International Journal of Epidemiology, 2015, 1–12
doi: 10.1093/ije/dyv018
Health & Demographic Surveillance System Profile

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Health & Demographic Surveillance System Profile: The Rufiji Health and Demographic Surveillance System (Rufiji HDSS)

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Accepted 5 February 2015

Abstract

The Rufiji Health and Demographic Surveillance System (HDSS) was established in October 1998 to evaluate the impact on burden of disease of health system reforms based on locally generated data, prioritization, resource allocation and planning for essential health interventions. The Rufiji HDSS collects detailed information on health and survival and provides a framework for population-based health research of relevance to local and national health priorities.

In December 2012 the population under surveillance was about 105 503 people, residing in 19 315 households. Monitoring of households and members within households is undertaken in regular 6-month cycles known as 'rounds'. Self reported information is collected on demographic, household, socioeconomic and geographical characteristics. Verbal autopsy is conducted using standardized questionnaires, to determine probable causes of death. In conjunction with core HDSS activities, the ongoing studies in Rufiji HDSS focus on maternal and new-born health, evaluation of safety of artemether-lumefantrine (AL) exposure in early pregnancy and the clinical safety of a fixed dose of dihydroartemisinin-piperaquine (DHA-PQP) in the community. Findings of studies conducted in Rufiji HDSS can be accessed at www.ihi.or.tz/IHI-Digital-Library.

Key words: Demography, fertility, mortality, migration, verbal autopsy, cause of death, INDEPTH net-work, Tanzania, Rufiji

Key Messages

- The Rufiji HDSS plays a key role in health planning by supplying longitudinal health and demographic indicators along with relevant contextual data.
- The population of Rufiji HDSS has experienced a gain in life expectancy by 4.4 and 11.6 years for males and females, respectively, from 1999 to 2012. Over the same period, the under-five mortality rates decreased by more than half from 135.5 per 1000 live births to 61.4/1000, but neonatal mortality remained high at 24.4/1000.
- The total fertility rates have declined from 6.2 births per woman in 1999 to 4.6 in 2012.

Why was the HDSS set up?

Rufiji HDSS was a vital component of Tanzania Essential Health Interventions Project (TEHIP), a collaborative demonstration project of Tanzania Ministry of Health and Social Welfare (MoHSW) and International Development Research Center of Canada (IDRC). TEHIP was established to test the idea that evidence-based health planning could produce efficiencies that would lead to positive improvements in local health. The Rufiji HDSS was established as a sentinel site by TEHIP in 1998 to collect comprehensive data on mortality to: (i) generate and package annual longitudinal data on burden of disease for district planners in coastal districts of Tanzania; and (ii) to monitor the cause-specific mortality impact of changes in district health services. The project showed that child mortality fell by over 40% in the first 5 years following introduction of evidence-based planning.[1] Most HDSS sites were established to host randomized trials of health interventions. The Rufiji HDSS was unusual in that it was established to provide a health systems observatory to monitor the effects of changes in health policies and services.

Following the completion of TEHIP in 2003, the MoHSW handed over management of Rufiji HDSS to Ifakara Health Institute, based on its wider experience and contributions in research and training on public health issues.

What does the Rufiji HDSS do?

Since its inception, Rufiji HDSS collects detailed information on health status and demographic indices such as births, deaths, pregnancies, pregnancy outcomes, marital status changes, migrations (in and out of the survey area), cause-specific mortality for all age groups, education level of individuals, occupation of household members, immunization status and household socioeconomic status based on an asset score.

The Rufiji HDSS offers opportunity to conduct programmes that focus on health system strengthening, social drivers of health, health systems research and secondary data analysis for better understanding of the dynamics of health, population and social transitions. Through these programmes, studies have been conducted intended to: (i) improve maternal, newborn and child health; (ii) improve reproductive and child health; (iii) assess household health and food security; iv) understand the temporo-spatial dimensions of malaria transmission intensity and mortality; understand care-seeking behaviour prior to fatal episodes of disease; (v) assess household socioeconomic status and under-five mortality; (vi) evaluate the impact of data use for planning; (vii) assess the consequences of rapid scale-up of antiretroviral treatmengt for HIV for African health systems and maternal and child health; and (viii) evaluate the systems effectiveness of case management of malaria.

The current programmes in Rufiji HDSS, ongoing since 2010, till focus on the same themes of research and include studies to: (i) improve maternal, new-born and child health; (ii) evaluate safety of artemether-lumefantrine (AL) exposure in early pregnancy; (iii) evaluate the clinical safety of a fixed dose of dihydroartemisinin-piperaquine (DHA-PQP) in the community; (iv) explore infant feeding patterns; (v) monitor vital events through use of information technology; and (vi) assess orphanhood and life trajectories.

Where is the HDSS area?

The Demographic Surveillance Area (DSA) is located in Rufiji District, Coastal Region Tanzania about 178 km south of Dar es Salaam city and extends between −7.47° and −8.03°S and 38.62° and 39.17°E (Figure 1).

The Rufiji HDSS covers 1813 km^2 that comprises 38 villages of Rufiji District. The district is largely rural though population is clustered around Utete (outside the district headquarters), Ikwiriri, Kibiti and Bungu townships (Figure 2). The population density of Rufiji HDSS is about 53 people per km^2 and the average population per village is about 2552. The district has hot and humid weather throughout the year with average monthly temperature of 23.7–28.4°C.[2] There are two main rainy seasons:

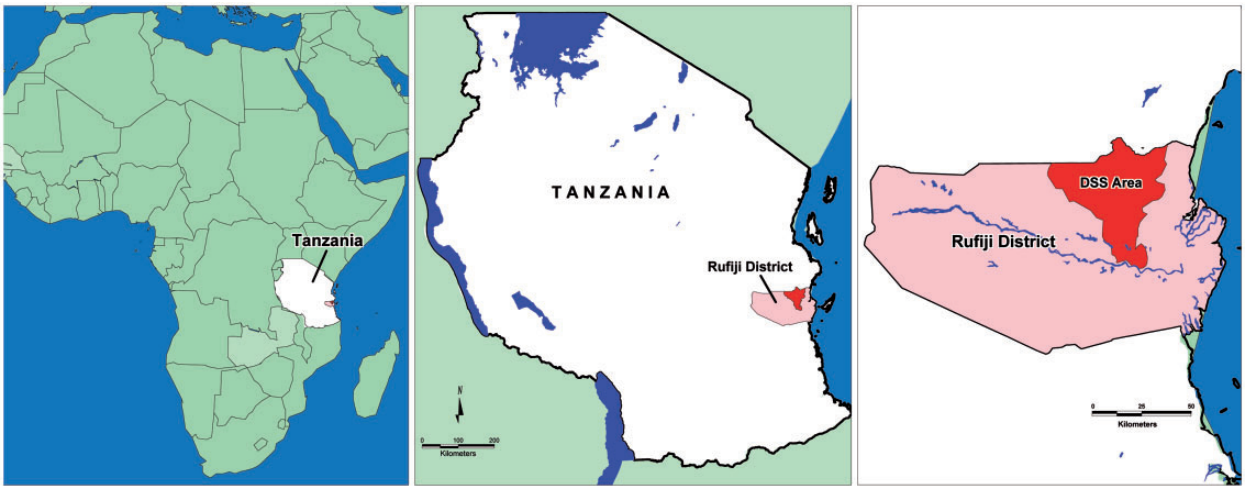

Figure 1. Location of Rufiji HDSS.

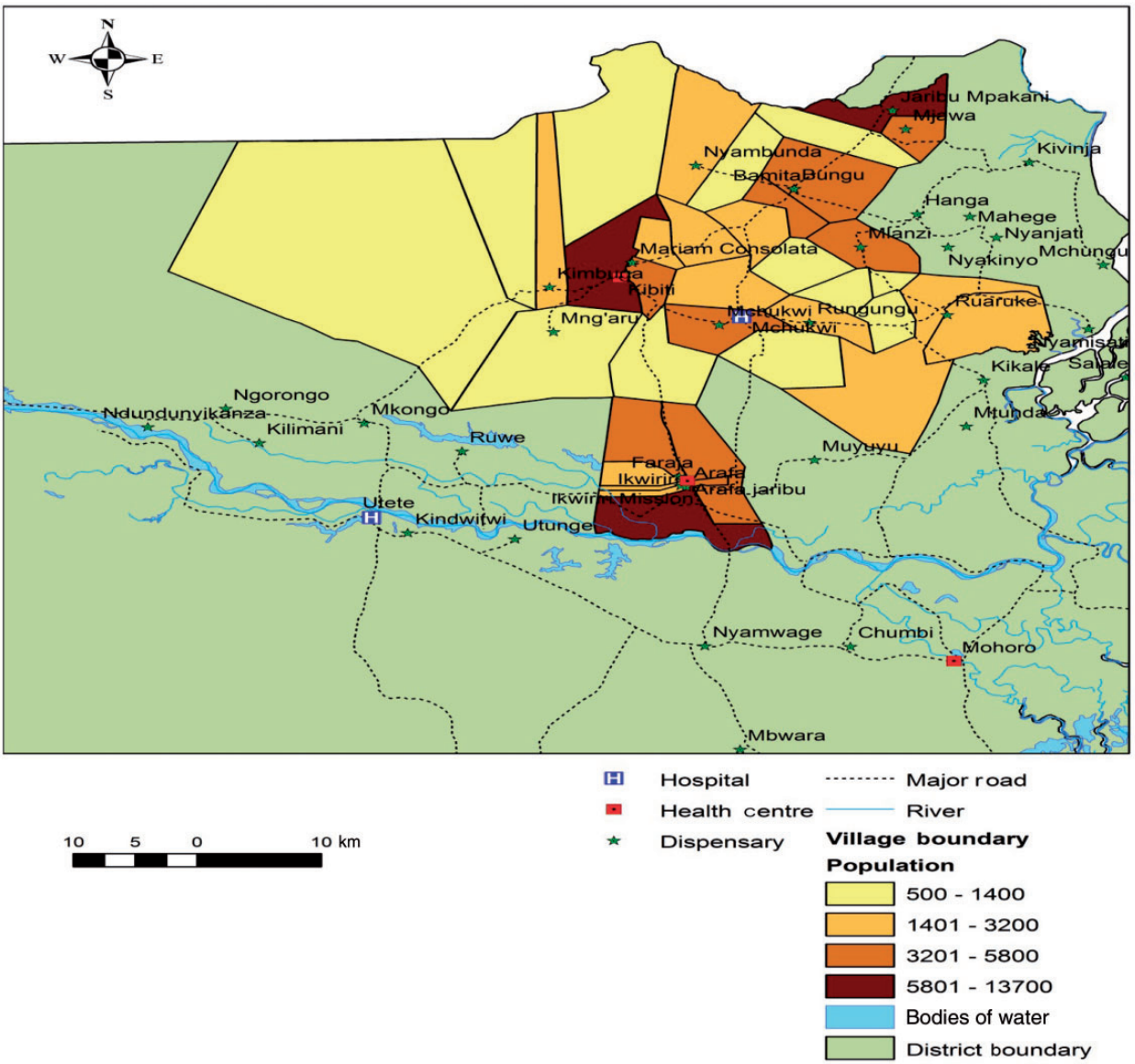

Figure 2. Rufiji HDSS population distribution by ward and health facilities.

October–December and February–May. The average annual rainfall ranges from 800 mm to −1000 mm.

The main economic activity is subsistence farming relying on periodic flooding of alluvial soil for rice and maize farming. Other crops include cassava, millet, sesame, coconut, cashew nuts and fruit trees. Animal husbandry and associated farming practices have started to emerge with the influx of the Sukuma ethnic group who are predominantly from the Western and Lake zones of Tanzania.

As of 2012, the district has a total of 64 health facilities, of which 54 are public and 10 private. These include 2 hospitals (1 government and 1private), 5 government health centres and 57 dispensaries; 20 of these facilities are found within the DSA (Figure 2).

Who is covered by the HDSS?

At the initial census (October 1998–anuary 1999), all individuals who were intending to be resident in the DSA for at least 4 months were eligible for inclusion. Verbal consent to participate in the census was sought from the head of every household. Definitions of several characteristics such as household, membership, migration and head of household are set in order to correctly assign individuals or households to events or attributes. A household in Rufiji HDSS is defined as a group of individuals sharing, or who eat from, the same cooking pot. A member of the HDSS is defined as someone who has been resident in the DSA for the preceding 4 months. New members qualify to be an in-migrant if s/he moves into the Rufiji HDSS and spends at least 4 months there. Women married to men living in the Rufiji HDSS and children born to these women qualify to be members of the Rufiji HDSS. In the case of multiple wives, the husband will be registered as a permanent resident in only one household. He will be linked to other wives by his husband identification number given to his wives. After the census, the study population is visited three times a year in cycles or updated rounds over February–May, June–September and October–January to update indicators (Figure 3). From July 2013 onwards, Rufiji HDSS switched to two data collection rounds per year, which happen in July–December and January–June. Mapping of households and key structures such as schools, health facilities, markets, churches and mosques was done by field interviewers using handheld global positioning systems (GPS). Updating of GPS coordinates has been an ongoing exercise especially for new structures and for demolished structures.

In 2012 the population size of the DSA was about 103 503 people, residing in 19 315 households. The population structure, age and sex composition of the area is presented in Figure 4. There are several ethnic groups in the DSA. The largest is the Ndengereko; other groups include the Matumbi, Nyagatwa, Ngindo, Pogoro and Makonde. The population comprises mainly Muslims with few Christians and followers of traditional religions. The main language spoken is Kiswahili. English is not commonly used in the area. Around 75% of the population aged 7–15

Figure 3. An update round interview underway in a household, by a trained fieldworker within the Rufiji HDSS.

years have attended primary education, 14% of those in age group 15–65 years have secondary education and only 1% of the population has tertiary education. Almost 50% of the adult population aged 15–65 are self-employed in agriculture, 28% engage in other small economic activities, 16% are selfemployed in small-scale business and 6% are unemployed. Fuel wood is the main source of energy for cooking and shallow wells are the main source of water for domestic use. The household heads in Rufiji HDSS are considered as breadwinners and most (67.3%) are male.

Active community engagement programmes are in place which include key informants (KIs) days, where the HDSS team convenes meetings with KIs for presentations on recent findings to feed back to community and for distribution of newsletters to households (Figure 5). Community sensitization events are held at the time of introducing new studies. These initiatives have cemented good relationships with the community and eventually maintained high participation.

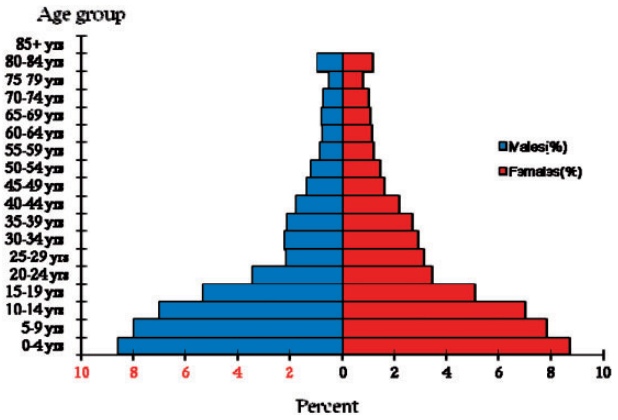

Figure 4. Rufiji HDSS 2012 population pyramid (males 49 610, females 53 893).

What is measured and how have the Rufiji HDSS databases been constructed?

During the update rounds, interviewers collect the information that is shown in Table 1. In addition, information on household socioeconomic status is collected annually since 2000 (Box 1). Geographical information system data (GIS) on latitude, longitude and altitude of each household and other key structures have been collected over time.

Verbal autopsies collect detailed data through structured and standardized INDEPTH Network verbal autopsy forms[3] on symptoms and signs during the terminal illness, allowing assignment of cause of death following physician's review to a list of causes of death, based on the 10th Revision of the International Classification of Diseases.[4] Other information such as food security, morbidity/fever, vaccination and nutritional status for under-fives was collected at some points of the year as nested studies. Household assets, education status and other assets are updated yearly.

Figure 5. Rufiji HDSS field interviewer provides a news letter to the Rufiji HDSS member, as one of the feedback mechanisms.

Table 1. Information collected at each re-enumeration round of the Rufiji HDSS

Subject	Information
Homestead	Latitude, longitude, altitude and village code
	Name of hamlet, location ID
Household	Household name
	Household head
Individuals	Names (3), sex, date of birth, marital status, relation to household head, occupation, education level and ndividual ID
Residents	Update of residency status (resident, died, out-migrated)
	Update marital status for members $\geq$ 13 years of age
	Update pregnancy status for women aged 13–49 years, location ID and individual ID
Pregnancy outcome	Live birth, number of babies, stillbirth, abortion
	Date and place of birth
	Names (3) and sex of child
	Mother's personal identity number (link), father's personal identity number
Deaths	Date of death, place of death, individual ID
In-migration	Date of in-migration, individual ID
	Names (3), sex and date of birth of migrant
	Reason for in-migration
	Relation to household head
	Origin of migration episode
	Previous residence within the Rufiji HDSS
Out-migration	Date of out-migration, individual ID
	reason for out-migration, destination of migration episode
Verbal autopsy	Causes of deaths

ID, identification.

Box 1. Information collected annually by Rufiji HDSS for estimating household socioeconomic status

Number of selected durable household goods
Type and number of livestock
House occupancy status
Source of drinking water
Toilet facilities
Number of rooms used for sleeping
Main materials used for floors
Main materials used for roof
Main materials used for walls
Type of energy used for cooking
Source of lighting
Ownership of land
Ownership of house
Ownership of bed nets
Access to mobile phone

The quality of collected information is monitored through a validation process where 3–5% of households are sampled at random for re-interview by a field supervisor who validates the previous collected data. Data from the field are received every 2 weeks during supervisors meetings where new household registration books are issued for updating in the field and the ones issued the previous fortnight are collected for entry at the data centre. Data are entered into the server through a network of workstations.

Until 2014, the HDSS used custom-designed software called the Household Registration System 2 (HRS 2) developed in Visual FoxPro 6.[5] A unique permanent identification number is assigned to each member during the initial registration. Further checks are done by the data manager at the end of each week and provide a list of errors that need correction in field. From January 2014, the Rufiji HDSS has used the OpenHDS program [http://openhds.rcg.usm.maine.edu/] to register and update health and demographic indicators. This transformed Rufiji HDSS from paper based to electronic data capture on mobile tablet devices with real-time transmission of data to central servers.

Key findings and publications

The health and demographic indicators for the period 1999–2012 are summarized in Figure 4 and in Table 2. The Rufiji HDSS population pyramid in December 2012 reveals a broad base that tapers towards the older ages, showing a population with high fertility and high child mortality. It indicates a young population, with highest

Table 2. Demographic characteristics of the Rufiji HDSS in 1999 and in 2012

Indicators	Results 1999	Results 2012
Total resident population	70 500	103 503
Male: female ratio	92:100	93:100
Household size	4.8	5.5
Crude rate of natural increase (change per 1000 population excluding migration)	2.2	2.1
Crude birth rate/1000 pyo	35.8	29.2
Crude death rate/1000 pyo	13.8	8.0
Crude out-migration rate/1000 pyo	187.4	132.2
Crude in-migration rate/1000 pyo	114.2	142.5
Total fertility rate (children per woman 15–49 years old (average)	6.2	4.6
Neonatal mortality ratio/1000 live births	35.34	24.4
Infant mortality ratio/1000 live births	107.6	36
Under-5 mortality (probability of dying between birth and 5th birthday/1000 pyo	135.5	61.4
Life expectancy at birth (male) (years)	58.6	63
Life expectancy at birth (female) (years)	57.4	69

pyo, person years of observation.

mortality at young ages. Table 2 demonstrates remarkable reductions in mortality over time in all age groups, except for the neonates. Also it shows dramatic decline of total fertility rate (TFR) from 6.2 in 1999 to 4.6 in 2012.

Health system research

Our important findings to date relate to the impact of the Integrated Management of Childhood Illness (IMCI) strategy on equality of health outcomes and access across socioeconomic gradients in rural Tanzania, which was examined by comparing changes in mortalities and inequities between 1999 and 2002 in HDSS-monitored districts with IMCI (Morogoro Rural and Rufiji) and without (Kilombero and Ulanga). Equity differentials for six child health indicators improved in IMCI districts whereas four improved in the comparison districts ($p < 0.05$). The level of inequality decreased between 1999 and 2002 in the IMCI districts but remained unchanged in comparison districts. The study showed the introduction of IMCI led to improvement in child health that did not occur at the expense of equity.[6] In 2011 the IHI, the Tanzania MoHSW and Columbia University launched 'Connect' as a randomized cluster trial to test the maternal and child mortality impact of posting paid community health workers, known as community health agents (CHAs), to communities for providing preventive, promotional and curative antenatal, newborn, child and reproductive health care. The Connect project already deployed 148 CHAs to 50 randomly selected intervention villages in Rufiji and inIfakara, another HDSS managed by the IHI. In 2015, the research will evaluate impacts on infant and child health and nutrition and maternal, newborn and child mortality, will assess outcomes including service utilization/coverage, improved health behaviour, increased equity and decreased social cost for health-seeking behaviours, will assess service delivery and quality outputs, will assess health systems inputs/processes and will conduct cost-benefit analysis.[7]

Health system research studies shown that the scale-up of antiretroviral therapy (ART) for HIV has not followed a system approach and is currently distorting rather than strengthening health systems [http://www.arvmac.eu/?page_id=49]. The study also found widespread negative attitudes and perceptions of ART care, HIV testing and the ART programme and lack of trust in its sustainability, as well as lack of community and healthworker involvement in the programme planning and treatment.[8] Another study, that aimed to strengthen health information systems in monitoring vital events by using mobile phones, found that the SMS (short message service) intervention makes significant improvements in the notification step and modest improvements in the registration step of routine civil registration[9] and, more importantly, reveals major weaknesses in the routine Civil Registration and Vital Statistics (CRVS) for rural populations in Tanzania.

Food security and household socioeconomic status impact on childhood mortality

Social drivers of health studies have shown that there is significant association between number of days of household members being ill and food insecurity in terms of dietary energy consumed. If health services are not improved in rural areas, particularly in Rufiji District, the problem of low food production leading to food insecurity will remain.[10] Household socioeconomic inequality and maternal

Table 3. Key findings and publications from Rufiji HDSS

Ref	Author	Objective of the study	Method	Results
2	Mrema S *et al.*	The objectives were to assess the association between monthly weather (temperature and rainfall) on all-cause mortality by age in Rufiji, Tanzania, and to determine the differential susceptibility by age groups	The study used mortality data from Rufiji HDSS for the period 1999 to 2010. Time-series Poisson regression models were used to estimate the association between monthly weather and mortality adjusted for long-term trends. Distributed lag model was applied to estimate the delayed association of monthly weather on mortality. Analyses were stratified per age group to assess susceptibility	It was found that children and older adults are most sensitive to weather mortality in Rufiji district. Rainfall was found to have a stronger association in the age group 0–4 year in both short and long lag times. On the other hand, monthly average temperature had a stronger association with death in all ages and mortality increased with falling monthly temperature[2]
12	Exavery A *et al.*	To investigate birth spacing practices among women of childbearing age in Rufiji, Tanzania	Longitudinal data collected in the Rufiji HDSS from January 1999 to December 2010 were analysed. The outcome variable, non-adherence to the minimum inter-birth interval, comprised all inter-birth intervals < 33 months. Inter-birth intervals >/= 33 months were considered to be adherent to the recommendation. Chi-square was used to test association between non-adherence and each of the explanatory variables. Factors affecting non-adherence were identified using a multilevel logistic model	This study revealed that one in every two inter-birth intervals among 15–49-year-old women in Rufiji district is poorly spaced, with significant variations by socio-demographic and behavioural characteristics of mothers and newborns[12]
13	Ae-Ngibise KA *et al.*	To estimate and identify the risk factors for injury mortality in the Rufiji HDSS in Tanzania	Secondary data from the Rufiji HDSS covering the period 2002 and 2007 were examined. Verbal autopsy data were used to determine the causes of death based on the 10th Revision of **for estimating household socioeconomic status** the International Classification of Diseases (ICD-10). Trend and Poisson regression tests were used to investigate the associations between risk factors and injury mortality	The highest frequency of death due to injuries in Rufiji resulted from road traffic crashes. Injuries accounted 4% of total deaths. Men were three times more likely to die from injuries compared with women. Elderly (defined as 65+) were 2.8 times more likely to die from injuries compared with children less than children < 15 years of age[13]
14	Shabani J *et al.*	To explore the clustering of under-five mortality in Rufiji HDSS Tanzania	SatTScan software was used to identify possible significant clusters. A total of 2745 cases of under-fives with 134 099 person-years for the period between 1999and 2008 were analysed. Mortality rates for every year were calculated, likewise a spatial scan statistic was used to test for clusters of total under-five mortalities in both space and time	The spatial analysis of under-five mortality in Rufiji HDSS identified three significant clusters. The mortality rates were very high for the years 1999–2002 according to the analysis. During the 10 years of analysis, mortality seemed to decrease in Rufiji HDSS[14]

(Continued)

Table 3. Continued

Ref	Author	Objective of the study	Method	Results
15	Adam T	The objective of the study was to report the cost of IMCI compared with routine care in four districts in the United Republic of Tanzania	The total district costs of child care were estimated from the societal perspective as the sum of child healthcare costs incurred in a district at the household level, primary health facility level and hospital level. It also included administrative and support costs incurred by national and district administrations. The increment cost of IMCI is the difference in costs of child health care between districts with and without IMCI, after standardization for population size	It was found that the annual cost per child of caring for children < 5 years old in districts with IMCI was 44% lower than the cost in the districts without IMCI. Much of the difference was due to higher rates of hospitalization of children < 5 years old in the districts without IMCI. Not all of this difference can be attributed to IMCI but even when differences in hospitalization rates are excluded, the cost per child was still lower in IMCI districts. Given the evidence of improved quality of care in the IMCI districts, the results suggest that cost should not be a barrier to the adoption and scaling up of IMCI[15]
16	Khatib RA *et al.*,	To evaluate effective coverage of artemisinin-based combination treatment in Tanzania	Continuous rolling household surveys were conducted in Kilombero-Ulanga and the Rufiji HDSS sites from 2009 to 2011. The surveys were linked to the routine HDSS update rounds. Members of randomly pre-selected households that had experienced a fever episode in the previous 2 weeks were eligible for the structured interviews.	It was found that in Kilombero-Ulanga 41.8% and in Rufiji 36.8% of fever cases had access to an authorized ACT provider with 24 hours of fever onset. In neither of the HDSS site was age, sex, socioeconomic status or seasonality of malaria found to be significantly correlated with timely access[16]
17	Rumisha SF *et al.*,	To assess, capture and detect seasonality peaks and patterns in mortality using the infant mortality data from Rufiji HDSS, Tanzania	Bayesian negative binomial models with time- and cycle-dependent parameters and autoregressive temporal error terms were applied to capture seasonality	Seasonal patterns were found to be similar among different age groups during infancy, and timing of their mortality peaks were also not different. Seasonality in mortality rate with two peaks per year corresponded to rainy seasons[17]
18	Huho B *et al.*	To understand the range of values for the proportion of human exposure to insect vectors of disease that has occurred indoors in sub-Saharan Africa	Matched surveys of mosquito and human behaviour from six rural sites in Burkina Faso, Tanzania, Zambia and Kenya, with ITN use ranging from 0.2% to 82.5%, were used to calculate the proportion of human exposure *to Anopheles gambiae sensu lato* and *Anopheles funestus senso lato* that occurs indoors as an indicator of the upper limit of personal protection that indoor vector control measures can provide	The study found that, the vast majority of human exposure to *Anopheles* bites occurred indoors. Neither variety strongly preferred feeding indoors, but they overwhelmingly preferred feeding at times when most humans were indoors[18]

(Continued)

Table 3. Continued

Ref	Author	Objective of the study	Method	Results
19	Justice A *et al.*	This study intended to assess the impact of place of delivery on neonatal mortality in rural Tanzania	The data from Rufiji HDSS were analysed. A total of 5124 live births and 166 neonatal deaths were recorded from January 2005 to December 2006. The place of delivery was categorized as either a health facility or outside. Neonatal mortality rate was calculated as the number of neonatal deaths per 1000 live births. Univariate and multivariate logistic regression models were used to understand association between neonatal mortality and place of delivery and other maternal factors while adjusting for potential confounders	It was found that, about 67% of neonatal deaths occurred during the first week of life. There were more neonatal deaths among deliveries outside health facilities than among deliveries within health facilities. Mothers who delivered outside a health facility have higher odds of experiencing neonatal deaths than those who delivered in a health facility[19]
20	Schellenberg JA *et al.*	The study aimed to assess inequalities in the use of child healthcare services with respect to sex and socioeconomic status in two districts in the early phase of IMCI implementation and in two others without IMCI programme	Baseline household survey was done early in the implementation phase of IMCI. The study included cluster samples of 2006 children younger than 5 years in four rural districts. Questions focused on the extent to which carers' knowledge of illness, care-seeking outside the home and care in health facilities were consistent with IMCI guidelines and and messages. Principal components analysis was used to develop a relative index of household socioeconomic status	52% of 1968 children reported having been ill in the 2 weeks before the survey. Carers of 415 (41%) of 1014 of these children had sought care first from an appropriate provider. 71 (26%) carers from families in the wealthiest quintile knew ≥ 2 danger signs compared with 48 (20%) of those from the poorest, and wealthier families were more likely to bring their sick children to a health facility. Their children have a better chance of receiving antimalarials and antibiotics for pneumonia[20]

ACT, artemisinin-based combination therapy; ITN, insecticide-treated bed nets.

education were associated with under-five mortality in Rufiji HDSS. The under-fives in poorest households were more likely to die compared with those in the least poor households.[11] More key findings and publications are presented in Table 3.

Future analysis plans

Rufiji HDSS will continue to work and provide data on health and demographic indicators for better understanding of dynamics of health, population and social transitions. Also the Rufiji HDSS plans to conduct a comparative analysis of fertility and demographic transition. Currently the analyses of Rufiji HDSS data are based on the impact of malaria in a rapid decline of child mortality, orphanhood and life trajectories, development of a space-time model for forecasting mortality due to malaria, impact of maternal deaths on living children and impact of community-based health services on maternal and child health. However, opportunity for collaboration is open with respect to the conditions of Rufiji HDSS data-sharing policy.

Strengths and weaknesses of Rufiji HDSS

Rufiji HDSS remains the acceptable alternative way of collecting in-depth longitudinal data so essential to improving health, alleviating poverty and achieving other essential social goals in the developing world where there is lack of effective and comprehensive national civil registration and vital statistics systems. Despite its importance, Rufiji HDSS has incomplete data for instance on vaccination, birthweight and contraception use.

High participation and acceptance by the community in the Rufiji HDSS makes it a crucial component of ongoing efforts to reform healthcare delivery in Tanzania. Difficulties in reconciling migrations have jeopardized the ability of Rufiji HDSS to track births, deaths and causes of deaths on time, but this is expected to become easier with the introduction of real-time reporting in the OpenHDS data system.

Close to 80% of deaths in Rufiji HDSS occurred outside health facilities. Information on the major local causes of death and disability generated by Rufiji HDSS has increased the efficiency of district health system in trying to ensure that planning is evidence based. The complexity method of verbal autopsy processing in ascertaining the probable causes of deaths makes it difficult in to provide timel data to the end users.

The use of tablets and OpenHDS with machine-coded verbal autopsy will allow the Rufiji HDSS to achieve more timely data collection and improved data quality.

Data sharing and collaboration

Rufiji HDSS shares annual District profiles that translate complex patterns of burden of disease into simple language and graphics for the district health management teams. Basic Rufiji HDSS data and data requisition forms are available at the IHI central server and website [www.ihi.or.tz], respectively. Access to online data requires permission from the data centralization team [dc@ihi.or.tz]. Requests for data are subject to ethics committee approval and will only be accepted from *bona fide* researchers with specified research objectives or collaborations.

Funding

We thank the Ministry of Health and Social Welfare of Tanzania, International Development Research Center (IDRC), Department for International Development (DFID) of United Kingdom Government, Rockefeller Foundation, Bill and Melinda Gates Foundation, Doris Duke Foundation, Comic Relief, European Union Seventh Framework Programme, United States Agency for International Development (USAID), United States Centres for Disease Control, Roll Back Malaria initiative-Malaria Transmission Intensity and Mortality Burden Across Africa (RBM-MTIMBA), the President's Malaria Initiative, Global Fund for Human Immunodeficiency Virus (HIV), Tuberculosis (TB) and Malaria, Ifakara Health Institute and the International Network for the Demographic Evaluation of Populations and their Health (INDEPTH) for funding the Rufiji HDSS.

Acknowledgements

The authors also thank the INDEPTH Network for facilitating the publication of this profile. We acknowledge the tremendous work of field staff, data clerks and analysts who collect and process this information. The authors are most grateful to the villagers who continue to share their personal information.

Conflict of interest: The authors declare that they have no competing interests.

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