Research Article

Feasibility of establishing and operationalizing basic Health and Demographic Surveillance System (HDSS) in rural area of northern India

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Abstract

Background: Success of public health programmes is dependent on its inherent flexibility to continually incorporate new evidence and new experiences made available through timely, accurate, and relevant information. Unfortunately, routine health management information systems do not provide desired inputs at appropriate times.

Objective: To ascertain the feasibility of establishing and operationalizing health and demographic surveillance system (HDSS) in a defined rural population of district Jammu.

Materials and Methods: The present study was carried out in 6 villages in field practice area of Postgraduate Department of Community Medicine, Government Medical College Jammu selected using multistage random sampling methodology. Study area was mapped manually and by using geographic information system (GPS Etrax® system) depicting all households and associated landmarks. All the households were listed and assigned an alphanumeric unique identification number. Information on predesigned formats was then obtained from all listed households at initial and subsequent visit made at 6 months. Possibility of linking facility based data was also studied. Verbal autopsy was conducted as per International network for the demographic evaluation of populations and their health (INDEPTH) standardized verbal autopsy proforma.

Result: An HDSS was visibly functional within 6 months' time of initiation of the project using available manpower, space, and local support. No constraints were felt with regard to availability of separate space for HDSS as it was provided unconditionally either by the health care institution or panchayat. Local health workers and volunteers were retrained by the investigator for which no extra funds were needed. However, no vehicle for transportation was available, therefore personal vehicle was used to move from one village to another. It took 113 days (553 h) for a team of one investigator, one health worker and one volunteer to complete mapping, assign unique identification numbers, and collect baseline information of 1030 household spread over 3.56 km^2. Repeat survey took 60% less time i.e., 45 days or 225 h. Each household consumed 15–25 min on initial visit and 10 min on follow-up. A single verbal autopsy took longer time (60 min) to complete.

Conclusion: The study demonstrated that HDSS can be established and operationalized using available human and non-human resources albeit with little training and technical assistance. No significant bottlenecks were encountered in operationalizing HDSS. Vehicle, upgradation of available space, data management tools, incentive for staff, and volunteers would be needed to sustain HDSS.

KEY WORDS: Health and demographic surveillance system, feasibility study, demographic surveillance system, community oriented care

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Introduction

The process of information gathering is vital to the assessment of the population health. Both cross-sectional demographic health surveys (DHS) and longitudinal demographic surveillance system (DSS) are employed for this purpose. DHS has given way to DSS and to Health demographic surveillance system (HDSS) over the years to capture the entire

gamut of activities designed for information gathering in a longitudinal manner.[1]

Although, its roots are traced to sub-saharan Africa (1940s)[2] and to India and Bangladesh (1960s and 70s),[3] Navrongo HDSS (NHDSS) in northern Ghana (1993) is seen as the prototypal HDSS for new HDSS across Africa and Asia.[4] Late 90s paved the way for expansion and transformation into an overarching organization "INDEPTH" which recommended the use of DSS for such longitudinal systems.[3]

Only 25% of health infrastructure, medical manpower, and other health resources are available to the India's rural population, which constitutes nearly three fourths of total population.[5] It is much too evident that in order to improve the health statistics of India it is necessary to focus on rural population. Health management information system (HMIS) to HDSS may prove to be a good step in this direction.

HDSS sites provide reliable and accurate data on vital events. Additionally, it provides a sampling frame for community-based research in countries where vital registration systems are non-existent or weak.[6] HDSS equip policy makers with the valuable, long-term evidence that they need to make decisions on development and health priorities and determine cost-effective interventions that can be scaled up to improve the well-being of broader populations.[7] There are 4 established HDSS sites in India situated at Ballabgarh (1961),[8] Pune (1977),[9] Muzaffarpur (2007)[10] and Birbhum (2008).[11] Upcoming HDSS sites include Somarth in Palwal, Pravra and Karad in Maharashtra.

A typical HDSS is designed to prospectively collect and analyze the demographic and health related data of well-defined population in clearly defined geographic area over time. It begins with an initial baseline census followed by regular update of key demographic events (birth, death, migration) and health events. It may also include registration of marriages, divorces, changes in social status, household relationships, and fertility estimates. After the initial census, one can only become an HDSS member through birth to a registered member or through in-migration, and one can cease being a member either through death or through outmigration. The control censuses are done to check the completeness of the follow-up procedures.[1] Other core variables that are monitored in every update round of a HDSS site are location ID, individual ID, residency, membership, migration, and cause of death. International network for the demographic evaluation of populations and their health in developing countries (INDEPTH) allows comparative analysis and stimulate collaboration with international research institutions.

However, there are certain bottlenecks in implementing HDSS e.g., insufficient funding, refusal to participate by some household members etc. Interview fatigue from within the households represents a challenge to the sustainability of the HDSS and data accuracy. Another difficulty is to keep track of evolving households with time. First, as the population grows and migrates, households are subject to divide, merge or physically move. Second, household members may move from one household to another (e.g., as young women marry). Such changes can lead to confusion and inaccuracies in the database.[4,12,13]

In light of the above, the authors undertook present study with the objective to ascertain the feasibility of establishing and operationalizing HDSS in a defined rural population of district Jammu. This is the first such endeavor in this part of the country and a first step for establishing HDSS in the entire state of Jammu and Kashmir.

Materials and Methods

After obtaining ethical clearance from the institutional ethical committee, the present study was carried out in Miran Sahib Zone of RS Pura Block, a rural field practice area of Postgraduate Department of Community Medicine, Government Medical College, Jammu. The Block is located in the south-west of Jammu city, adjacent to Indo-Pak international border with total area of 273 km^2 and the average population density of 538 km^{-2}. The observations were recorded in 2 phases, firstly at the start of the study *i.e.*, Nov 2013–Jan 2014 and secondly, 6 months later *i.e.*, during May–Jun 2014.

All the villages of this zone were listed and 6 villages out of them were randomly selected. Detailed meetings were held with the stakeholders and opinion leaders of the area to solicit their support and cooperation for establishing HDSS. The possibility of engaging local volunteers for full-fledged implementation at a later date was also explored.

Investigators and team visited all the selected study villages and located important landmarks of the area upon which maps of selected villages namely Gazian, AlawalChak, Langotian, Benagarh, Tutre, and Ganda were drawn using paper and pencil. These maps were fine-tuned using GPS Etrax® system by personnel having expertise in the use of GIS methodology.

During initial visit, ID number was allotted to a respective village. After listing all households, the investigator led team made house to house visits and detailed the purpose of the study to the head of the family. An alphanumeric unique identification number was allotted to each household. The same number was also inked on an important household document like ration card or a bank pass book. During the same visit, all the individual members of the family were assigned a unique identification code which was maintained regardless of household re-arrangement (*i.e.* marriage) and the baseline information regarding the individuals was collected using the predesigned proforma.

In case a house was locked, a second visit was made to contact the family members. However, if the house was found locked on the second visit also, the information about the household was sought from the neighbours and confirmed later from the family members. Subsequent update visits were made after 6 months, during which an update of vital events like births, deaths, in or out-migration, marriage etc. was made including updating of map, household membership, and observations recorded on predesigned proforma.

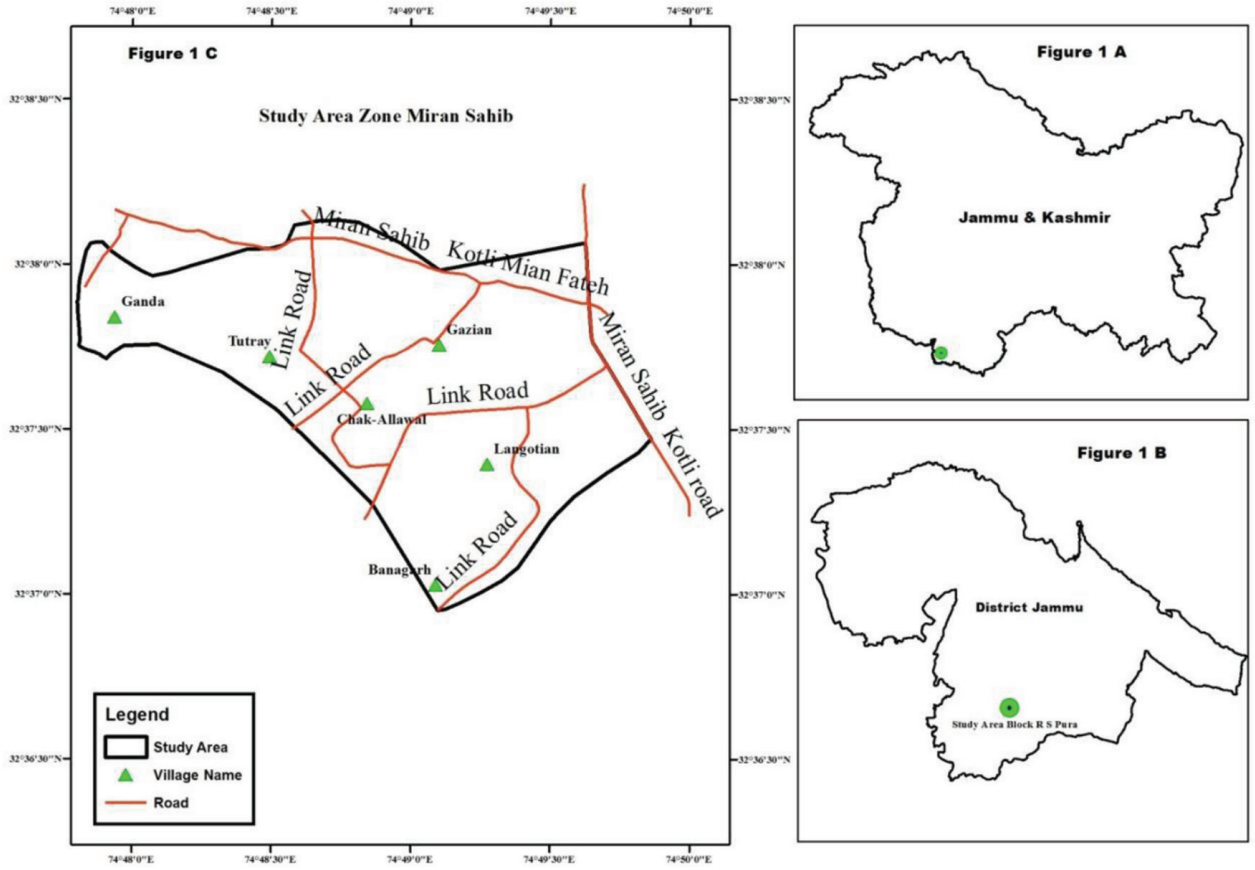

Figure 1A, B and C: GIS enabled map of the study area.

In case of any death, a detailed verbal autopsy was conducted as per INDEPTH standardized verbal autopsy proforma[14] by interviewing the closest caregiver of the deceased so as to ascertain the cause of death. In order to elicit the opinion of different stakeholders regarding establishment of HDSS, in person interviews were conducted by the investigator with health professionals having varying administrative experience in health services sector. The interviews were conducted at the convenience of administrators if they consented to participate in the study.

Result

Figure 1 A, B, and C depicts the GIS enabled map of the study area which was drawn by taking coordinates using GPS Etrax system. As estimated by GIS methodology, the study area is approximately 3.56 km^2 and lies at an elevation of 275–283 m from sea level with latitude ranging from 32°-31min-53.7s to 32°-38min-03.9s and longitude ranging from 074°-47min-48.4s to 74°-50 min after taking 8 coordinates by GPS Etrax system at the borders of study area. Manually drawn map of the same area and clusters of households in each village are shown in Figure 2. 1030 households spread across 6 villages spanning 3.56 km^2 were mapped by making house to house visits. Brief demographic features of the populations inhabiting these villages are given in Table 1A.

Note: Open spaces depicted in the figure are agricultural fields. Actual number of houses (1030) could not be shown because some household clusters are back to back constructed.

A total of 5150 inhabitants were enumerated at baseline census. Age and sex distribution revealed the average size of the family as 5 with males out numbering females (M:F ratio 1.12:1). Net increase in population was observed during surveillance period with births plus immigrants (24 + 17) surpassing deaths plus emigrants (14 + 9). Under-fives constituted 8.07% while 33.1 % were females in reproductive age group. Elderly comprised 6.3% of total population.

A 7 digit alphanumerical coding scheme has been followed to identify each individual. The household IDs are an extension of the area coding scheme, the extent of which is dependent upon the number of households in a particular

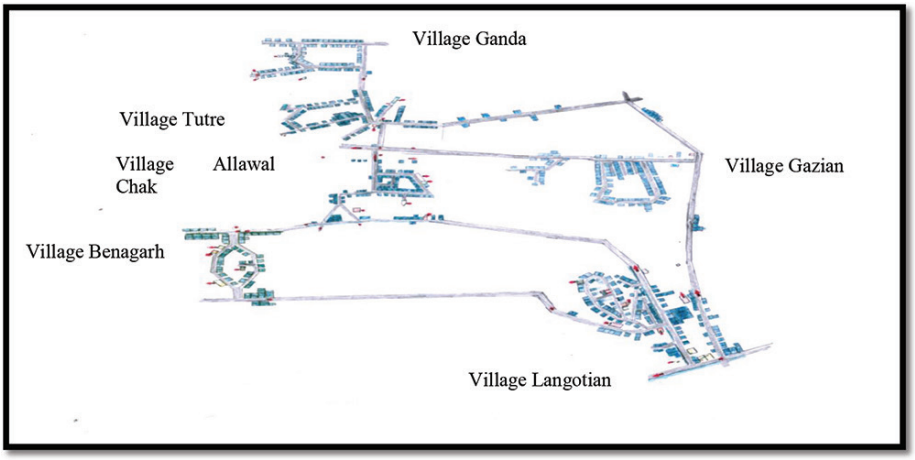

Figure 2: Manually drawn map of the hdss study area.

Table 1A: Village wise identification details, activities, and resources expended to operationalize HDSS

Identification details

Village	Village code	Household IDs	No. of households	Total population
Gazian	GZ-1000	GZ-1001 to GZ-1119	119	575
Langotian	LA-2000	LA-2001 to LA-2358	358	1782
Alawalchak	AL-3000	AL-3001 to AL-3133	133	637
Benagarh	BA-4000	BA-4001 to BA-4090	90	409
Tutre	TU-5000	TU-5001 to TU-5206	206	1102
Ganda	GD-6000	GD-6001 to GD-6124	124	645

(B) Activities and resources (Baseline HDSS)

Activities	Time	Resources	
		Human Resources	Non-Human Resources
(i) Sensitization meeting with opinion leaders	6 days		1. Space for conduction of meeting (one room) 2. One page brief information sheet
(ii) Identification of important landmarks. (iii) Assigning codes. (iv) Writing codes on gates.	12 Days		Stationary
(v) Manual preparation of maps (Rough drawings and refinements)	6 Days	1. Field Investigator 2. Volunteer 3. Local Health Worker	
(vi) Recording the coordinates making with Global positioning system	1 Day		GPS Etrax system®
(vii) Baseline data collection	68 days.		Stationary
(viii) Learning skills in map	2 days		
(ix) Electronic database	14 days		1 Laptop
(x) Movement to study villages*			Vehicle

(C) Key operation resources (Follow up HDSS)

Operations	Time	Human Resources	Non-Human Resources
(i) House to house visits	34 days	1. Field Investigator 2. Volunteer 3. Local Health Worker	Stationary 1 Laptop Vehicle
(ii) Verbal autopsy	4 days		
(iii) Electronic database	7 days		
(iv) Movement to study villages*			

*Includes time to move from one village to other.

area (Table 1A). To allot IDs to individuals within the households an alphabet was suffixed to the household ID, for example, if the first household in village Benagarh whose area code is BA4000 had 5 members, then the individuals were allotted BA4001A, BA4001B to BA4001E.

The time taken to do the manual and the GIS activity ranged between 15 and 25 min per household. For follow-up round, the time required was less (average 10 min per household). In households where death had occurred, it took nearly 60 min to do a verbal autopsy. For initial set of activities almost 3 months were taken during which investigator worked 5 h a day and 6 days a week (Table 1B). Activities in the follow-up phase took another 2 months (Table 1C). Total time taken by the investigator to complete baseline and follow-up activities, respectively took 113 days = 553 h (based on average working time of 5 h per day) and 45 days = 225 h.

Table 2 clearly demonstrates that various stakeholders were in favour of establishment of HDSS. Stakeholders did list some barriers which pointed more towards their ignorance about HDSS and its usefulness rather than their opposition to its establishment.

Discussion

HDSS functional across many parts of the world have richly contributed to the development of community oriented health care especially in Africa.[6] However, review of existing literature shows up certain HDSS elements inadequately worked up.[15] One such deficiency identified relates to feasibility of setting up such systems. Surprisingly, literature search revealed no HDSS before being set up ascertain their feasibility. These systems though being successfully implemented fail to offer a concrete roadmap for establishing newer ones, and trial and error largely determines the pace of establishment and sustainability. Clearly, there were no leads available for its establishment and challenges associated with it when undertook the project.

It is not to say that HDSS has succeeded equally everywhere; there are systems that have failed to establish as per the expectations.[16,17] The underlying reasons for this discrepant situation are diverse. A priori realization made us to include a qualitative component to investigate the same. Nevertheless, we would like to offer a caveat that the findings may still fail to depict a true picture for the reasons specified below:

Although the project has been undertaken in a limited area and in a small population with success, the replicability and expansion of the project on larger basis would require serious consideration of local influences.

Broadly, the study revealed that establishing HDSS is unlikely to pose great difficulty at the place, notwithstanding the fact that it was able to investigate only few components of feasibility in present study. As detailed in results section, the investigators did not encounter significant impediment in the attempt to establish HDSS in the area except constraints on account of sufficient funds. Also, there were not any refusals to participate or community fatigue, the two impediments cited by many investigators.[18]

Community fatigue is unlikely to pose serious problems considering that the investigators were active in the area since 1978 although it cannot be ruled out as a possibility if HDSS gets extended to areas outside the field of practice area of community medicine. Therefore, attempts are needed at the outset to tide over the phenomenon taking cues from other HDSS sites on how they tackled this issue.[1,4,7,18]

Investigators expected that HDSS would help produce favorable impact on health institutions and local community; on other programmes operating in the area; and on staff retention, contrary to the report impedimented by other investigators.[1,19]

From the observed facts, it is clear that establishment of HDSS and expansion is quite feasible with the available human and non-human resources. What is not clear though is the extent, scope, and time frame for its establishment? Review of existing literature fails to reveal consensus on this and many other issues including the ideal population base an HDSS should cater to. Assefa[20] reiterates that there is no exact formula or statistical ways to determine the optimal sample size of an HDSS. This uncertainty makes difficult for the project resources that would ultimately be required to sustain the HDSS in the area. As such there are wide variations reported by different investigators regarding the human and non-human resources required to run and sustain an HDSS.[8,9,11,21]

Table 2: Barriers and facilitators in establishment of HDSS in rural population of Jammu as opinionated by health care staff[a]

Factors		%
Favourable	Awareness about population enumeration methods (≥3 methods)[b]	90
	No significant barrier in the implementation of HDSS	75
	HDSS can be implemented using existing resources[c]	80
	Health facility linkage possible	80
Unfavourable	Data gathered through HDSS not useful	90
	Not aware about HDSS	40

[a]Based on in person interviews with medical officers, healthadministrators, senior support staff, key informants
[b]Census, SRS, DLHS etc.
[c]Man, money, logistics, time

It is believed that a population size of 1,00,000 would be ideal for the setting keeping in mind that the minimum available human resources in place to undertake initial activities under HDSS are there. It can be possible to establish the HDSS for 100,000 populations in the area of the present study with re-organization and training of existing staff. A closer study of 3 well established HDSS reveals that 20–40 technical and non-technical staff is needed to undertake diverse activities under HDSS.[9,11,20]

In the present study, we had approximately 40 staff members belonging to different cadres available (as on July 2015) in the field practice area who could perform the desired functions for HDSS upon being adequately trained. Staffs may fall short for some categories. It is pertinent to point out at this juncture that a mechanism is existent in the state where by department of health and medical education collaborate in extending health care services to approximately 2,00,000 population. It is another matter that the collaboration has been inefficient and only serves to fulfill the obligations of medical council of India which proposes that all medical colleges shall have to undertake community based training of undergraduates, interns, and postgraduates in dedicated field practice areas. Thus, establishment of HDSS could serve to strengthen both the medical college and department of health by efficient utilization of resources already in place. Even medical education curriculum gets enriched and training of undergraduates and interns in such systems ultimately churn out competent, skilful community physicians as envisioned by the medical council of India.[21]

It is true that the funds could be a hindrance in the attempt to establish the HDSS. A survey conducted by INDEPTH in 2009 estimated that an average expenditure to the tune of USD 2,50,000 per year is required for an HDSS of 60,000 people with 3 update rounds per year in rural settings. This gives a per capita cost of USD 4.17.[10] This is still cost effective when the cost is compared with the value of the data generated. The cost obviously would be cut down by at least two thirds if the existing staffs are employed for HDSS. This cut off limit is based on the usual level of expenditure incurred on human resources in most public settings in any program.

Notwithstanding the above, opportunities for tapping the funds exist as some activity areas in National Health Mission[22] and research can be strengthened if an efficient HDSS is in place. This mechanism is expected not only to be mutually beneficial but treads along the principles of convergence thought so important in preventing the duplication of resources and efforts in achieving common and mutually inclusive objectives.[7,23]

HDSS managers should therefore be able to highlight the utility of this platform for enhancing the surveillance infrastructure if they wish to succeed. Further, advocacy must focus on projects that will make their systems more relevant to the national and local agenda through direct engagement with the Ministry of Health.

Fortunately few funders have started to agree to provide some support for running the core HDSS in INDEPTH projects. It is worth mentioning here that Tanzania, Ghana and Burkina Faso are examples of countries where the Ministries of Health contribute in small but significant ways to the running of HDSSs in their countries which collaborates with the Ministry of Health.[6] In India, the Ballabgarh HDSS serves to demonstrate this quite effectively.[8]

Finally, although implementing a HDSS site presents several challenges, the benefits far outweigh the difficulties associated with its establishment. Nonetheless, the challenges and obstacles encountered can be overcome if the concept of the HDSS was well explained and is acceptable to the stakeholders and the community.

Conclusion

The key lesson learnt is that any HDSS site for that matter must develop and adapt in accordance to local needs and situations. Facilitating factors for establishment of HDSS in the area are high community acceptability, availability of requisite human resource, and technical expertise to train the staff. However, tools for data collection and management, including hardware, manual networking of data, internet connectivity could pose some problems which can be overcome with proper funding in place.

Recommendations

A strong health care system requires a strong health management information system. Efficient policy planning and evaluation of health care projects require accurate and timely information which only an efficient HMIS provides. A well-established HDSS embedded within HMIS could supplement and enrich the information by providing quality data to the planners. Re-organization and appropriate training of the human resource would be a key to success. We intend to sensitize the Government and other agencies about its utility and seek funding to operationalize HDSS on a larger population of 1,00,000 envisaged for expansion in a phased manner.

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