ouattara M *et al*. Patients routinely report more symptoms to experienced field enumerators than physicians in rural Côte d'Ivoire. *Am J Trop Med Hyg* 2013;**89**:592–96.
23. Righetti AA, Adiossan LG, Ouattara M *et al*. Dynamics of anemia in relation to parasitic infections, micronutrient status, and increasing age in south-central Côte d'Ivoire. *J Infect Dis* 2013;**207**:1604–15.
24. Kouadio MKD, Righetti AA, Abé NN *et al*. Local concepts of anemia-related illnesses and public health implications in the Taabo health demographic surveillance system, Côte d'Ivoire. *BMC Hematol* 2013;**13**:5.
25. Glinz D, N'Guessan N, Utzinger J, N'Goran EK. High prevalence of *Strongyloides stercoralis* among school children in rural Côte d'Ivoire. *J Parasitol* 2010;**96**:431–33.
26. Righetti AA, Glinz D, Adiossan LG *et al*. Interactions and potential implications of *Plasmodium falciparum*-hookworm coinfection in different age groups in south-central Côte d'Ivoire. *PLoS Negl Trop Dis* 2012;**6**:e1889.
27. Phillips JF, Macleod BB, Pence B. The Household Registration System: computer software for the rapid dissemination of demographic surveillance systems. *Demogr Res* 2000;**2**:1–40.
28. World Health Organization (WHO). *Atlas of African Health Statistics 2014*. Geneva: World Health Organization, 2014.
29. Ministère de la Santé, de la Lutte Contre le Sida (MSLS) et l'Institut National de la Statistique (INS) et ICF International. *Enquête Démographique et de Santé et à Indicateurs Multiples du Côte d'Ivoire 2011–2012: Rapport de Synthèse*. Calverton, MD: MSLS, INS et ICF International, 2013.
30. Keiser J, Silué KD, Adiossan LK *et al*. Praziquantel, mefloquine-praziquantel, and mefloquine-artesunate-praziquantel against *Schistosoma haematobium*: a randomized, exploratory, open-label trial. *PLoS Negl Trop Dis* 2014;**8**:e2975.
31. Bonfoh B, Raso G, Koné I *et al*. Research in a war zone. *Nature* 2011;**474**:569–71.
32. King JD, Buolamwini J, Cromwell EA *et al*. A novel electronic data collection system for large-scale surveys of neglected tropical diseases. *PLoS One* 2013;**8**:e74570.