PUBLIC HEALTH CARE DELIVERY SYSTEM IN RURAL INDIA: A CASE STUDY OF SEWAPURI BLOCK (VARANASI DISTRICT, U.P.) - A LESSON FOR NIGERIA

Dr. Meeta Ratawa Tiwary,

Senior Lecturer , Department of Geography,
Yobe State University, Damaturu, Yobe, Nigeria.

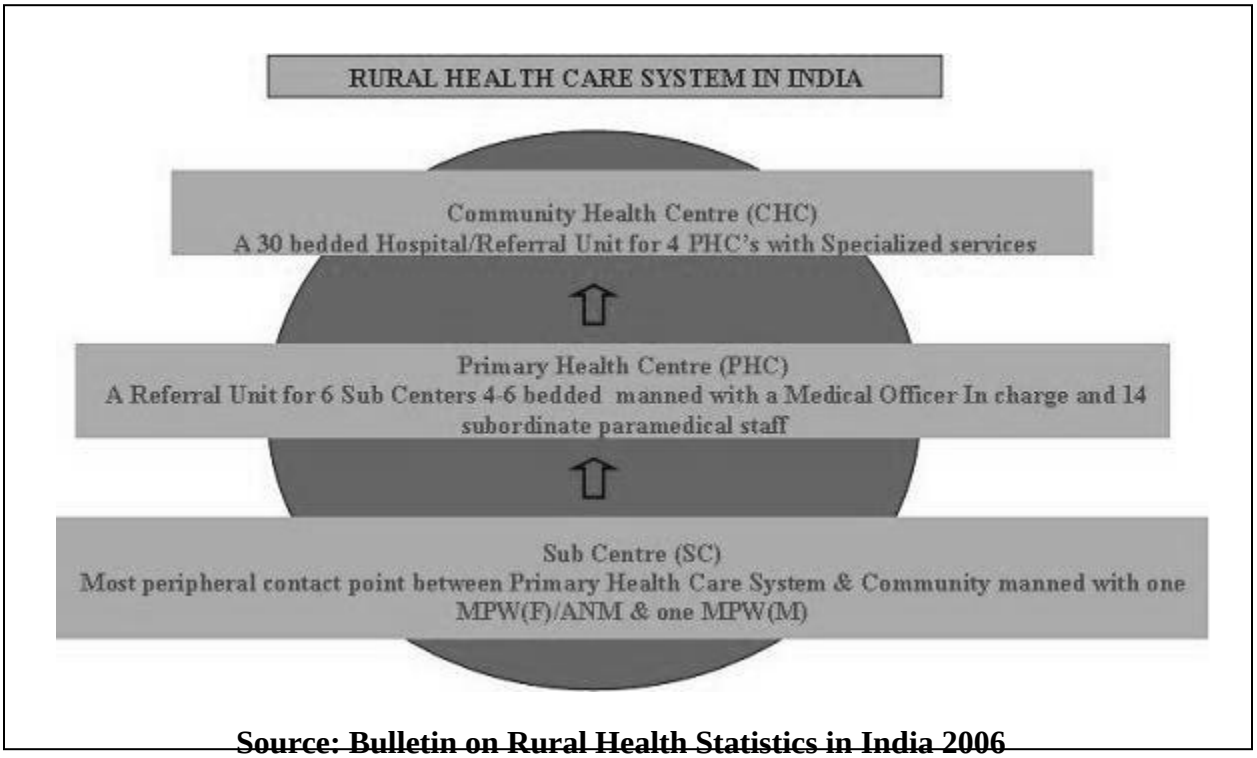
ABSTRACT

Good health is a prime and vital indicator of the quality of life which is considered as one of the fundamental rights of human being. Therefore, it becomes an earnest need for all the nations to provide health care facilities and services to all its citizens. Growing population, poverty, income inequality, gender disparity, health inequity and poor access to health care facility are few common problems persisting in rural India and Nigeria. The present pattern of rural health care delivery system is appropriate in solving the problem but it is unable to expand its facility to the growing rural population. The Rural Health care delivery system in India comprises the hierarchy of the Community Health Centres (CHCs), Primary Health Centres (PHCs) and Sub Centres (SCs) to provide curative and specialized health facilities to rural population. Growing population and growing expectations of the people along with the rising costs of health care have produced a challenge for transforming the public health care into an accountable, accessible and affordable system of quality services both in India and Nigeria. The present study attempts to describe the present public health care delivery system in rural India and Nigeria, with a case study of spatial pattern and efficiency of rural health care delivery system in Sewapuri block along with the proposal of new network of health facilities. The study also suggests similar proposal for the Nigerian health system.

Key Words: Rural health care, levels of health care, rural health system**,** rural health care services, health care facility, quality of human life, National Rural Health Mission, Nigerian health system.

Introduction

Health is one of the vital indicators reflecting quality of human life and socio-economic development of a country. In this context, provision of health care services to all its citizens becomes one of the primary responsibilities of the state. India has made possible efforts to establish a comprehensive and decentralized health care system in both urban and rural areas. After independence India adopted the goal of welfare state and launched a scheme called Community Development Program for socioeconomic development of rural population. CDP had three major objectives to fight against poverty, ignorance and poor health in rural areas. For addressing the health problems of the rural population, an integrated health service system was established on the lines of Bhore Committee. Long before the Alma Ata Declaration of 1978, which promised 'Health for All' by 2000, Bhore Committee (1946) recommended that a Primary Health Center should be set up to serve as the focal point for providing comprehensive, curative and preventive health services in rural areas (Goel, 2001). Since then the rural health care delivery system has gone through various changes in terms of its organization, staffing patterns, infrastructure and co-ordination. At present, a hierarchal three tier health delivery system exists from the village to block level, the pattern of which is based on the administrative design of Gram Sabhas. National Rural Health Mission was conceptualized during the Tenth Five Year Plan to augment health care services in the rural areas of the country. The National Rural Health Mission (since 2005) covered the whole country with special focus on 18 States, which had either weak socio-demographic indicators and/or primary health infrastructure. The National Rural Health Mission aims to create a comprehensive Budget Head by integrating all vertical health programmes of the Departments of Health and Family Welfare, namely, RCH II, Malaria, National Leprosy Eradication, National Kala-azar, National Iodine Deficiency Disorder and the National Blindness Control Programme. A generic public health delivery system envisioned under NRHM from the village to block level has been introduced at the national level (Figure 1and 2) as well as the population norm at which the health care facilities serve the rural area (Table1).

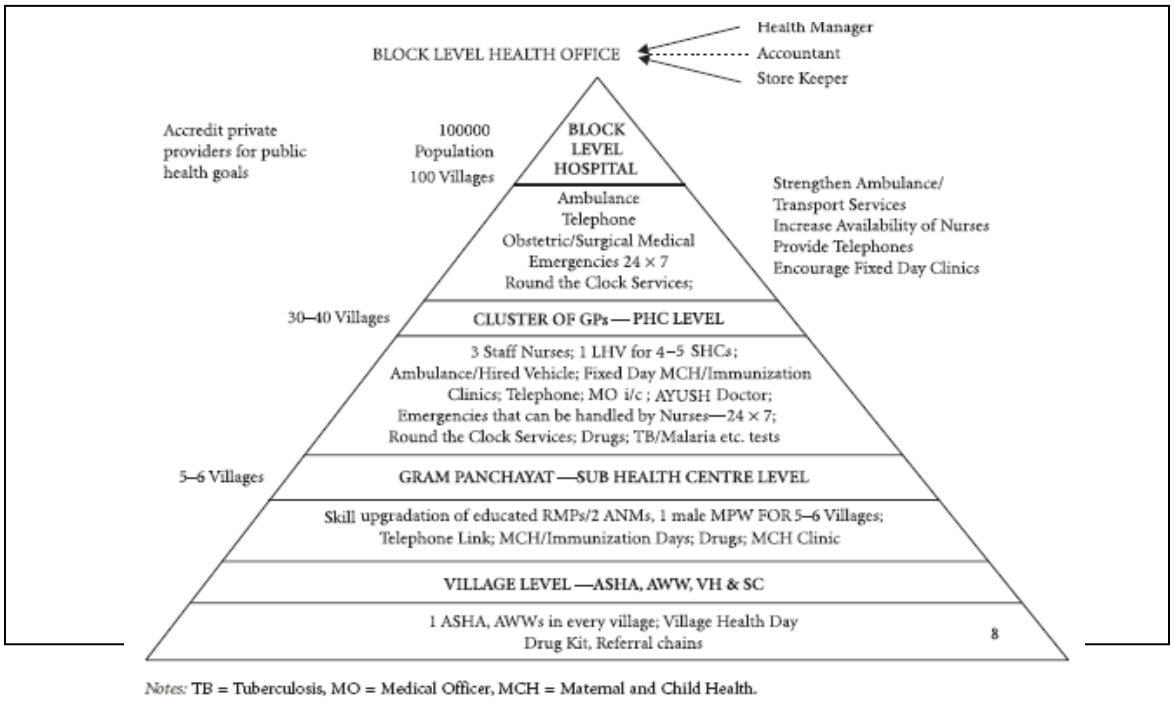


Source: Bulletin on Rural Health Statistics in India 2006

Figure 1: Three tier health delivery system

Table 1: Population norm for three tier health delivery system in rural areas

Center	Population Norm	
	Plain Area	Hilly/Tribal/Difficult Area
Sub Center	5000	3000
PHC	30000	20000
CHC	120000	80000



Notes: TB = Tuberculosis, MO = Medical Officer, MCH = Maternal and Child Health.

Source: 11th Five Year Plan, Health and Family Welfare and AYUSH

Figure 2: NRHM- Illustrative Structure

The importance of health of community as well as to personal welfare has long been recognized by public authorities in Nigeria. This perhaps explains why since the Second World War the various national development plans that have been executed have given considerable attention to health care provision. At the same time increasing population in Nigeria against the background of the economic crises in the country since the late 1970s has drawn the attention of public authorities to the need for population growth control. As a result, a national population policy has been put in place since 1988 and it is being implemented in all parts of the country. Nigeria is made up of at least 250 linguistic groups (which some describe as ethnic groups), of which 3 are major groups comprising over 60% of the total population. Although all of these groups share

common major macro-culture and macro traditions, each evolved its own micro-culture and micro traditions in response to prevailing environmental circumstances. Traditional medicine and healing constituted part of the micro cultural evolution. In pre-explorers and pre-western trader's Nigeria, traditional medicine was the system of health care delivery. It would seem from available accounts that the earliest form of Western-style health care in Nigeria was provided by doctors brought by explorers and traders to cater for their own well being (Chuke , 1988). A series of plans formulated goals for nationwide health care services. The Fourth National Development plan (1981-1985) addressed the issue of preventive health services for the first time. The policy statement contained in this plan called for the implementation of the Basic Health Services Scheme (BHSS), which provides for the establishment of three levels of health care facilities; namely 1) Comprehensive Health Centers (CHC) to serve communities of more than 20,000 people; 2) Primary Health Centers (PHC) to serve communities of 5000 to 20,000 persons; and 3) Health Clinics (HC) to serve 2000 to 5000 persons. Thus, a CHC would have at least 1 PHC in it catchment area (ideally 4) and a PHC would have at least 1 HC in its catchment area (ideally 2). These institutions were to be built and operated by state and local governments with financial aid from the federal government. By this policy, the provision of health services would be the joint responsibility of the federal, state and local governments. The adoption of the WHO target of Health for All by the Year 2000 by the federal government was marked by shifts in emphasis and structural changes in health care administration. Nigeria is currently made up of 36 states and over 500 local government areas. Each local government area (LGA) is made up of between 150,000 to 250,000 people. By the scheme proposed in the Fourth National Development plan, each LGA would have a minimum of 7 PHCs and 30 HCs with at least one CHC at the apex of the health care services. The larger LGAs would each have, at least 12 PHCs and 50 HCs feeding into one or more CHCs (WHO, 1987).

Objectives:

The objectives of the study are:

- To understand the hierarchy of health care facilities in India and Nigeria.
- To study the efficiency of health care facilities in ratio of population / household. (as a case study of Sewapuri block, Varanasi district in India)

- To propose and locate new or additional health care facilities (as a case study of Sewapuri block, Varanasi district in India)
- To suggest similar method of locating additional health facility in Damaturu Local Government Area.

Data base and methodology:

The present study is based on secondary sources of data collected from PHC (Ghosila village) and Primary Census Abstract (2001). Information collected for the selected health care facilities (CHC, PHC, SC) were:

(1) Whether the service is available or not

(2) If available, then where they are located

(3) Name of the villages that each center serves

(4) Number of persons that each center serves

The data pertaining to health facility in Nigeria and Damaturu Local Government Area have collected from Directory of Health Facilities in Nigeria, 2011.The number of additional health facilities has been proposed in Sewapuri block of Varanasi district in India on the basis of the population norm (Table 1). Keeping in mind the growing population of the area, additional centers have been proposed according to the projected population. .The maps have been prepared by the digitization of the study area from the mosaiced toposheets no. 63 K/11 and 63 K/15 on MapInfo Professional 8.5 software. New locations for proposed number of health centres have been derived through model of retail gravitation introduced by Reilley popularly known as breaking point formula. The formula is

$$B2 = \frac{D12}{1 + \sqrt{P1/P2}}$$

[Where P1 and P2 are the population of two villages; D12 is the distance between the two villages. Point B2 has been marked closer to the village having minimum population].

Similar methodology of finding and locating new health facilities have been suggested for Damaturu Local Government Area.

Health care facilities

Health care extends beyond the narrow limits of medical care. It embraces a multitude of 'services provided to individuals or communities by agents of the health services or professions, for the purpose of promoting, maintaining, monitoring, or restoring health' (Last, 1993). It is the responsibility of the government to provide health care to its citizens equally. In India, health care is completely a governmental function. There are three levels of health care: Primary health care, Secondary health care and Tertiary health care. Primary care level is the first level of contact of individuals, the family and community with the national health system where essential health care is provided (Park, 2007). The Alma Ata Conference defined primary health care as follows "Primary health care is essential health care made universally accessible to individuals and acceptable to them, through their full participation and at a cost the community and country can afford" (WHO, 1978). The next higher level of care is the secondary (intermediate) health care level. At this level more complex problems are dealt. The Tertiary care level is a more specialized level than secondary care level and is provided by the regional or central level institutions, e.g., Medical College Hospitals.

(a) Health system: The different levels of health care are organized into a well coordinated system. Community participation is now a major component of the health care system. A medical system consists of a variety of distinct elements and interactions among elements and interactions among them. A medical or health care system consists of vectors; cultural, economic and environmental conditions; caregivers; government regulation; human behaviour; and intervention, including the interaction among all of these (Meade and Earickson, 2000)

(b) Health care services: A *service* is a function provided for persons and its level refers to such features as its sophistication, cost, and the frequency of demand for it (Hodgson and Jacobsen, 2008). Health care services should be comprehensive, accessible acceptable, affordable and provide scope for community participation.

(c) Health care facilities: A *facility* is an establishment providing services; its level is defined by the highest level of service it offers (Hodgson and Jacobsen, 2008). Low level services can be supported by a relatively small population and are located relatively densely in space. High level services require a large supporting population and are located sparsely in space. In India the rural health care facility comprises of CHC, PHC and Sub center and has successive inclusiveness. Successive inclusiveness means that facilities of each level offer the services available at all lower levels of facility as well as those that require at least at that level of facility (Hodgson and Jacobsen, 2008).

A case study of Sewapuri block (India, Uttar Pradesh) and Damaturu LGA (Nigeria, Yobe State)

Sewapuri block is located between 25º 12´32´´N - 25º25´N and 82º 40´E – 82º 50´ 17´´E in the south eastern part of the Varanasi District in Eastern Uttar Pradesh. It has a total area of 169.12 Sq. Km with 12 *Nyay Panchayats*, 82 *Gram Sabhas* and 188 villages having population of 2,05,567 persons (Census, 2001). The growth rate of population of the study area is 2.93 percent per annum. Sewapuri block is entirely rural in character. Growing population and growing expectations of the people along with the rising costs of health care have produced a challenge for transforming the public health care into an accountable, accessible and affordable system of quality services. The projected population for the year 2011 is 2, 65,755 persons (the census 2011 is not available yet). By 2021 the population of the block will be 3,43,567 persons.

Damaturu Local Government was created in 1976 Borno State. With the creation of Yobe State in 1991 it became the State capital. It shares borders with Borno State to the East, Fune LGA to the West, Tarmuwa LGA to the North and Gujba LGA to the south. The local government has a population of 1,00,995 according to 2006 census. The population of the LGA is unevenly distributed with Damaturu town being the most populated area. Damaturu is divided into eleven (11) political wards namely Njiwaji/Gwange, Nayinawa, Damakasu, Murfakalam,

Kallalawa/Gabai Sasawa/Kabaru, Bindigari/Pawari, Gambir/Moduri, Kukareta, Damaturu central and Maisandari. The LGA has four districts namely Shehuri, Maisandari, Sasawa and Bulaburin. These four districts are further divided into 28 villages and the numerous settlements. Damaturu town still uses the traditional leadership despite having modern type of settlements (CMAR, 2011).

Health care facilities in Sewapuri Block

Sewapuri block has one CHC, three PHC and thirty five subcentres. The **Sub-Centre** is the most peripheral unit and first contact point between the primary health care system and the community. Each Sub-Centre is manned by one Auxiliary Nurse Midwife (ANM) and one Male Health Worker MPW (M) .One Lady Health Worker (LHV) is entrusted with the task of supervision of six Sub-Centres. Sub-Centres are assigned tasks relating to interpersonal communication in order to bring about behavioral change and provide services in relation to maternal and child health, family welfare, nutrition, immunization, diarrhea control and control of communicable diseases programmes. The Sub-Centres are provided with basic drugs for minor ailments needed for taking care of essential health needs of men, women and children. In Sewapuri block there are 35 ANM, 35 MPW and 6 LHW.

PHC is the first contact point between village community and the Medical Officer. The PHCs provide an integrated curative and preventive health care to the rural population with emphasis on preventive and promotive aspects of health care. The PHCs are established and maintained by the State Governments under_the Minimum Needs Programme (MNP)/ Basic Minimum Services Programme (BMS). At present, a PHC is manned by a Medical Officer supported by 14 paramedical and other staff. It acts as a referral unit for 6 Sub Centres. It has 4 - 6 beds for patients. The activities of PHC involve curative, preventive, primitive and Family Welfare Services. In Sewapuri block there is one PHC at Ghosila village and two additional PHCs at Domela and Pachwar village. **CHCs** are established and maintained by the State Government under MNP/BMS Programme. It is manned by four medical specialists i.e. Surgeon, Physician, Gynecologist and Pediatrician supported by 21 paramedical and other staff. It has 30 in-door beds with one OT, X-ray, Labour Room and Laboratory facilities. It serves as a referral centre for 4 PHCs and also provides facilities for obstetric care and specialist consultations. In

Sewapuri block the CHC started functioning since April 2007. In the beginning there was inadequate infrastructure at CHC but at present, there are one Surgeon, Physician, Gynecologist and Pediatrician supported by 21 paramedical and equipped with other facilities.

Distributional pattern of health care facilities

CHC is located at Hathi Bazar and is well connected with road network and is accessible being very close to the Hathi market. But the CHC is accessible only to the people of Hathi and surrounding villages (Figure 3). This is because it is not located at the center of the block; rather it is located in the eastern part of the block which makes travel distance and travel time greater for rest of the population of western and southern part of the block Three PHCs are located in the central and western part of the block. Southern part of the block has only a few subcentres. The 35 SCs in the block are distributed all over

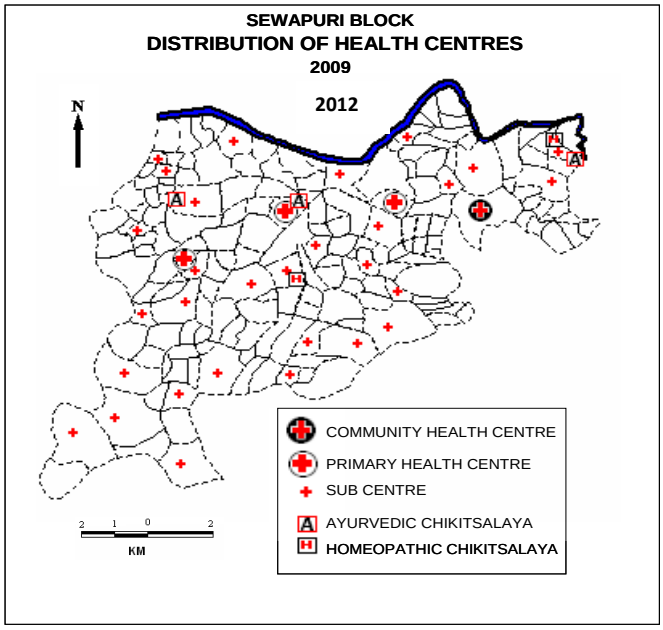


Fig. 3

the block. They serve only 95 villages covering 158595 persons and 116.89sq.km area out of 188 villages covering 205567 persons and 169.12sq.km. There are 17 subcentres that serve villages

having population less than 5000 persons and 14 subcentres that serve villages having population more than 6000 persons. There are only 4 SCs that serve the villages having population of 5000-6000 persons (5000 persons / SC as a set population norm). There is a disparity in the number of villages that are being served by each SC, for example Pachwar, Sonbarsa, Bhikhampur and Barki are the villages having SC that serve only their own population which is less than 5000 persons each. Whereas there are some SCs which serve 4-5 villages having more than 5000 persons in total, for example, KalikaDham, Sirhira and Kapsethi (Table 2 and 3). The present spatial pattern of health facility in the block is entirely based on the administrative design of the gram sabhas and not the needs of the population or the number of persons within a particular gram sabha (Figure 4). Moreover, the system is unable to expand its facility and services according to the growing population.

Table2: Sub centres and their served villages, population and area

Sub center	Serving Villages	Population covered	Serving Area (sq.km)
1. Sirihara	Sirihara	1584	1.00
	Gopalpur	980	0.15
	Ghosila	1099	1.10
	Gajepur	1531	1.00
	Uparwar	1678	1.01
2. Bhitkuri	Bhitkuri	1197	2.20
	Majhiyarpur	733	0.96
3. Sakalpur	Sakalpur	1509	0.91
	Dalpattipur	245	0.16

	Bankat	1308	0.62
	Suilra	668	0.30
4. Pachwar (additional PHC and SC)	Pachwar	2096	0.98
5. Kapsethi	Kapsethi	2014	1.76
	Lohradih	2088	1.53
	Bankat	559	0.36
	Raghunathpur	1496	1.45
6. Gaharpur	Gaharpur	614	0.50
	Gairaha	970	0.98
	Maharajpur	1311	0.49
	Rasulhan	1458	0.34
7. Gajapur	Gajapur	1531	1.00
	Tatehra	524	0.25
	Pura Majhola	381	0.17
	Mokarwan	524	0.25
	Lakhansenpur	1391	0.90
	Daulatia	730	0.78
8. Kalika Dham	Bazar Kalika	1378	0.11
	Bajardiha	444	0.46
	Baradih	3210	2.98
	Banauli	1391	1.40
	Odarhan	893	0.59
9. Barema	Barema	1660	2.15

	Hariharpur	827	0.71
10. Rameshwar	Hirampur	733	1.13
	Lachipur	633	0.67
	Parsipur	613	0.44
	Jagapatti	856	0.80
11. Hathi	Hathi	4200	2.00
	Amripur	921	0.80
	Telari	160	0.43
	Ramduttpur	193	0.17
12. Maniaripur	Maniaripur	1384	1.35
	Khargupur	1894	0.89
	Barni	1826	1.17
13. Tendui	Tendui	4094	4.16
	Gaddopur	691	0.55
	Rakhi sattanpur	281	1.59
14. Sattanpur	Sattanpur	2958	2.26
	Khamauna	900	1.10
	Mahangipur	2010	0.75
	Raisirampur	1979	0.60
15. Ramdih	Ramdih	1353	0.77
	Arjunpur	1717	1.52
	Matuka	3521	1.21
16. Purandarpur	Purandarpur	856	1.05
	Gorain	1737	0.83

	Shambhupur	455	0.44
17. Sonbarsa	Sonbarsa	1080	0.92
18. Barora	Barora	2310	0.50
	Deipur	3471	1.48
	Khemapur	1685	0.81
	Dhanipur	20	0.08
19. Kardhana I	Kardhana	10231	5.26
20. Kardhana II	Kardhana		
21. Amini	Amini	4726	2.55
	Khalispur	2330	2.67
	Ramrathauna	444	0.45
22. Bhorkala	Bhorkala	2721	1.97
	Kinnupur	141	0.31
	Jogiapur	555	0.76
	Virapur	659	0.72
23. Leduai	Leduai	926	0.81
	Kansraipur	628	0.40
	Lalpur	1138	0.93
	Nayapur	1323	0.69
24. Ramnisf	Ramnisf	422	0.37
	Kharagrampur	1018	0.49
	Todarpur	1036	1.08
25. Dilawalpur	Dilawalpur	1863	2.57
	Chaklola	521	0.62

	Kuttupur	451	0.25
26. Bhikhampur	Bhikhampur	3234	4.29
27. Barki	Barki	3124	3.22
	Rampur	1979	0.60
	Newadia	1043	0.49
28. Sikari	Sikhari	1222	1.00
	Belwa	1748	1.15
29. Domaila	Domaila	2171	3.29
	Milkipur	794	0.85
30. Chatermanapur	Chatermanapur	4184	2.15
	Chitrasenpur	3412	1.94
31. Thatra I	Thatra	7748	6.13
32. Thatra II	Thatra		
33. Pure	Pure	5416	2.85
34. Bihra	Bihra	4213	3.89
	Gudia	1951	1.38
35. Birampur	Birampur	575	0.71
Total subcentres = 35 Total villages covered = 95 Total population served = 158595 Total area served = 116.89sq.km			

Source: PHC, Ghosila, Sewapuri Block.

Table 3: Distribution of health centres

Population	No. of subcentres	Sr. no. of the subcentres

<5000	17	2,3,4,6,7,9,10,16,17,22,23,24,25 ,26,28,29,35
5000-6000	4	11,12,13,33
>6000	14	1,5,8,14,15,18,19,20,21,27,30,3 1,32,34

Compiled by the author (Source: Table 2)

Health care facilities in Damaturu

In Nigerian context the provision of care at this level is largely the responsibility of Local Governments, with the support of the State Ministries of Health and within the overall National Health Policy. Most private sector practitioners are also located at this level but placed directly under the supervision of the private Hospital Regulatory and Licencing Board. Primary Health Facilities here are designed to serve catchment area population of ten to thirty thousand people. Nigeria has 30098 primary health care facilities out of which 21808 are public and 8290 are private (DHF, 2011). In Nigeria secondary health care is available at the LGAs as defined by the authorities of the state. Adequate specialized supportive services, such as laboratory, diagnostic, blood bank, rehabilitation and physiotherapy are provide at this level. Nigeria has 3992 secondary health care facilities out of which 969 are public and 3023 are private (DHF, 2011). In Nigeria every state has a Federal government established teaching hospital or a Federal Medical Centre. It has total 83 tertiary heath facility out of which 73 are public and 10 are private (DHF, 2011). In Damaturu LGA there are two private health facility of secondary type whereas other twenty three are public health facility (Table 4).

Table 4: Distribution of Health Centres in Damaturu LGA.

Health Facility in Damaturu Local Government Area	**Ownership**	**Health Facility**

		Type
yo Ajari Dispensary	Public	Primary
yo Ajiko Medical Centre	Private	Secondary
yo Borno Medical Clinic	Private	Secondary
yo Damakasu Dispensary	Public	Primary
yo Damanturu Federal Poly Clinic	Public	Primary
yo Damanturu Model Primary Health Centre	Public	Primary
yo Damaturu FSP Maternal and Child Health Clinic	Public	Primary
yo Damaturu Government House Clinic	Public	Primary
yo Damaturu Nigerian Police Force Clinic	Public	Primary
yo Dikumari Dispensary	Public	Primary
yo Federal Secretariat Staff Clinic	Public	Primary
yo Gabai Dispensary	Public	Primary
yo Gambir Dispensary	Public	Primary
yo Gwange Maternity and Child Health Clinic	Public	Primary
yo Kabaru Dispensary	Public	Primary
yo Kalallawa Dispensary	Public	Primary
yo Kukareta Maternity and Child Health Clinic	Public	Primary
yo Maisandari Clinic	Public	Primary
yo Murfa Kalam Dispensary	Public	Primary

yo Nayinawa Dispensary	Public	Primary
yo Sasawa Dispensary	Public	Primary
yo State Specialist Hospital	Public	Secondary
yo Very Important Persons Clinic	Private	Secondary
yo Yobe Medical and Maternity Clinic	Private	Secondary
yo Yobe State Secretariat Clinic	Public	Primary

Source: Ministry of Health, Damaturu, 2014.

Problems and Planning

There are some significant problems common to both study areas, which are following:

- The existing spatial distribution of the health care facilities is incapable to provide health care services to the present population.
- Poverty and rising costs of health care is causing a problem in the study areas in utilization of health care services. People are poor and are unable to afford the health care facilities provided by private sector. On the other hand the public sector is unable to provide proper health care services.
- There is a gap in health infrastructure and human resources. Lack of staffs results in improper follow up of patients. Appropriate and trained human resource as well as adequate health infrastructure is needed.
- There is a lack of adequate number of health facilities in the study areas.
- Lack of any sort of mobile health facility accentuates the problem especially in villages located far away from SCs India and Primary Health Clinics and Health Posts in Nigeria.
- There is a lack of community participation with the present health care facility system.
- There is a lack of Private Public Partnership (PPP) which would otherwise solve the problem of present spatial distribution of health facilities and also making them affordable.

- Problems specific to Nigerian health system: The 2000 World Health Report ranked Nigeria as the 187th of the 191 member nations for its health systems performance. That speaks a whole lot about the fact that our health system is not working. The health system in Nigeria is structured along the three levels of primary, secondary and tertiary. However, the neglect of primary health care system, its maldistribution as well as the secondary health care, has resulted in an inverted health care pyramid. In future also this will not produce any health for the people but will always have the threat to collapse.

Planning for the spatial location of new health care facilities in Sewapuri block:

According to the set norm for India given in Table 1, the study area should have 4 PHCs at 1 CHC and 6 SCs at 1 PHC. In Sewapuri block there are 3 PHCs at 1 CHC. The number of SCs per PHC is 11 instead of 4. So from administrative point of view it becomes difficult for the PHCs and CHC to maintain link with all SCs. The number of PHCs and SCs are less than the required number for present population. The study area should have 1 CHC, 7PHC (4 Main PHC and 3 additional PHCs) and 42 SCs. According to the projected population Sewapuri block must have 2 CHCs, 8 PHCs and 53 SCs in the year 2011. But unfortunately the block provides health services with the same spatial arrangement of health facilities even at present. New location of health facilities have been found out with the help of the formula of breaking point given by Reilley. Groups of villages have been formed which do not have public health facility. Population of 2001 census have been taken to calculate the location of new health facilities. Sixteen new locations have been found out to locate four additional PHCs and seven additional SCs, Ayurvedic Chikitsalaya, Homeopathic Chikitsalaya and MCH (Table 5 and Figure 5). Levels of facility have been assigned the locations wherever they are not present in order to ensure equitable distribution of health facilities in the study area.

A lesson for Nigeria:

In Nigeria the priority of the governments was to improve the geographic access to health care. Therefore, location allocation models were used to solve the problem of geographic inaccessibility to health services since their introduction in the early 1960s in North America and

other developed economies. It was the best method if the conditions of problem definition and data availability were met for selecting locations of new health services. Stock in 1982 worked on Northern Nigeria showing how utilization of health facilities falls with distance. But new locations could not be suggested because of lack of appropriate data. Even today shortage of accurate, reliable and timely data on households and communities hampers health policy making, planning and research. Basic population data, a prerequisite in location allocation model applications, is frequently obsolete or inaccurate especially in northern Nigerian states. Therefore, the simple method of finding out new locations of health facility in Sewapuri block can also be applied in deriving additional number of health facilities in Damaturu LGA and finding out there new locations. However, population data for Damaturu LGA is not available after the year 2006. Still it can be worked out if population projection can be made for coming years.

Table 5: Distribution of new health centres

	Name of the villages (Population) **(P1) = village having highest population** **(P2) = village having lowest population**	**Distance (D12)** **Scale:0.5 cm =1 Km**		**Breaking** $B2 = \frac{D12}{1+\sqrt{P1/P2}}$ **point (B2) (Km)**		**Location of Additional health centres**
		cms	**Km**	**cms**	**Km**	
1.	Satehra(79) (P2), Dabethua (615) (P1), Sivdaspur(371), Majhbhitia (0)	0.7	1.4	0.20	0.37	Satehra (SC)
2.	Hittapur (474), Tarapur(223) (P2), Jagatipur(958),	0.8	1.6	0.21	0.43	Tarapur (Homeopathic)

	arbhanpur(1663)(P1)					
3.	Beyar (366), Dubepur(462), Bhagautipur (848), Isharwar (848)(P1), Mirchia(87)(P2)	0.4	.8	0.1	0.16	Mirchia (sc)
4.	Narayanpur(265), Jammanpur(210) (P2), Khillupur(529), Dandoopur (665) (P1)	0.6	1.2	0.22	0.44	Jammanpur (Homeopathic)
5.	Beshupur (2745) (P1), Rampur Muttilke (395) (P2), Raisipur (931), Sapehta (489)	0.6	1.2	0.2	0.33	Bsshupur(sc)
6.	Pachbahwa (0), Gogwa (536) (P2), Newada(1979) (P1), Lachipur (573)	0.4	.8	0.13	0.27	Gogwa (sc)
7.	Peduka (601) (P1), Patrechak (562), Bhuilaee(552) (P2)	0.5	1	0.23	0.47	Bhuilaee (MCH)
8.	Tiwaripur (339), Dayapur(357), Naha (1010) Gosaipur (698), Tekaria (318) (P2), Bhatauli (1218) (P1)	0.3	0.6	0.1	0.20	Tekaria (PHC)
9.	Babuapur (184), Maheshpur (31) (P2), Ratanpur (77), Ekauna (210), Sarangpur (1061)(P1), Talhua (141) Naktua (276), Baijalpur(452), Chak Chalewa (49)	0.9	1.8	0.13	0.26	Maheshpur (sc)
10.	Atarsuia (48) (P2), Nawalpur (99), Hirapur (287) (P1)	0.4	.8	0.11	0.23	Atarsuia(PHC)
11.	Jiyarampur (171) (P2), Nonkhara (711), Devpalpur (172), Basuhanchak (461), Sumerapur (183), Adampur	1.1	2.2	0.23	0.46	Nonkharan (sc)

	(2401) (P1), Chaktalparewa (0), Tekha (209)					
12.	Arara (463) (P2), Chaksonbarsa (0), Dewapur Khurd (0), Domanpur (811) (P1), Lahiya (615), Dewapur Kala (600)	1.4	2.8	0.6	1.20	Dewapur Khurd (PHC)
13.	Newada Khas (1449) (P1), Bhararia (1156), Keutan (644), Purashiv (318) (P2)	1.5	3	0.5	0.95	Kevtan (sc)
14.	Chaur (273) (P2), Purananda (873), Belwa (1748), Jagdishpur (749), Nohanipur (2729) (P1),	0.7	1.4	0.2	0.33	Belwa (Homeopathic)
15.	Khandak (798) (P1), Milki Chak (794), Bhor Khurd (48) (P2), Katwarupur (492)	1.00	2	0.2	0.39	Milki Chak (Ayurvedic)
16.	Jameenbal Bhular (518) (P2), Tamachabad (963) (P1)	1.1	2.2	.5	0.93	Thatra (PHC)

Derived from the breaking point formula given by Reilley (1931).

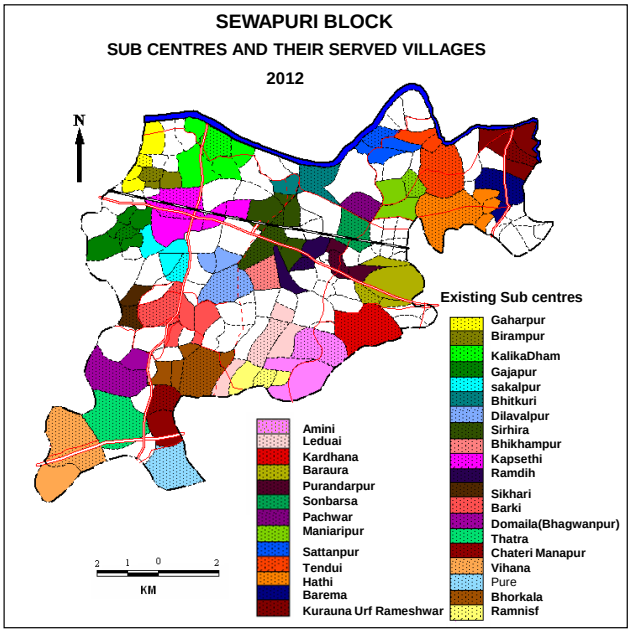

SEWAPURI BLOCK
SUB CENTRES AND THEIR SERVED VILLAGES
2012
N
Existing Sub centres
Gaharpur
Birampur
KalikaDham
Gajapur
sakalpur
Bhitkuri
Dilavalpur
Sirhira
Bhikhampur
Kapsethi
Ramdih
Sikhari
Barki
Domaila(Bhagwanpur)
Thatra
Chateri Manapur
Vihana
Pure
Bhorkala
Ramnisf
Amini
Leduai
Kardhana
Baraura
Purandarpur
Sonbarsa
Pachwar
Maniaripur
Sattanpur
Tendui
Hathi
Barema
Kurauna Urf Rameshwar
2 1 0 2
KM

Fig. 4

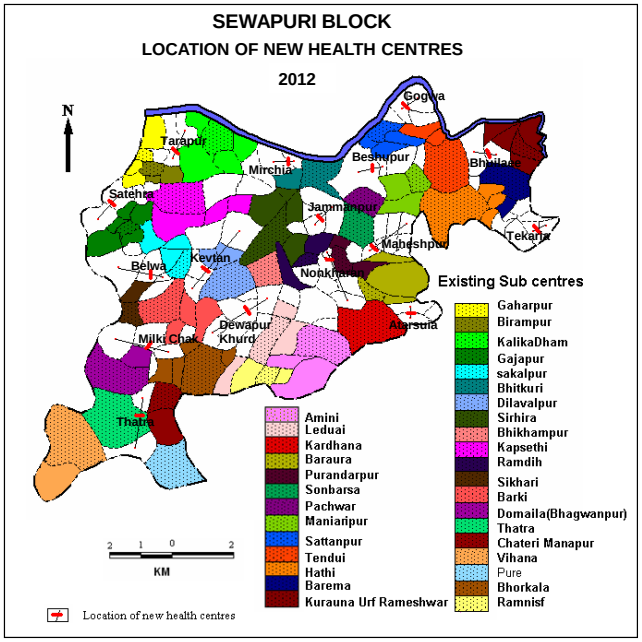

SEWAPURI BLOCK
LOCATION OF NEW HEALTH CENTRES
2012
N
Gogwa
Tarapur
Mirchia
Beshnpur
Bhvilase
Satehra
Jammanpur
Tekarur
Maheshpur
Kevtan
Belwa
Nonkhanda
Existing Sub centres
Gaharpur
Birampur
KalikaDham
Gajapur
sakalpur
Bhitkuri
Dilavalpur
Sirhira
Bhikhampur
Kapsethi
Ramdih
Sikhari
Barki
Domaila(Bhagwanpur)
Thatra
Chateri Manapur
Vihana
Pure
Bhorkala
Ramnisf
Dewapur Khurd
Milki Chak
Abarsula
Thatra
Amini
Leduai
Kardhana
Baraura
Purandarpur
Sonbarsa
Pachwar
Maniaripur
Sattanpur
Tendui
Hathi
Barema
Kurauna Urf Rameshwar
2 1 0 2
KM
Location of new health centres

Fig. 5

Conclusion

Integrated rural development involves the optimum utilization, conservation and development of human and material resources in an appropriate framework of local organisations and institution. It requires services in the area of health and nutrition, marketing, education, transportation and communication, and other infrastructural bases and institutions (Sharma, 1984). For a better **r**ural health care system an integrated rural development approach is required. In the Vision for Health (11^{th} Five Year Plan, 2009), a new vision based on faster, broad-based, and inclusive growth has been adopted with the objective to achieve good health for people, especially the poor and the underprivileged. In order to do this, a comprehensive approach is needed. It includes education concerning prevailing health problems and methods of identifying, preventing and controlling them; promotion of food supply and proper nutrition, and adequate supply of safe water and basic sanitation; maternal and child health care, including family planning; immunization against major infectious diseases; prevention and control of locally endemic diseases; appropriate treatment of common diseases and injuries; promotion of mental health and provision of essential drugs. The existing distribution of health facilities has to be supplemented with the proposed additional health facilities in order to fulfill the tasks of the rural health care system. Provision of infrastructure is based on population norms. This has to be replaced by habitation-based, community- based and disease - based needs. Locations of the new health facilities in future should be done on the basis of accessibility to the health centres measured in travel time and not just distance from nearest health centres. Therefore a curative, preventive and integrated approach must be applied for the achievement of health objectives.

References

1. Beaumont, J. R. (1980). Spatial interaction models and the location-allocation problem, *Journal of Regional Science*, vol.*20*, issue 1, pp.37–50.

2. Beaumont, J. R. (1987). 'Location-allocation models and central place theory'. In A. Ghosh & G. Rushton (Eds.). *Spatial analysis and location-allocation models,* Van Nostrand-Reinhold, New York, pp. 21–54.

3. Goel, S.L. (2001). *Health Care System and Management, Vol.1,* Deep and Deep Publications Pvt. Ltd., New Delhi, pp.164-165.

4. Hodgson, M.J. and Jacobsen, S.K. (2008). A hierarchical location-allocation model with travel based on expected referral distances, *Annals of Operations Research*, Published online, 2 July 2008 , p.272.

5. Last, J.M. (Ed.) (1993). *A Dictionary of Epidemiology*, Oxford University Press, New York, p. 55.

6. Mahadev, P.D. and Thangamani, K. (1984). Location and Accessibility Constraints and Planning for Rural Health Services: A case Study of Bellary District, India, *Indian Geographical Journal, 59, (1),* pp.135-140.

7. Meade, M.S. and Earickson, R.J. (2000). *Medical Geography, Health care delivery system worldwide*, Rawat Publications, New Delhi, p.311.

8. Park, K. (2007). *Textbook of Preventive and Social Medicine*, Banarsidas Bhanot Publication, Premnagar, Jabalpur, p.740.

9. Planning Commission, (2009): *Eleventh Five Year Plan (2007-2012)*, Govt. of India, New Delhi , Vol. II, Social Sector, Health and Family Welfare and AYUSH, p.74-75.

10. Reilly, William J. (1931). *The Laws of Retail Gravitation*, New York, Knickerbocker Press.

11. Sharma, P.R. (1984). 'Spatial Organisation Model for Rural Development: An Approach through Settlement Systems', *Habitat International*, Oxford, Vol-8, No.1, p. 33.

12. WHO (1978). *Alma Ata 1978: Primary Health Care, HFA Sr. No. 1,p.49.*

13. WHO (1987). *Report on World Health Situations, vol.2, No.7.*

14. Makura , I. and Gallagher, M. (2011). *Community Mobilization Assessment Report Damaturu and Fune LGAs, Yobe State.*

15. Chuke P. O. (1988). *The International Handbook of Health Care Systems.* Greenwood Press, N.Y.