



Health & Demographic Surveillance System Profile

Health & Demographic Surveillance System Profile: The Birbhum population project (Birbhum HDSS)

Saswata Ghosh,^{1,2} Anamitra Barik,¹ Saikat Majumder,¹
Ashoke Gorain,¹ Subrata Mukherjee,^{1,2} Saibal Mazumdar,¹
Kajal Chatterjee,¹ Sunil Kumar Bhaumik,¹
Susanta Kumar Bandyopadhyay,³ BiswaRanjan Satpathi,³
Partha P Majumder^{1,4} and Abhijit Chowdhury^{1*}

¹Society for Health and Demographic Surveillance, Kolkata, India, ²Institute of Development Studies, Kolkata, India, ³Department of Health & Family Welfare, Government of West Bengal, Kolkata, India and ⁴National Institute of Biomedical Genomics, Kalyani, India

*Corresponding author. Project Director, Society for Health and Demographic Surveillance, Swasthya Bhavan, GN29, Sector V, Kolkata 700091, India. E-mail: achowdhury2002@yahoo.co.in

Accepted 13 November 2014

Abstract

The Birbhum HDSS was established in 2008 and covers 351 villages in four administrative blocks in rural areas of Birbhum district of West Bengal, India. The project currently follows 54 585 individuals living in 12 557 households. The population being followed up is economically underprivileged and socially marginalized. The HDSS, a prospective longitudinal cohort study, has been designed to study changes in population demographic, health and healthcare utilization. In addition to collecting data on vital statistics and antenatal and postnatal tracking, verbal autopsies are being performed. Moreover, periodic surveys capturing socio-demographic and economic conditions have been conducted twice. Data on nutritional status (children as well as adults), non-communicable diseases, smoking etc. have also been collected in special surveys. Currently, intervention studies on anaemia, undernutrition and common preschool childhood morbidities through behavioural changes are under way. For access to the data, a researcher needs to send a request to the Data Manager [suri.shds@gmail.com]. Data are shared in common formats like comma-separated files (csv) or Microsoft Excel (xlsx) or Microsoft Access Database (mdb). The HDSS will soon upgrade its data management system to a more integrated platform, coordinated and guided by INDEPTH data sharing policy.

Key Messages

- The Birbhum HDSS is the only demographic and health surveillance site in eastern India which: provides data on vital events; tracks pregnancy, antenatal, perinatal and postnatal care; and conducts verbal autopsy in sampled households in the study area (since 2011).
- Fertility transition in the study area has taken place without meeting standard preconditions of demographic transition such as substantial decline of infant and child mortality rates.
- Although infectious and parasitic diseases and non-communicable diseases coexist in the study population, non-communicable diseases are the leading causes of death, implying that epidemiological transition is under way.
- The Birbhum HDSS conducted metagenomic analysis of stool samples collected from 10 pairs of siblings of agegroup 6-59 months, identifying key microbial groups which can be utilized for targeted therapeutic interventions for managing severe acute malnutrition.

Why was the Birbhum HDSS set up?

The Birbhum HDSS was initiated in 2008 with a mandate to promote and conduct researches on demographic processes, population health and epidemiology, and healthcare utilization in a well-defined prospective population-based cohort. The ultimate goal was to provide a research platform, analytical as well as interventional, which would be able to address major issues in public health and human development in India. Primary ownership of Birbhum HDSS is through an autonomous organization that was specifically formed for this purpose, namely the Society for Health and Demographic Surveillance (SHDS). The Department of Health and Family Welfare (DoH&FW) of the Government of West Bengal funds the HDSS.¹

Research on demographic processes primarily includes fertility transition and contraceptive use, and migration and its impact on health. Health systems research comprises studying access, equality and utilization of healthcare services, health insurance and health expenditure. Epidemiological research includes: a metagenomic study to find out the role of the gut microbiome in determining nutritional status of children; non-communicable diseases related to metabolic syndrome, including formation of risk cohorts; and follow-up observational studies on early atherosclerosis, lean diabetes etc. Research on population health primarily contains issues related to mortality, morbidity, maternal and child healthcare, nutritional status and mental health.¹ The society was also set up with the aim to guide health education, foster healthcare delivery and, finally, impinge upon policy formulation for promoting human development in the state of West Bengal.

Where is the HDSS area?

The HDSS is situated in the district of Birbhum, which lies in the western part of the state of West Bengal, in the

eastern region of India. Situated between 23° 32' 30" (right above the tropic of cancer) and 24° 35' 0"N latitudes, and 87° 5' 25" and 88° 1' 40"E longitudes, and about 4545 km² in area, this district is triangular in shape (Figure 1). Birbhum district is characterized by undulating geophysical topography and remoteness, caused by the Chhotanagpur plateau which protrudes through the western borders of the district. Droughts are common, with the mean annual rainfall in the district at 1300 mm.

The district headquarters, Suri, is 240 km from the state capital Kolkata, to which it is well connected by road and railways. Currently, Birbhum district has a population of 3 502 387, with a population density of 771 inhabitants per square kilometre.² Its population growth rate was 16.15% over the decade 2001-11.² Birbhum has a sex ratio of 956 females for every 1000 males, and a literacy rate of 70.9%.² More than six out of 10 are believers of Hinduism, and more than 35% are followers of Islam.² According to the 2011 census, 29.5% of the population belongs to the scheduled castes and 6.9% to the scheduled tribes.³ Other than those speaking the local dialect of Bengali, there are Santhals and ten other tribal communities in Birbhum, amongst whom Koda, Mahali and Oraons are more common.

Who is covered by the HDSS and how often have they been followed up?

The primary reason to choose Birbhum district was its predominantly rural character and backwardness in terms of socio-demographic and human development indicators.⁴ Other reasons include: previous experience in conducting epidemiological studies in that area; cooperation and commitment of local health administration and self-government institutions; and feasibility in operation and administration. The said HDSS is situated in four

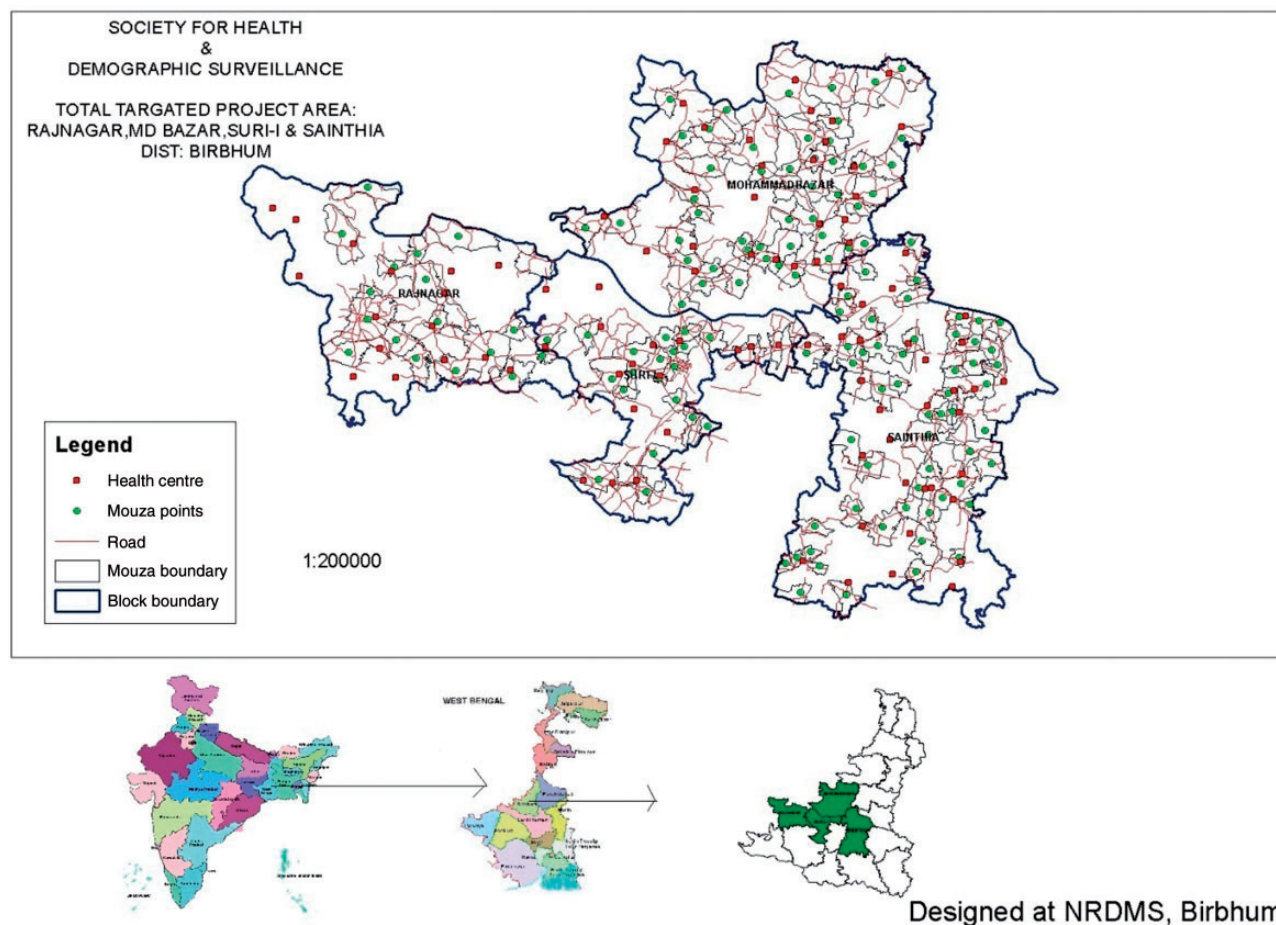


Figure 1. Location of the Birbhumi HDSS study area.

administrative blocks of Birbhumi, namely Rajnagar, Mohammed Bazar, Suri-1 and Sainthia.

Demographic surveillance started with a household census carried out during November 2008 and February 2009 in 351 villages. These villages consisted of 297 763 individuals (male 152, 475, female 145 288) residing in 66 343 households, with a household number assigned to each household. By adopting a multi-stage sampling design, 13 261 households were selected, expecting a drop-out and non-participation rate of 10%. After explaining the objectives, these households were then approached and encouraged to enrol with the HDSS. A total of 13 053 households (59 395 individuals) consented and formed the cohort as on November 2008. The current study involves 12 557 households (54 585 individuals). Each person living in the HDSS-sampled households was issued a unique permanent identification number to enable follow-up. A usual resident is defined as any person who has lived in the study area continuously for at least 6 months. Excepting the tribal-dominated areas of Rajnagar and Mohammed Bazar, settlements are generally dense.

Table 1 summarizes characteristics of sampled households and populations for the study area at two different time points during the existence of Birbhumi HDSS. The population in this region primarily earn their livelihood by working in primary and informal sectors. The sex ratio was found to have improved in recent years, and household size decreased a little. Literacy rate was 66.8% in 2009 and improved marginally during the inter-survey period. Although access to safe drinking water was nearly universal, access to other basic amenities such as sanitation, drainage facilities and modern cooking fuel were found to be very much inadequate. Furthermore, during 2011 over half of the households met hospitalization expenditure by borrowing or by mortgaging or selling assets. This indicates that the study population is characterized by backwardness, marginalization and impoverishment.

As far as attrition is concerned, the number of households has been reduced from 13 053 in 2009 to 12 557 in 2012. The reasons for attrition were found to be permanent migration (48.8%) followed by non-cooperation (28%), temporary migration (9.7%), households merged

Table 1. Basic demographic and socioeconomic characteristics of study population during 2009 and 2012 at Birbhum HDSS

Characteristics	2009	2012
Total population	59395	54585
Total household	13053	12557
Average household size	4.6	4.3
Male population (%)	51.1	50.8
Female population (%)	48.9	49.2
Sex ratio all ages (females per 1000 males)	959	970
Population believe in Hinduism (%)	70.4	70.3
Population follower of Islam (%)	29.0	29.1
Population follower of Christianity (%)	0.6	0.5
Household heads belong to scheduled caste (SC) (%)	33.6	34.09
Household heads belong to scheduled tribe (ST) (%)	9.8	10.0
Household heads belong to other backward castes (OBC) (%)	6.2	6.7
Household heads belong to non-SC/ST & non-OBC (%)	50.4	49.2
Literacy rates (%)	66.8	68.9
Male literacy rates (%)	73.6	75.4
Female literacy rates (%)	59.6	62.3
Working in primary sector activities (%)	30.5	34.4
Working in secondary sector activities (%)	30.8	23.3
Working in tertiary sector activities (%)	38.8	42.3
Households having access to improved sources of drinking water (%)	98.0	99.6
Households having access to improved sanitation facilities (%)	20.9	25.3
Households having access to modern cooking fuel (%)	5.9	9.3
Households having drainage facilities (%)	NA	27.6
Catastrophic health expenditure of households in episodes of hospitalization (%)	NA	50.5

NA: not available.

Examples of primary sector activities are agriculture and related activities, mining and quarrying. Secondary sector activities incorporate industrial and household manufacturing production. Retail and wholesale sales, transportation and distribution, and banking services are good examples of tertiary sector activities. Catastrophic health expenditure includes expenses met by borrowing/mortgage, selling household assets or charity

with other households (11.1%) and death in single-member families (1.8%).

The age and sex structure of the Birbhum HDSS population is similar to the some southern Indian states where fertility transition has already taken place.⁵ The age-sex pyramid (Figure 2) depicts a scenario of declining fertility, with a shrinking base of 27% of the total population below 15 years of age, and indicates a gradually ageing population with 4% of the population above the age of 65 years. The higher percentage of females in the age group 25–39 years suggests male-dominated migration to urban areas in search of livelihood. The age-dependency ratio stands at

46 (young-age dependency ratio 40 and old-age dependency ratio 6).

Each surveyor visits a sample household once a fortnight to update the demographic information of that household. During the visit, information on vital events, reproductive and child health and migration are recorded. Field monitors cross-check this recorded information to avoid possible omission of events. Special surveys on focused research areas are also conducted when conceptualized and found necessary (Figure 3). Additionally, verbal autopsies of deaths occurring at all ages are conducted to determine underlying causes of death—from January 2011 on a pilot basis and routinely from January 2012. Verbal autopsy of 841 deaths had been conducted by the end of 2013.

What has been measured and how has the HDSS database been constructed?

Demographic data of individuals including births, deaths, migration, maternity and pregnancies and abortion (from 2012) were collected from November 2010 on a pilot basis and from January 2011 on a regular basis on paper-based forms and entered on a relational database constructed separately for each household in MS Access software. Table 2 summarizes all the measures available since the inception of Birbhum HDSS. Details of household and individual characteristics are available from the socioeconomic surveys conducted during 2009 and 2012 on paper-based forms. During the socioeconomic survey of 2012, a number of additional variables related to acute and chronic morbidity, health-seeking behaviour and out-of-pocket health expenditure were also collected. In addition, information on utilization of reproductive and child health services was obtained. Information on contraceptive awareness, usage and pregnancy intention was also collected from sexually active married women.

Motivated by the fact that there exists high prevalence of childhood anaemia and undernutrition in India, currently a randomized controlled trial is under way which aims at examining the effects of behavioural changes due to promotion of hand-washing on different anthropometric, serological, biomedical and morbidity indicators among 3380 children of the age group 36–71 months.

Since the gut microbiome plays an important role in nutrient pre-processing, assimilation and energy harvesting from food, a metagenomic approach was adopted to investigate the role in nutrition of the gut microorganisms of under-five children. The study was conducted among 10 pairs of randomly selected siblings—one undernourished (underweight, stunted or wasted) and one normal. The changes in the abundance of various taxonomic and

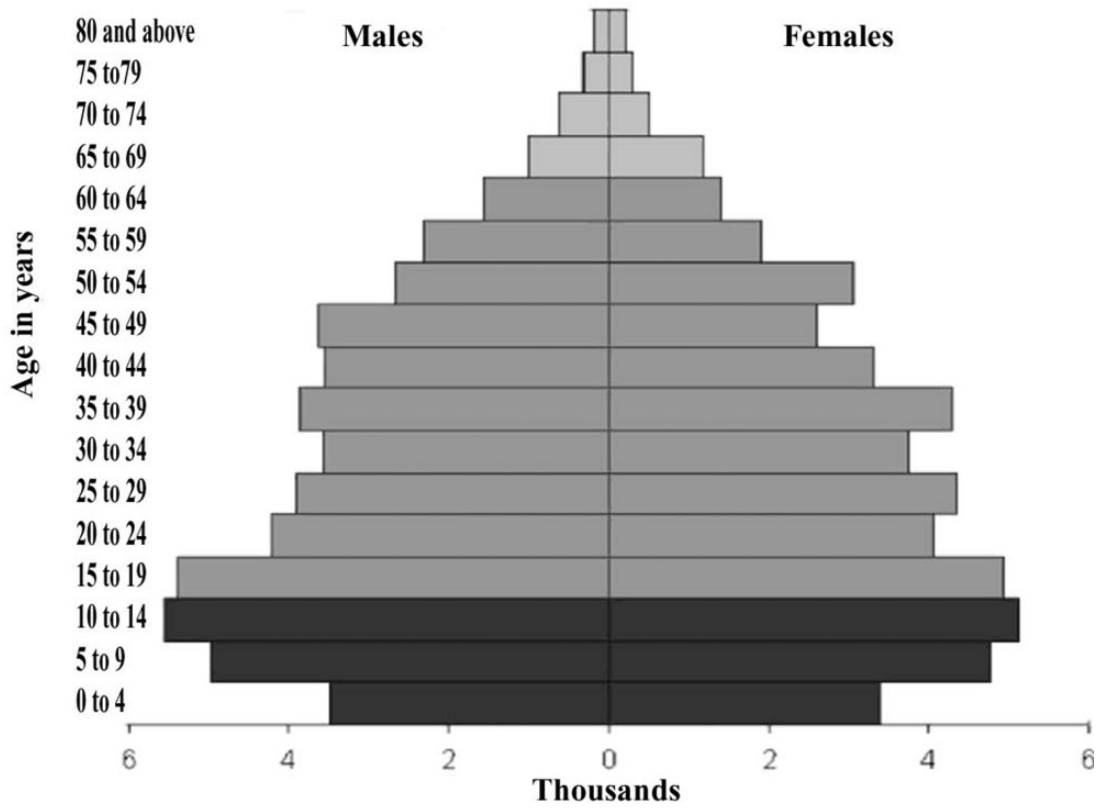


Figure 2. Population pyramid of study population of 2012 of Birbhum HDSS.

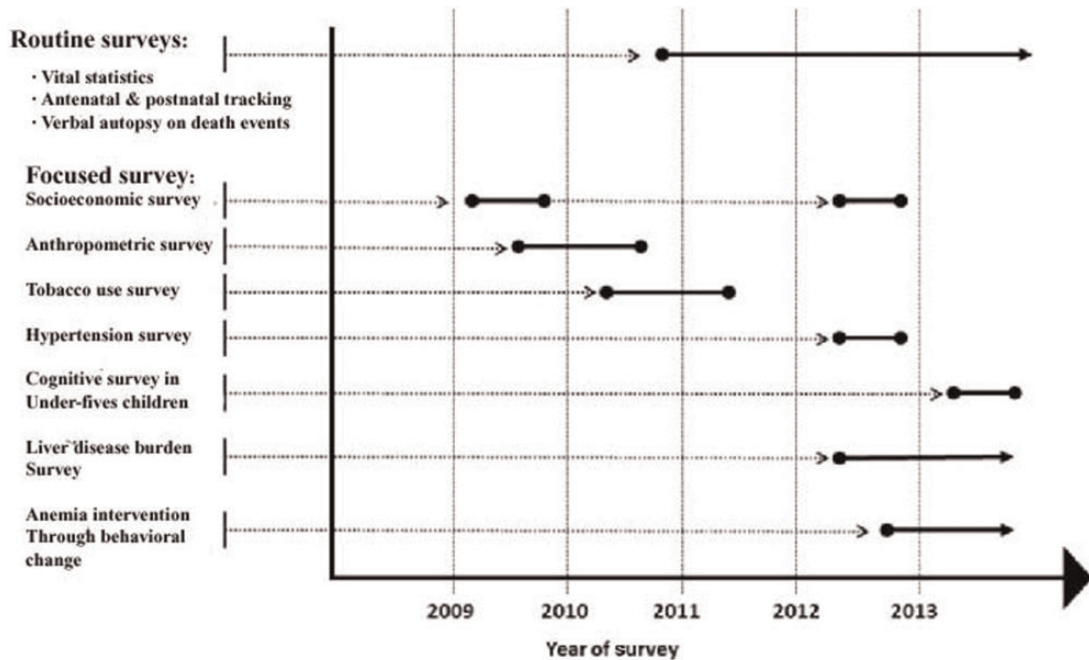


Figure 3. Time span of the survey conducted in 'Society for health and demographic surveillance (SHDS)' project area.

Table 2. Measures available from 2008 to date at the Birbhum HDSS

Variables measured	Year						
	2008	2009	2010	2011	2012	2013	2014
Residential address	y	y			y		
Household roster: relationship with the head of the household, sex, marital status, education, occupation		y			y		
Type of home construction, sanitation, number of rooms, source of drinking water, electricity, main cooking fuel, possession of household assets		y			y		
Possession of livestock, household expenditure on food and non-food items including healthcare, catastrophic health expenditure					y		
Utilization of maternal healthcare services for the women who delivered a live birth/stillbirth during preceding 3 years of survey					y		
Contraceptive awareness, use, pregnancy intention for married and sexually active women					y		
Child immunization					y		
Vital statistics (birth, death, migration, marriage)				y	y	y	y
Antenatal and postnatal tracking of pregnant women				y	y	y	y
Abortion					y	y	y
Verbal autopsy of all deaths				y	y	y	y
Self-reported general health status		y			y		
Episodes of clinically diagnosed chronic and infectious diseases					y		
Healthcare access, utilization, hospitalization		y			y		
Health insurance status/type		y			y		
Access and utilization of <i>RastriyaSwasthaBimaYojana</i>							y
Height, weight, bodyfat percentage, hip/waist circumference			y				
Blood pressure measurement (10 years and above individuals)			y				
Blood pressure measurement (age 18 years and above)					y		
Physical activity, diet (ongoing)							y
Smoking and smokeless tobacco misuse				y	y		
Alcohol misuse (ongoing)							y
Total cholesterol, HDL, triglycerides					y	y	y
Collected stool and blood sample of 20 children (10 pairs of siblings from each household)				y			
Status of liver (normal echo texture, fatty liver etc.)					y	y	y
Status of gallbladder (normal, calculi etc.)					y	y	y
Carotid intima medical thickness (right, left)					y	y	y
Baseline information on assessment of haemoglobin, iron status, height, weight, mid upper arm circumference, worm burden in stool							
Distribution of soap, promote regular hand-washing and collect data on history of diarrhoea and acute respiratory tract infection							y

HDL. High-density lipoprotein; y, yes.

functional groups were investigated across these gut microbiomes.⁶

Besides conducting routine data collection, the surveyors also accommodate specific studies after going through adequate training (for example, collecting data related to hypertension, measurement of biochemical parameters of metagenomic studies, or community-based specific intervention study on anaemia, undernutrition and common childhood morbidity among preschool children through behavioural changes).

Key findings and publications

Although the Birbhum HDSS started functioning from 2008, recording of vital events started during later part of 2010 on a pilot basis and on a regular basis from 2011. Table 3 depicts the vital rates for 2011 and 2012. Any trend of vital events can hardly be established from data for such limited period. However, it seems that infant and child mortality rates are somewhat higher during 2012 compared with 2011. Such an increase may be attributed to the better reporting of vital events, particularly the

Table 3. Vital rates 2011 and 2012 among study population of Birbhum HDSS

Indicators	2011	2012
Crude birth rate	12.2	15.2
Crude death rate	6.2	6.4
Infant mortality rate	37.1	46.0
Total fertility rate	2.1	2.2
Neonatal mortality rate	31.6	35.6
Under-5 mortality rate	44.0	50.6
Sex ratio	959.0	970.0
Rate of out-migration (%)	22.4	27.7
Rate of in-migration (%)	10.1	12.2
Mean age at marriage among girls	18.1	18.1

sensitive events like infant and child death, as with time good rapport has been established between surveyors and household members. Further, verbal autopsy as well as antenatal and postnatal tracking of mothers were started from 2011. These routine surveys were useful for the validation of accurate numbers of deaths and thus the missing deaths could be reduced gradually. Nonetheless, the vital rates are found to more or less resemble those of overall India as well as of West Bengal.⁷ It may be noted that fertility transition has also been taken place in the study area, as in case of rural West Bengal.^{7,8} It is worth noting that fertility transition in the study area has taken place without meeting the standard preconditions for fertility decline such as: significant socioeconomic progress; major fall in infant mortality; substantial improvement in female age at marriage; significant improvement in maternal health, etc.⁹

Causes of death (according to ICD-10 classification) data as collected through verbal autopsy for the year 2012 and 2013 suggest that although communicable and non-communicable diseases coexist, deaths due to non-communicable diseases (NCDs) are substantially higher compared with infectious and parasitic diseases (66.3% due to NCDs against 14% due to infectious and parasitic diseases). Among all deaths that occurred during 2012 and 2013, more than one-fourth died due to diseases of circulatory systems (ICD-10: I00 to I99), followed by symptoms, signs and abnormal clinical and laboratory findings not elsewhere classified (ICD-10: R00 to R99) (10.3%), and external causes of morbidity and mortality (V01-Y98) (9.4%). Contrary to the earlier findings, it seems that epidemiological transition is under way even among socio-economically weaker sections of rural society.¹⁰

According to the tracking data of pregnancy, antenatal, perinatal and postnatal care in 2011 and 2012, around 15% teenage pregnancies were found in the study area (Table 4). The table also shows that the majority of pregnant women received comprehensive antenatal clinic care.

Table 4. Characteristics of antenatal, perinatal and postnatal care among pregnant women of the Birbhum HDSS area during 2011 and 2012

Characteristics	2011	2012
Pregnancies below 19 years of age (%)	15.3	16.2
Blood group tested (%)	44.7	50.3
Haemoglobin tested (%)	79.5	85.9
Urine sugar test conducted (%)	63.7	71.4
Urine protein test conducted (%)	61.4	66.8
Blood pressure checked (%)	65.4	94.1
Weight measured (%)	61.7	96.8
Two tetanus toxoid injections received (%)	NA	68.4
100+ iron and folic acid tablets consumed (%)	NA	19.5
Institutional delivery (%)	70.5	75.0
Deliveries in public institutions (%)	94.1	89.0
Caesarean section (%)	9.1	13.3
Postnatal care within 48 h ^a (%)	19.8	21.2

NA, not available.

^aAmong those who had home delivery.

Since the surveyors of the HDSS started measuring weight and blood pressure of adult household individuals as from 2012, a substantial increase of measurement of these parameters can be noted between 2011 and 2012. During 2011 and 2012, more than 70% of deliveries were institutional, the overwhelming majority being conducted in public institutions. A minority of women who had delivered at home had gone for postnatal check-ups within 48 h of delivery. During 2013, out of 890 pregnancies which were tracked in the HDSS area: 819 pregnancies (92%) resulted in successful live birth; 55 pregnancies (6.2%) were terminated due to spontaneous or induced abortion; and 16 pregnancies (1.8%) ended in stillbirth (not shown in the table). Of the total live births: 78.6% were delivered in an institutional set-up; in 15.4% of cases caesarean section was performed; and 18.8% were found to be low-birthweight (LBW) babies (not shown in the table).

Table 5 represents age-sex variations in nutritional status among children of HDSS-sampled households. Nutritional status among children of the study area was found to be significantly poor and resembles the all-India pattern. Although prevalence of stunting and underweight among children increases with age, prevalence of wasting declines as age increases. Prevalence of stunting as well as underweight was observed to be higher among girls compared with boys, reflecting that gender discrimination against women starts during early childhood in rural Indian society.¹¹⁻¹⁴

Age-sex variation of adult nutritional status (age \geq 18 years) of the study population as measured by body mass index (BMI) suggests that prevalences of undernourishment (BMI $<$ 18.5) among both sexes are substantial (45%

Table 5. Nutritional status of children aged 6-59 months: percentage of children classified as malnourished according to three anthropometric indices in the Birbhum HDSS households, 2010

Age group in months	Height for age (stunting)			Weight for age (underweight)			Weight for height (wasting)			Number of children
	Percentage below -3SD	Percentage below -2SD	Mean z-score	Percentage below -3SD	Percentage below -2SD	Mean z-score	Percentage below -3SD	Percentage below -2SD	Mean z-score	
06-11	9.64	23.49	-0.31	16.67	43.98	-1.83	24.30	47.59	-1.68	498
12-23	12.33	22.42	-0.62	25.90	60.65	-2.24	27.35	57.74	-2.01	892
24-35	19.79	29.85	-1.37	27.79	68.00	-2.33	20.62	52.62	-1.26	975
36-47	31.42	42.43	-2.31	21.83	62.09	-2.15	14.02	41.11	-0.50	1063
48-59	37.86	47.42	-2.84	16.16	54.21	-2.01	10.04	33.37	0.22	1046
Sex										
Male	22.34	33.16	-1.54	20.75	58.85	-2.13	17.92	46.84	-1.09	2265
Female	26.03	36.40	-1.80	23.36	59.62	-2.15	18.74	44.82	-0.76	2209
Total	24.40	34.90	-1.67	24.10	59.60	-2.13	19.40	47.50	-0.92	4474

**Figure 4.** Blood pressure measurement was carried out before ultrasonography at a sample village. Ultrasonography had been conducted for the assessment of liver disease burden disease and carotid intima thickness (predictor of atherosclerosis).

among men and 43.5% among women). Proportions of overweight and obesity ($BMI \geq 23$) are somewhat higher among females compared with males. Proportions of undernourished adult men as well as women are found to be higher in the younger age group (18-24 years) as well as in the older age group (60 years and more). Proportions of overweight and obesity are higher among the middle-aged (35-60 age-groups) of both sexes.

The findings of the hypertension survey (Figure 4) among adult (≥ 18 years) members of HDSS-sampled households suggest that although prevalence of hypertension does not differ much between males and females (males: 12.5%, females: 11.3%), pre-hypertension was found to be

substantially higher among males compared with females (Appendix Table A1, available as Supplementary data at *IJE* online). It was observed that the likelihood of stage 1 and stage 2 hypertension increases significantly with age.

About 66% of males and 24% of females were using some form of tobacco during 2011-12 in the HDSS study area, according to the smoking survey (Appendix Table A2, available as Supplementary data at *IJE* online). Males primarily smoked Biri (36%), whereas females were more likely to use smokeless tobacco (20.5%). Further, likelihood of smoking increases substantially with age up to 60 years and then starts to decline. However, smokeless tobacco usage does not decline with age.

Using HDSS data, a number of research papers are currently being prepared and some of them are already under review in peer-reviewed journals (Ghosh TS *et al.* 2014¹⁵; Ghosh S *et al.*, unpublished submitted for publication). We expect our findings will guide the local health administration and decision makers to prepare strategic maps and set priorities according to health needs of the local people.

Future analysis plan

In addition to the aforementioned ongoing analyses of data, in the short-term future we aim to continue analysing our demographic and socio-economic database to explore the relationships among fertility intention, son preference and contraceptive use in the context of low fertility. Currently there are ongoing analyses to investigate access and utilization of RastriyaSwasthaBimaYojana (RSBY), a health insurance scheme initiated by the Government of India for below-poverty-line households in event of hospitalization. Besides, we are also currently exploring whether expenditure on acute illnesses reduces the probability of seeking treatment for chronic diseases. Analyses of demographic and socioeconomic determinants of drop-out in child immunization, from BCG to measles, are also on our agenda. Relationships among alcohol intake, physical activity and prevalence of chronic diseases will also be studied once data collection is over.

What are the main strengths and weaknesses?

From the outset, the Birbhum HDSS has pursued a multi-disciplinary academic agenda in population and health research. Research planning and execution at the Birbhum HDSS involve intimate discussions among health and biological scientists, demographers, economists and social scientists. The rigor of cohort development, through statistically valid sampling methods, has geographically extended the ambit of the study population in order to accommodate regional heterogeneities and make the cohort more representative. This also provides scope for future expansion.

One of the major strengths of the Birbhum HDSS compared to other HDSS sites in India is the provision of ongoing and periodically updated information on births, deaths, pregnancy, antenatal, perinatal and postnatal care, and migration in a large rural population. In addition, a number of cross-sectional surveys have been carried out on nutritional status (children as well as adults), hypertension and tobacco usage. These include a metagenomic study to understand the role of the gut microbiome in determining the nutritional status of children aged under five years,

and metagenomic studies on metabolic syndrome-related conditions which are ongoing. Intervention studies on anaemia, undernutrition and common childhood morbidities among preschool children (via promoting practice of hand-washing) add to the plurality of studies that are in progress. Multi-institutional participation provides further strength and opens up the HDSS for wider usage. Government funding ensures long-term support and governance through an independent body provides academic freedom.

The major weakness of the Birbhum HDSS is the low number of its academic publications. It is expected that entry into INDEPTH is likely to enable it overcome this issue through collaborations.

Data sharing and collaboration

Two prominent HDSS in India other than Birbhum HDSS are Ballabgarh in Haryana and Vadu in Maharashtra. It is pertinent for the researchers who are working on demographic and population health-related issues in India to know which data are available across three HDSS sites. HDSS-Vadu came into existence in 2002, and the Ballabgarh project has been in place since 1961. All three HDSS sites cover only rural population, mostly of poor and lower middle-class economic status, with Birbhum, Ballabgarh and Vadu respectively covering samples of 54 585, 90 240 and 140 000 individuals in 2011-12. Estimates from sample households show that the sex ratio is against the women in all HDSS sites (970 in Birbhum, 885 in Ballabgarh and 751 in Vadu). In terms of some available and comparable demographic indicators (such as crude birth and death rates, total fertility rates, infant and under-five mortality rates), Birbhum exhibits a picture somewhat comparable to Ballabgarh but poorer than Vadu according to most of the indicators (for details see [Appendix Table A3](#), available as [Supplementary data](#) at *IJE* online).

The Birbhum HDSS data are currently collected on paper forms and stored in a well-managed Microsoft Access database. The data manager is accountable and is primary custodian of the data. Data are anonymized and shared in common formats like comma-separated files (csv) or Microsoft Excel (xlsx) or Microsoft Access Database (mdb). For access to the data, a researcher needs to send a request to the Data Manager [suri.shds@gmail.com]. With an eye to improved data life-cycle management and data sustainability, the Birbhum HDSS is working towards upgrading its data management and being ready for public access through approved open data repositories like INDEPTH.

Supplementary Data

[Supplementary data](#) are available at *IJE* online.

Funding

Department of Health and Family Welfare and the Department of Science and Technology, Government of West Bengal, India.

Conflict of interest: None declared.

References

1. Society for Health and Demographic Surveillance. *Report of the Activities of the Society for Health and Demographic Surveillance 2013*. Birbhum District, West Bengal: Department of Health and Family Welfare, Government of West Bengal, 2013.
2. Registrar General of India. *Primary Census Abstract, 2011*. New Delhi: Ministry of Home Affairs, Government of India, 2013.
3. Registrar General of India. *Primary Census Abstract, 2001*. New Delhi: Ministry of Home Affairs, Government of India, 2003.
4. Government of India and United Nation Development Programme. *District Human Development Report: Birbhum*. Kolkata: State Planning Board, Government of West Bengal, 2008.
5. International Institute for Population Sciences (IIPS). *District Level Household and Facility Survey (DLHS-3), 2007-08: India*. Mumbai, India: IIPS, 2010.
6. Ghosh TS, Sengupta S, Bhattacharya T *et al*. Gut microbiomes of Indian children of varying nutritional status. *PLoS One* 2014;**9**:e95547.
7. Registrar General of India. *Sample Registration System Statistical Report, 2012*. New Delhi: Ministry of Home Affairs, Government of India, 2013.
8. Guilmoto CZ, Rajan SI. Fertility at the district level in India. Lessons from 2011 census. *Economic and Political Weekly* 2013;**XLVIII**:59–70.
9. Basu AM, Amin S. Conditioning factors for fertility decline in Bengal: History, language identity, and openness to innovations. *Popul Dev Rev* 2000;**26**:761–94.
10. Ghosh S, Kulkarni PM. Does the pattern of causes of death vary across socioeconomic classes within a population? – An exploratory analysis for India. *Genus* 2004;**LX**:55–81.
11. Pande RP. Selective gender difference in childhood nutrition and immunization in rural India: the role of siblings. *Demography* 2003;**40**:395–418.
12. Kishore S. May god give son to all: Gender and child mortality in India. *Am Sociol Rev* 1993;**58**:247–65.
13. Das Gupta M. Selective discrimination against female children in rural Punjab, India. *Popul Dev Rev* 1987;**13**: 377–400.
14. Das Gupta M, Bhat PNM. Fertility decline and increased manifestation of sex bias in India. *Popul Stud* 1997;**51**:307–15.
15. Ghosh TS, Sengupta S, Bhattacharya T *et al*. Gut microbiomes of Indian Children of varying Nutritional Status. *PLoS One* 2014. doi:10.1371/journal.pone.0095547.