

HEALTH AND DEMOGRAPHIC SURVEILLANCE SYSTEM PROFILE

The Ballabgarh Health and Demographic Surveillance System (CRHSP-AIIMS)

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The Ballabgarh Health and Demographic Surveillance System (HDSS), also known as the Comprehensive Rural Health Services Project (CRHSP) Ballabgarh, is located in north India and was established in 1961 to develop a model for rural health-care practice in India. In addition to demographic surveillance and community-based research, CRHSP Ballabgarh provides preventive, health-promotion, and curative services to its surrounding population. The population served by CRHSP Ballabgarh in 2011 was about 90 000. The system collects data for the entire population through fortnightly visits by health workers (HWs). The system's data base is updated once every month and further updated with missing data and special morbidity surveillance data during the annual census. Since 1961, CRHSP Ballabgarh has collected demographic data, reproductive data, and health data about mothers and their children. More recently, the project began collecting data on diseases such as tuberculosis, and because of changes in life style it recently began collecting data about non-communicable diseases (NCD) and risk factors for NCDs. Nonetheless, an adverse sex ratio, with more boys than girls, and a stagnant neonatal mortality rate, remain major challenges in the population served by CRHSP Ballabgarh. The project shares data with different agencies for health-management purposes, which can be made available to bona fide researchers on receipt of a proposal (enquiries should be directed to: crhsp.ballabgarh@gmail.com); collaboration requests are welcome.

Keywords Ballabgarh, HDSS, CRHSP, non-communicable diseases, maternal health, child health

Why was the HDSS set up?

Only 25% of India's health infrastructure, medical manpower, and other health resources are available to the country's rural population, which constitutes two thirds of the total population.¹ To improve the health statistics of India and to achieve equity in health, it was necessary to focus on the health status of the rural population.

In 1961, with the help of the Rockefeller Foundation, the All India Institute of Medical Sciences (AIIMS), in collaboration with the state government of Haryana, began the Comprehensive Rural Health Services Project (CRHSP) Ballabgarh, also known as the Ballabgarh Health and Demographic Surveillance System (HDSS). The objectives of this project were to demonstrate a

model health-care delivery system for rural India, including demographic surveillance, to orient and train medical students in primary health care and to identify and conduct priority operational research to help address the needs of all of India. The Comprehensive Rural Health Services Project (CRHSP) Ballabgarh is managed by the Centre for Community Medicine of the All India Institute of Medical Sciences in New Delhi.

The Comprehensive Rural Health Services Project (CRHSP) Ballabgarh works as a site for community-based research, and functions as a demographic and health surveillance system. This demographic surveillance system has now been in operation for more than 40 years. To strengthen its surveillance system, CRHSP Ballabgarh joined the International Network for the Demographic Evaluation of Populations and Their Health (INDEPTH) in 2003. A computerized Health Management Information System (HMIS) was begun at CRHSP Ballabgarh in February 1988.² In addition to this, CRHSP Ballabgarh provides the HDSS population and that of the surrounding areas with health-promotion services in the form of health education, preventive services such as immunization and disease screening, and curative services for most of the diseases that can be managed at a secondary-care-level hospital.

What does it cover now?

In collaboration with the US Centers for Disease Control and Prevention, CRHSP Ballabgarh began a prospective, longitudinal, phase IV, household-randomized, controlled, and observer-blinded trial in 2009 to measure the total and indirect household-protective effects of immunizing children from the ages of 6 months through 10 years with seasonal, inactivated trivalent influenza vaccine.³ The study is continuing and about 6000 children have so far been vaccinated with the trivalent vaccine. Another study, with the purpose of estimating the burden of disease of influenza and other respiratory diseases, is in progress at the Ballabgarh HDSS. During 2009 and 2010 the incidence of influenza A (H1N1) among children <18 years of age was 345/1000 person years and that for adults (persons >18 years of age) was 69/1000 person years during the pandemic period, but rose to 199 and 131/1000 person years, respectively, during the post pandemic period.⁴ The neonatal mortality rate in Ballabgarh has remained fairly constant over past few years. Different interventions are being planned to reduce infant mortality, in collaboration with the United Nations International Children's Education Fund (UNICEF). Treatment adherence among hypertensive and diabetic patients is also being studied at Ballabgarh HDSS. By the end of 2013 it is planned to have screened all individuals above the age of 18 years for diabetes and hypertension with the idea

of forming a cohort that could be followed in the future to estimate the incidence and prevalence of diabetes and hypertension. A cardiovascular disease survey is currently ongoing in the area under the aegis of the Indian Council of Medical Research to provide data, analysis, and modeling for all of India.

New challenges in the form of non-communicable diseases (NCDs) have emerged in the HDSS because of rapid changes in life style in the population it covers. Thus, most of its research work in the past decade has been directed towards NCDs. This includes the burden of mortality from NCDs, risk factors for NCDs in India, metabolic syndrome, cervical cancer, rheumatic heart disease, and, more recently, coronary heart disease. This has helped advocacy efforts directed toward having the Indian government initiate a national program on NCDs. These activities have also included the validation of various tools for identifying risk factors and quantitating disease burden, such as the World Health Organization (WHO) STEPs approach (not yet published) and verbal autopsy tools.⁵ The Ballabgarh HDSS has conducted three rounds of NCD risk-factor surveys (2003, 2007, and 2012) that will provide invaluable insight into changing lifestyles in rural India (Table 1).^{6,7} Mixed trends were observed for all risk factors, with a notable increase in obesity and hypertension, in 2012. These findings could come from differences in sampling technique, age structure, or measurement criteria. In 2002, the Surveillance for Demographic, Environment and Health Information (SUDEHI) project was initiated at the HDSS with the objectives of collecting information on human behaviour that predisposes populations to both common communicable diseases and NCDs, and of ascertaining health-care-seeking behaviour.⁸

Among other interventions, the Ballabgarh HDSS has implemented a community-based intervention against NCD in an urban Ballabgarh setting, a school-based intervention (submitted for publication), and an intervention for managing NCDs through a simplified approach used in a secondary hospital at Ballabgarh. In the past couple of years, it has been shown that health workers (HWs) can be trained to do risk assessment for NCDs, and community health workers are now involved in NCD prevention and control. These findings are in the process of being published. The Ballabgarh HDSS has been identified as a resource centre for NCD surveillance by the Ministry of Health and Family Welfare of India, as well as a resource center in the recently launched National Program on Cancer, Diabetes and Cardiovascular Diseases (NPCDCS). As a designated WHO Collaborating Centre for Capacity Development and Research in community-based NCDPC, the Ballabgarh HDSS has provided technical assistance to neighboring countries and also conducted capacity-building workshops for regional participants.⁹

Table 1 Trends in the prevalence of risk factors for non-communicable diseases over a 10-year period in rural Ballabgarh

	Males			Females		
	2003–2004	2007–2008	2011–2012	2003–2004	2007–2008	2011–2012
<i>n</i>	884	878	1345	974	978	1431
Percentage of current smokers	65.7	66.7	65.1	26.5	30.7	23.8
Percentage of other current tobacco use	7	6.5	10.6	2.4	2.4	1
Percentage with regular alcohol consumption (past 12 months)	32.7	29	35.1 ^a	0.1	0.1	0.1 ^a
Percentage consuming ≥ 5 servings of fruits and vegetables	6.3	16.2	0.8	2.5	6.2	0.1
Less than 150 minutes of moderate or 75 minutes of vigorous activity or equivalent	23.2	40.1	25	41.2	50.1	38.3
Mean BMI	20.9	21.1	22.4	22.1	21.8	23.1
Percentage overweight (BMI ≥ 25)	13.9	12.9	26.7	24	20.8	30.7
Mean waist circumference		81.5	86.2		79.3	79.8
Prevalence of central obesity [WC ≥ 102 cm (M) or ≥ 88 cm (F)]	4.5	7.3	9.7	24.1	28.1	25.7
Mean systolic BP	122.16	121.73	126.9	119	115.74	121.2
Mean diastolic BP	76.28	74.56	83.5	73.51	73.22	80.6
% Hypertensive (systolic BP ≥ 140 mm Hg or diastolic BP ≥ 90 mm Hg or on medication)	19.7	14.8	33.6	16.8	10.4	27.3

^aAlcohol consumption in the past month. BMI, body mass index; BP, blood pressure; F, female; M, male; WC, waist circumference.

In addition to this, the Ballabgarh site was involved in creating a monitoring and evaluation framework for the NPCDCS.¹⁰

Where is the HDSS area?

Ballabgarh is located in north India, in the Faridabad district of the state of Haryana. It is situated between 28° 25' 16" north latitude and 77° 18' 28" east longitude (Figure 1). It lies within the National Capital Region of India. It is bounded by the state of Delhi (the national capital) to the north, the Gurgaon district of Haryana state to the west, and the state of Uttar Pradesh on its eastern and southern sides. It is about 22 miles from the All India Institute of Medical Sciences (AIIMS) by road on the Delhi–Mathura National Highway-2, and is also well connected through the Delhi–Mathura double-track broad-gauge line of the Northern Railways and North-Central Railways.

The predominant castes (social hierarchical groupings characteristic of India) in the Ballabgarh region are Jats (middle caste), Rajputs and Pandits (upper castes), and Scheduled Castes (lower castes). The Ballabgarh HDSS experiences three distinct seasons annually, consisting of winter, summer, and a rainy season, each lasting an average of 4 months. The rainy season begins in July and lasts until September; the remainder of the year is dry. The temperature in the Ballabgarh region ranges from 2°C in winter to 48°C in summer. The main economic activities of the region

are agriculture and agriculture-dependent trades, and the main crops grown are wheat, sugar cane, and millet.

The Ballabgarh HDSS project has two primary health centres (PHCs) and one secondary-level hospital at Ballabgarh. The two PHCs, at Dayalpur and Chhainsa, are situated 6 miles and 13 miles, respectively, from Ballabgarh. The area served by these two PHCs is also referred to as the Intensive Field Practice Area (IFPA) of the Ballabgarh HDSS project, which caters for 28 villages through the networking of 12 sub-centers (Figure 2). The IFPA of the project serves a population of 90 240 residing in 9584 households (as of 31 December 2011).¹¹ Each PHC has 6 sub-centers, which in turn cover populations ranging from 12 000–16 000. A team of male and female HWs manages each of the sub-centers and provides the health care in the villages served by the sub-centers, under the supervision of health supervisors, who are in turn guided by the PHC medical officer in-charge.

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

In the villages covered by the Ballabgarh HDSS, houses are first enumerated by the HWs. Families living in the houses are identified and are provided with a specific family reference number. Each and every resident of the 28 villages in the IFPA is

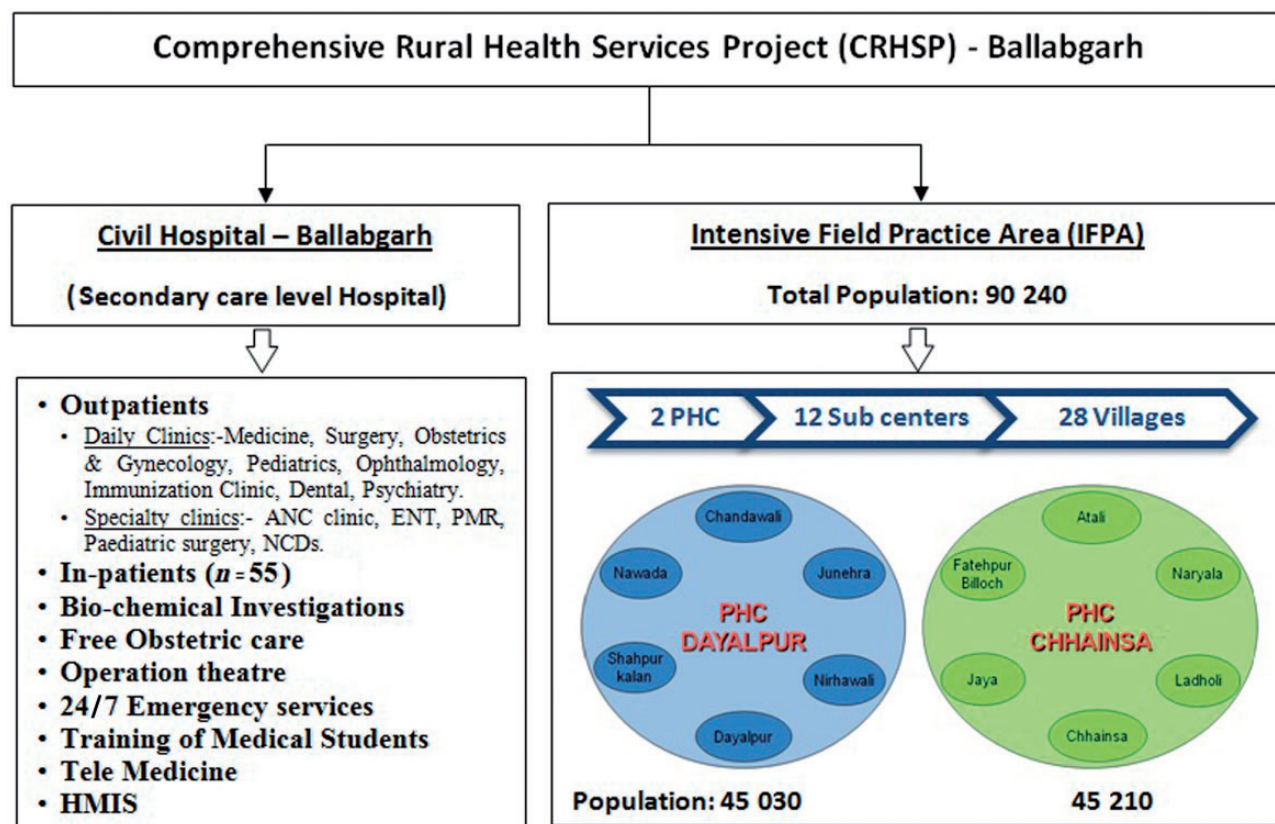


Figure 1 Location of CRHSP Ballabgarh in India

considered as a unit in the health and demographic surveillance system. Any individual who has remained in a household for more than 6 months of the past 12 months is considered a 'resident' of the IFPA. To 'remain' in a household means that the individual sleeps, on average, for four or more nights per week at the household.

The population covered by the Ballabgarh HDSS increased from 40 703 in 1972 to 90 240 in 2011.^{10,12}

The health and demographic data from the Ballabgarh HDSS for the year 2011 are summarized in [Table 2](#). In comparison to 1991 and 2001, the width of the middle of the population pyramid increased in 2011. High levels of premature mortality can be seen among women in the pyramids for 1991 and 2001. Life expectancy for women had improved by 2011 ([Figure 3](#)), and the population pyramid depicts the effort establish family-planning practices and improvements in



ENT: Ear, nose and Throat

PMR: Physical Medicine and rehabilitation

ANC: Antenatal Care

NCD: Non communicable Diseases

HMIS: Health and Management Information system

Figure 2 Comprehensive Rural Health Services Project

health services in the HDSS area. Over the past two decades the birth rate in the HDSS area declined from 40 per 1000 population in 1991 to 23.2 per 1000 population in 2011. Over the years, the sex ratio has become increasingly skewed in the IFPA because of a preference for male children leading to female foeticide.¹³ In 2011, the male:female ratio was 113:100.

The HIMS of CRHSP Ballabgarh is updated by the the HWs, mainly through: (i) a monthly visit (routine visit); and (ii) annual visits (annual census). All households in a given village are visited once each by a male HW and a female HW. The schedule of visits by the HWs is so designed that there is a gap of 15 days between house visits by the male and female workers. Thus, households are visited by an HW (male or female) approximately every two weeks. A certain number of houses are checked and verified by a supervisor and a few are re-checked and verified by a medical officer and other doctors. In addition, one extra round of annual census data collection is done during the months of December and January to update the demographic profile and household characteristics in the Ballabgarh region as

well as to collect new specific information not covered routinely. Special attention is given to acquiring any information missed during the monthly visits. For quality assurance, 20% and 5% of houses are selected randomly and verified by health supervisors and medical officers, respectively, during the annual census. A monthly work plan is generated by the HMIS and given to the HWs for accomplishing defined tasks such as immunization and the distribution of oral contraceptives in specific households in the area of the HW's visit for that month in addition to the HW's routine visits. A pre-fixed schedule (beat schedule) is followed by the HWs for their routine monthly house visits.

What has been measured and how have the HDSS data bases been constructed?

During monthly visits by HWs, relevant health information and vital statistics data are collected during

the delivery of routine health-care services in accord with the guidelines of India's national health programs. Information collected during the annual census and monthly visits is provided in Table 3. A verbal autopsy is conducted for every death in the study area, using a structured interview schedule prepared separately for deaths of individuals between the

ages of 0 and 28 days, those between the ages of 29 days and 5 years, and those more than 5 years of age. The verbal autopsy is done by HWs and verified first by health supervisors, and the diagnosis for cause of death is made independently by two medical officers. The verbal-autopsy tool used at Ballabgarh is a validated tool developed by HDSS Ballabgarh.⁴ Each worker is assigned one day a month on which to enter the data collected during the previous months' house visits. The HMIS is also updated after the annual census. Thus, the Ballabgarh HDSS database is updated 13 times annually for each household. Each individual enumerated in the HDSS is provided with a unique personal identification number.

Other information is collected during the monthly visits by HWs but is not updated in the HMIS. This information comprises the number of visits made by Ballabgarh HDSS health supervisors for quality checks, malaria slide preparation, categories of TB patients registered, outcomes of TB treatment, cases of rheumatic fever, and outpatient and inpatient load at each sub-centre and the primary health centres. This information is communicated in paper format to district health authorities. It is also available in the electronic databases maintained at the primary health centres of the Ballabgarh HDSS.

The primary purpose of the HMIS is to support HWs in delivering health-care services to the population served by the Ballabgarh HDSS. Its other important objectives are to support program managers in monitoring and supervising the system's workers. The HMIS has undergone three generations of evolution over the years of its existence, reflecting the advances made in information technology during that time, as well as the changing needs of the users of the HMIS. Starting from a Microsoft disk operating system (MS DOS) in 1988, with DBASE III as its database, the current MySQL of the Ballabgarh HDSS's electronic

Table 2 Demographic characteristics of Ballabgarh HDSS (2011)

	Indicators	Result
1	Total Population	90 240
2	Male:female ratio	113
3	Male:female ratio at birth	123
4	Population density	1680/Km ²
5	Population growth/1000	8.5
6	Crude birth rate/1000	23.2
7	Crude death rate/1000	6.7
8	Crude out-migration rate/1000	16.5
10	Crude in-migration rate/1000	7.7
11	Total fertility rate	2.5
12	Neonatal mortality rate/1000 live births	27.2
13	Infant mortality rate/1000 live births	48.2
14	Under-5 mortality ratio/1000 live births	60.6
15	Life expectancy at birth	67
16	Life expectancy at birth (males) (years)	65
17	Life expectancy at birth (females) (years)	70
18	Immunization coverage	97.4%
19	Institutional Delivery	78.7%
20	Couple protection rate	59%
21	Antenatal care coverage	100%

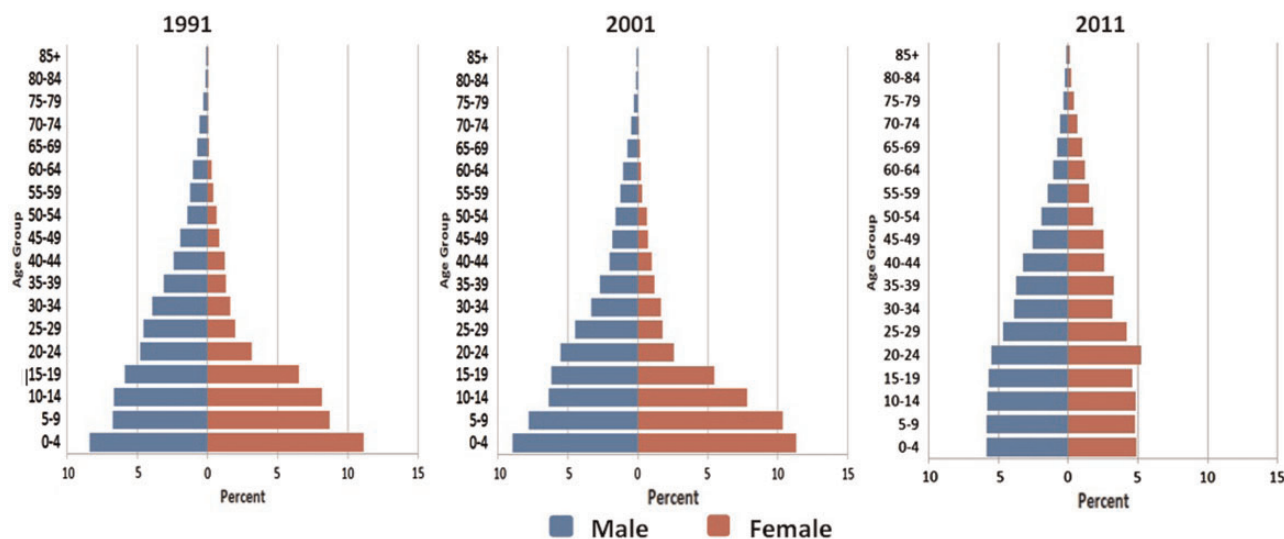


Figure 3 Changing population pyramid in the Ballabgarh HDSS (1991–2011)

Table 3 Information collected during the monthly and annual household visits by the health workers in the Ballabgarh HDSS

Information updated once a year through the annual census	
A) Household	Household number; family number; head of household
B) Individual	Relation to the head of household ; name; sex; date of birth; occupation; education; religion; caste; marital status; migration Status
Emigration	Date of emigration; destination of emigration; reason for migration
Immigration	Date of immigration; place from which immigration originated; reason for immigration; demographic details
Information collected during the monthly visits	
A) Antenatal care	Date of last menstrual period; date of registration; gravida; parity; date of tetanus vaccination; date of first Hb measurement; 1st Hb level; date of second Hb measurement; 2nd Hb level; blood pressure (systolic and diastolic); fundal height during each visit; high risk status; place of delivery; date of delivery; Total Iron tablets consumed; date of post-natal check-up; total number of visits made
B) Birth	Delivery outcome (live birth/still birth/abortions); date of birth; place of birth; type of birth (gestational age at delivery, normal delivery/caesarian section); birth weight; baby complication; sex of child; medical attendant
C) Immunization	Bacillus Calmette-Guérin (tuberculosis); oral polio vaccination; diphtheria-pertussis-tetanus; measles; vitamin A
D) Eligible couple	Husband's name; wife's name; date of marriage; present marital status
E) Family planning	Initiation date; type of method used; drop-out date; reason for drop out; service source
F) Morbidity	Diabetes; hypertension; stroke; coronary heart diseases; Tuberculosis; Treatment status
G) Mortality	Date of registration; date of death; place of death; duration of illness; tobacco use; cause of death (verbal autopsy)

Health worker male collects the information during annual census

Health worker females are responsible for maternal and child health. Once the antenatal case is registered, follow up schedule is generated by HMIS. Weekly antenatal care clinic are organized by female health workers female at sub-centers. They examine and record the findings and later update the HMIS

Health worker female follow up the cases registered during antenatal period. During monthly visit they collect the following information. For home deliveries, birth weight is measured at home (within two days of deliveries) and for institutional deliveries, birth weight is recorded from the discharge card

Health worker males are responsible for immunizing the child. Due date of immunization is provided to them through the work plan generated by the HMIS

During monthly visit, female health workers identifies and records eligible couple

During monthly visit by female health workers, information regarding family planning are recorded

Male health worker collects the information regarding the mortality status. These are self reported. Prescription slips are checked for confirmation. During confusions, physicians confirm the cases. For hypertension, diabetes, stroke coronary heart disease information was started from the year 2010 and for tuberculosis it started in 2012

Either of the health workers identify and record the mortality status. Verbal autopsies are carried after 12 weeks of death and later re-checked by the supervisors. Diagnosis for cause of death is done by the physicians

data system was chosen because it can handle a large data base and is stable, secure, scalable, and free. The Java (J2SE) programming language was chosen for the development of a graphical user interface.¹⁴

Key findings and publications

Since 2001, no definite trend has been observed in neonatal, infant, or under-5 mortality rates in the Ballabgarh HDSS area. Infant mortality in the area, governed chiefly by a plateauing of the neonatal mortality rate, has not declined over the past few years. Cultural beliefs play a major role in influencing newborn care practices in the area.^{15,16} Among certain common beliefs followed in the HDSS area are: (i) a mashing of the umbilical cord stump and its application to the eyes of the baby on day 6 after birth; (ii) a preference among mothers to not take their baby out of the house after birth until certain rituals are performed a few days after birth; and (iii) a preference among mothers to not weigh a baby at frequent intervals because they believe that doing so could lead to slowing of the baby's growth. Vaccination coverage is very high in the Ballabgarh HDSS (>95%), although a delay in vaccination is observed.¹⁷

Female foeticide is a 'felt need' of the population in the Ballabgarh HDSS area, and there is social pressure toward and acceptance of this practice. The technology of sex-selective abortion is widely available, despite a legal ban, and those likely to use it have adequate knowledge about its use. Government efforts to curb this practice have had limited success.¹⁸ A prospective longitudinal study was undertaken to describe the epidemiology of acute respiratory illness (ARI) caused by viruses in young children. During 440 child-years of follow-up there were 1307 ARIs, including 236 acute lower respiratory infections (ALRIs) and 19 severe ALRIs.¹⁹

Research done at CRHSP led to a policy change from a single-purpose (vertical approach) HW to a multi-purpose HW scheme at the national level in India.¹² Other significant work done at the CRHSP has been in relation to NCDs and demographic issues (realization of the need for denominators, birth and death registration by the HWs, and documentation of the rates and causes of death at different ages), which resulted in the measurement of various disease-related and demographic rates and helped the Ballabgarh HDSS to publish more than 150 articles in various peer-reviewed journals ([Supplementary Table 1](#), available as Supplementary data at *IJE* online).²⁰

The prevalence of risk factors for NCDs in the Ballabgarh HDSS area was assessed with the WHO STEPwise tool. In 2003, the age-adjusted prevalence of tobacco smoking was 41% for men and 13% for women.⁶ Other studies based on the Ballabgarh HDSS have reported the prevalence of tobacco use to range from 53%–72% among elderly persons.^{21,22} The prevalence of alcohol consumption in 2003 was

24.6% for men. Among men, 9.0% had a body mass index (BMI) >25.0, as compared with a BMI of 15.2% among women. The prevalence of measured hypertension was 10.7% among men and 7.9% among women.²³ We have undertaken a validation of the Global Physical Activity Questionnaire (GPAQ) and International Physical Activity Questionnaire (IPAQ) for the WHO at the Ballabgarh HDSS site.²⁴ We found that the GPAQ can be used in place of the IPAQ because both instruments measure and capture physical activity with good reliability and validity, and WHO now uses the GPAQ for STEPS surveys.²⁵

Metabolic syndrome was observed in 12% (95% CI: 8.5–16.8) of women in the Ballabgarh HDSS.²⁶ The prevalence of non-alcohol-related fatty liver disease in the Ballabgarh HDSS area was 30.7%, and hypertension and hypercholesterolemia were found to be independent risk factors for this.²⁷ The overall prevalence of irritable bowel syndrome in the Ballabgarh HDSS was 4% (95% CI: 3.5–4.6).²⁸ The estimated prevalence of clinical rheumatic heart disease (RHD) was 0.8/1000 among school children, and the prevalence of RHD as diagnosed with Doppler echocardiography was 20.4/1000 (95% CI: 16.9/1000–23.9/1000). On follow up, RHD had worsened in 4% but regressed in 28% of the subjects.²⁹ Of 5050 women tested at the Ballabgarh HDSS, cervical intraepithelial neoplasia (CIN) was diagnosed in 37, and 1 and 20, respectively, had diagnosis of CIN 2 or CIN 3.³⁰

The average participation among the residents of Ballabgarh in the various research projects conducted in the HDSS area is very high (>90%), and the rate of sample collection from participants is about 85%.^{4,26}

Future analysis plans

A wealth index has been used to assess the socio-economic status of the families in the Ballabgarh HDSS area. This is similar to the index used in the National Family Health Survey 3 of India.³¹ Birth weight is being analyzed critically to identify the determinants of low birth weight. Similarly, in view of a high abortion rate and low female-to-male sex ratio in the Ballabgarh HDSS, we are planning to document various causes of abortion and will also try to link this with the worsening female-to-male sex ratio.

We plan to do a survival analysis for vaccinated as opposed to unvaccinated children, and also to determine whether there is any sex differential in non-specific effects of vaccination. Effects on mortality of a delay in vaccination are also being analysed.

In addition to this, we are planning to investigate the trend in mortality in the Ballabgarh HDSS area from 2002 onwards, through verbal interviews, and will also document the mean ages at premature death from specific causes across time. Another future plan is to use InterVA-4 software to assign cause of death from verbal autopsies.

Because the Ballabgarh HDSS is a WHO collaborating centre for capacity building and research in NCD prevention and control, we plan to measure the incidence and prevalence of various NCDs over time and as influenced by factors such as diet and physical activity.

Strengths and weaknesses

Working strongly in collaboration with the state government of Haryana and various other national and international agencies is one of the major strengths of the Ballabgarh HDSS. The AIIMS is a premier centre in the field of medical education and research in India. Being an academic institute, it ensures the availability of experts for the various activities at Ballabgarh HDSS. Also, the training of medical students (post-graduate students, undergraduate students, and nursing students), one of the prime mandates of CRHSP Ballabgarh, helps in capacity building and continuous improvement in the quality of work. The provision of 24/7 curative and preventive services available to the residents of CRHSP Ballabgarh garners the trust and goodwill of the community, which help us in conducting research and surveillance activities. The Comprehensive Rural Health Services Project Ballabgarh is also implementing various national health programmes. Community participation in various policy-making decision and other activities of the HDSS has further helped in the development of a good rapport with the community, which again ensures a high participation rate.

One of the major strengths of the Ballabgarh HDSS is the quality of the data produced during its surveillance activities. This quality is ensured by the strong monitoring and supervision of its surveillance activities, followed by independent quality checks incorporated at various steps of its health and demographic surveillance activities. The site leaders use the HMIS for programme management and supervision and for research. Work plans generated by the HMIS help field-level workers to concentrate on identified activities for any specific household that they visit, thus ensuring optimal utilization of time. Surveillance activities are further strengthened by community participation through annual meetings with the leaders and community workers of the villages served by the CRHSP Ballabgarh and by involving community volunteers in delivering health care. Regular government funding of CRHSP Ballabgarh is another strength of the HDSS and guarantees long-term sustainability even in the absence of any external funding.

Approximately 5% of the HDSS population are temporary migrants, who stay for about 5 to 6 months in hard-to-reach areas of the HDSS and then migrate to another location. Because the migrant population changes every year, no surveillance of

them can be usefully employed. Rapid urbanization of the HDSS area because of its proximity to Delhi, the capital city of India, poses a threat to the surveillance activities designed for a rural community. However, it also gives us an opportunity to study changes in life style during this transition and to find answers to questions related to such changes and to urbanization. Overall, the Ballabgarh HDSS constitutes a general demographic cohort that can be utilized to study a vast majority of health issues, from communicable diseases to NCDs and changing patterns during the transition from a rural to a periurban population.

Data sharing and collaboration

Anonymous, individual record-level data are now available from the HMIS at the headquarters of the Ballabgarh HDSS upon permission from the professor in charge of the CRHSP Ballabgarh. The individual data are also being shared on a regular basis with the INDEPTH Network. As part of a government organization under the Ministry of Health and Family Welfare of the Government of India, the Ballabgarh HDSS is working in collaboration with various national (Indian Council of Medical Research, Department of Science and Technology) and international organizations (INDEPTH Network, CDC, WHO, UNICEF) in various research activities, and shares data on related issues required by different agencies. Other partners can request access to the data by contacting the official E-mail address of the CRHSP Ballabgarh (crhsp.ballabgarh@gmail.com).

Supplementary Data

Supplementary data are available at *IJE* online.

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Conflict of Interest: None declared.

KEY MESSAGES

- The Comprehensive Rural Health Services Project Ballabgarh is a self-reliant, autonomous body with government funding that has been in existence for more than 50 years and has made demographic and mother-and-child health data available for over 20 years.
- The Ballabgarh HDSS has been academically productive with more than 150 publications.
- The population served by the Comprehensive Rural Health Services Project Ballabgarh has been under surveillance since 1972, and its data have been computerized for the past 20 years, providing an excellent means of capturing change in the population over time.
- In the past decade, the work of the CRHSP on NCDs in Ballabgarh has spanned the entire health-care planning cycle from the estimation of disease burdens to elucidating the determinants and causes of diseases, evaluating interventions and translating them into interventions at the population level, and evaluating the outcomes of interventions.
- The Ballabgarh HDSS has also participated in the validating various tools for the assessment and improvement of health, such as the WHO STEPwise approach, verbal autopsy tools, the WHO Global Physical Activity Questionnaire, and the WHO International Physical Activity Questionnaire.

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