Spatial Location Based Accessibility Assessment of Healthcare Institutions in Debre Berhan Zurya Woreda, North Shewa Zone, Regional State of Amhara, Ethiopia

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Abstract The research entitled with spatial location based accessibility assessment of healthcare institutions in Debre Berhan Zurya Woreda, North Shewa Zone, Regional State of Amhara, Ethiopia. Debre Berhan Zurya woreda is found in the southernmost part of Amhara reginal state and approximately 130kmrs to the North from the Capital Addis Ababa and Characterized by rigorous dynamic topography approximately at 3000m altitude above MSL. The Total Population of the This Woreda as eatimated by CSA for 2017 is 115, 815 thousands in urban and 138,264 thousands in rural. The study is principally aimed to assess the spatial location and Accessibility of health institutions at lower level from Health Posts (HPs) to higher level Referal Hospitals (RHs) in the district which are owned both government and privately. Specifically the study is aimed to assess spatial location of currently working institutions; to show service scarce areas where lacking population actually live and to suggest locational remedies to drawbacks whenever exist in the current institutions. GIS and GPS techniques have been employed with primary and secondary data inputs. The methodology comprises of data preprocessing, processing, analysis and display stages. After systematical approaches of analysis stage, it became possible to identify that accessibility and spatial locations of the health institutions in Debre Berhan Zurya Woreda particularly those of higher Clinics, Health Centers and hospitals are guaranteed only for urbanized population. Lack of road infrastructure in rural area to access the discriminatively established institutions aggravated the problem too.

Keywords: Debre Berhan Zurya Woreda, spatial location, accessibility, health institution, urban and rural

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1. Introduction

The current condition of rapid population growth in Ethiopia requires a special means of providing services and facilities such as health institutions (Clinics, health centers, Hospitals etc.), schools, water, market centers, power, infrastructures, fuels etc. in both urban and rural areas where as they are still considered as 'necessary material conditions for good human health' [1]. There is no such basic grounds based on which these services and other facilities are distributed among population of Ethiopian cities and districts as [2] indicated in their study as "Health inequalities originate through several factors - including the organization and management of space which could vary between socio-economic groups"). Several facility service area layer methods have been proposed by different scholars that enable governments to fairly reach the demands of their citizens for the services. Ethiopia is poorly experienced in uniformly distributing all amenities and facilities which are believed have to be reached the

citizens from the social service sector. In the aspect of rural and urban community for example is stated in study by [3] as "rural health policy, countries face major challenges in service delivery, human resources, governance, transportation, financing, communication, and in some regions corruption". They added, "In every country, the health status of rural dwellers is worse than that of their urban counterparts (p.396)". From the fact that demand and service management system is yet underdeveloped, traditional ways of achieving such objective intern directly or indirectly upsets both the government and the community in one's country or nation. Strengthening this, [4] stated about the Country Ethiopia "Ethiopia has poor health outcomes even by sub-Saharan Africa's standards characterized by many decades without a national health policy, weak healthcare system infrastructure and low government spending." Shortage of these healthcare services creates therefore 'Social health inequities [5]. The work provides important insight into its present application and an analytic framework for continued application in a challenging and dynamic environment [6]. In this research work, the authors are

introducing and testing ArcGIS analysis techniques in health care planning [7] in particular to Health institutions and facilities in Debre Berhan Zurya Woreda siting problems.

This paper work emphasizes how the formerly constructed or established health institutions in Debre Berhan Zurya Woreda are seen in GIS mapping analysis in matching with the demand and service setup; As seen from the World Health Organization [8], There are three levels of healthcare levels in Ethiopia namely primary, secondary and tertiary healthcare institutions. The primary level of care includes primary hospitals, health centers (HCs) and health posts (HPs). The primary health care unit (PHCU) comprises five satellite HPs (the lowest-level health system facility, at village level) and a referral HC (P.4). In this research paper, it has been tried to include the institutions at all levels and assessments are done where and how many existing centers are there and where and how many new institutions shall be constructed to achieve the objectives anticipated in the study.

The main objective is to make analysis and find results on how to balance distribution of the health institutions in Debre Berhan Zurya Woreda that provide services for the demands of the society in the area. Specifically the research work is intended to assess spatial location of currently working institutions; to show service deficient areas where lacking population actually live and to suggest locational remedies to drawbacks whenever exist in the current institutions.

The result of this study profoundly helps both the government and the society in placements and use of health care institutions in the research area based. It is desirable for a government to ensure high quality provision and equal and easy access to fundamental health care services to all citizens [3]. It is significant to the government to go through such kinds of studies for several applications. Public-sector facilities, such as hospitals, schools, libraries, fire stations, and Emergency Response Services (ERS) centers, can provide high-quality service to the community at a low cost when a good location is chosen.

2. Methodology of the Study

2.1. Backgrounds of the Study Area

Debre Berhan Zurya Woreda is one of the Amhara regional state districts in Ethiopia. It is delimited in the north by North Mafuz Mezezo Mojana, in the East by Ankober, in the South Angolala Terana Asagrt and in the West Siyadebrina Wayu Woredas. Debre Berhan is a historical city and Capital of Debre Berhan Zurya Woreda which is located 130km from the country's Capital Addis Ababa towards the North direction.
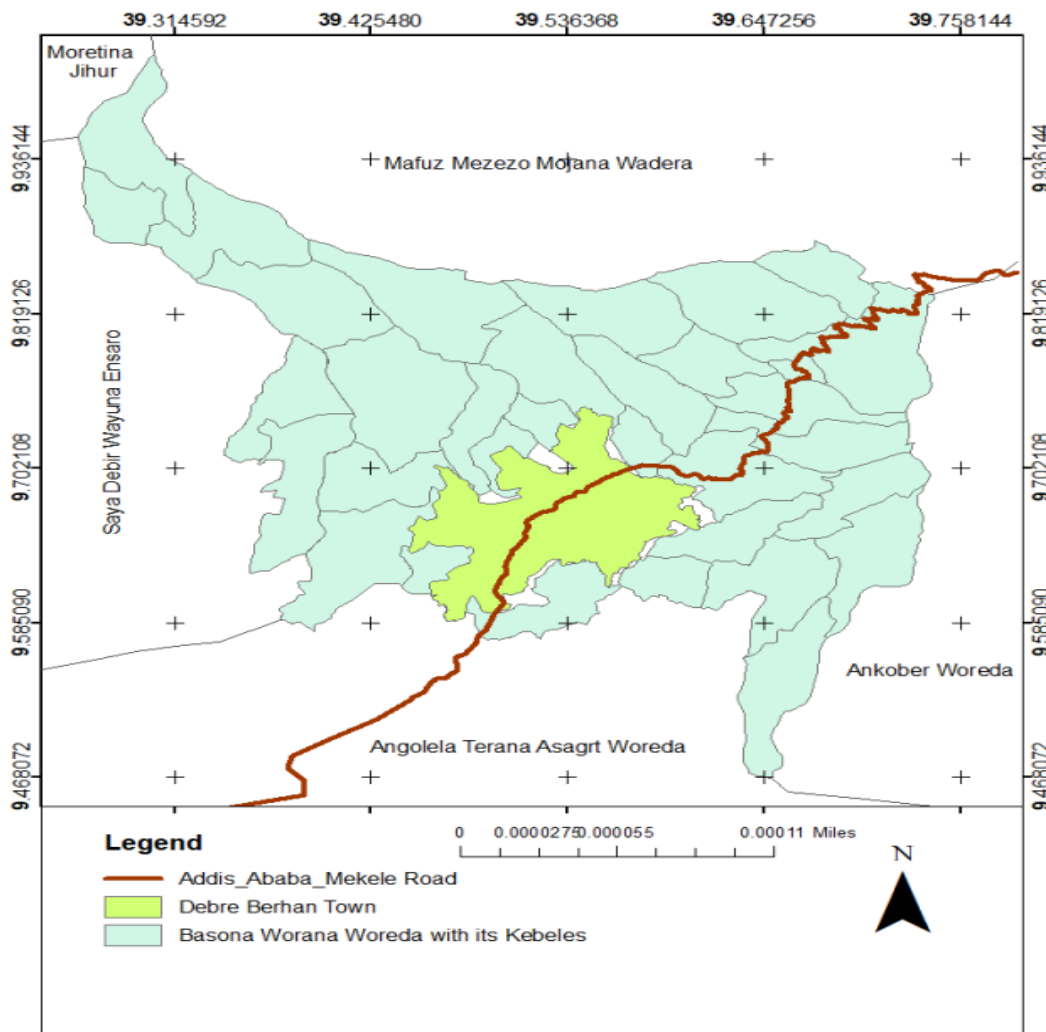

Figure 1. Location Map of Debre Berhan Zurya Woreda

2.2. Materials

ArcGIS software and its extensions, Global Mapper, DNR Garmin, and Google Earth are mainly used in addition to some others that are used rarely for minor purposes such as for uploading spatial information and conversion purposes, Notepad (MS excel) for further viewing, editing and arranging the spatial data of GPS whenever needed etc**.**

Laptop and Desktop Computers are of highest usage from the scratch of data collection to the end output of the findings without which data storage, adjustments (Pre-processing), editing, and analysis are unbearable. Researchers also have been also used the handheld type of GPS for collecting the spatial (locational) information that help determine the distance, area and boundaries of the study area.

Primary data sources and Secondary data sources were identified where primary data sources were Researchers' Instrumental Survey of GPS Ground Control Points (GCPs) and information Internet and personal interviews, and Secondary data were from Debre Berhan Municipal and Woreda Land Resource and Utilization Offices, Town and Woreda Health Offices and rarely used Aerial Photograph of Debre Berhan. Published literatures from the web and unpublished documents both qualitative and quantitative were secondary data sources in addition to different organizations.

2.3. Data Collection Methods

There are two major data collection methods used: Instrumental Survey and Interview with Organizations. Primary data of the institution were collected by the researcher by going to the desired institutions. It was done by means some equipment.

Informal interviews have been used to collect secondary data through contact and conversations with relevant workers in organizations to identify and collect valuable data and materials as shown in Table 2. A geodatabase comprising the input data is developed then for analysis.

2.4. Methods of Data Analysis

Data preparation and refining stage has been critically undergone before the main mapping and editing activities commence. Four crucial spatial figures are identified at this stage each of which represent Residential (where population live), Locations of Health Institutions, Land Use Map and Road Network Map of the Study area.

Previously adjusted map of institutions indicating where the service providing centers exist are secondly analyzed as point map. Their spatial references are adjusted through importing on ArcMap and linked with details or attributes. Populated areas are converted to points representing demand nodes. After standards and Criteria with which service and demands correlated are collected, decisions and out puts are produced. The method is diagrammatically provided below.
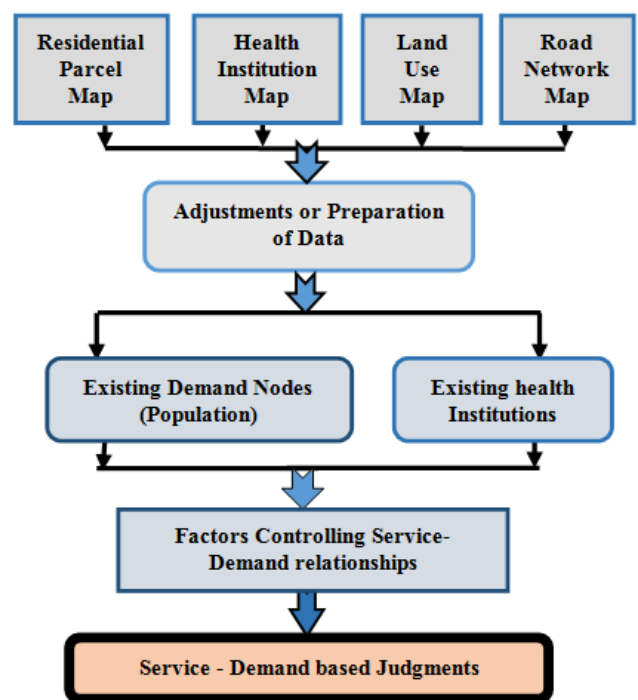

Figure 2. Methedological flow chart

Table 1. Primary data, their source and uses in the study

Data	Source	Format	Uses
GPS Coordinates of Health Centers	Health Institutions understudy	.dxf	Identifying the Town and Woreda locations of the centers
Road network	Land use map and Aerial photographs	GRID	Modify existing road network
Residential area	Landuse map and Aerial photographs	GRID	To modify residential areas

Table 2. Secondary data, their source and uses in the study

Data	Source	Format	Uses
Administrative maps of Amhara & Debre Berhan	Debre Berhan Zurya Woreda land Administration Office	.shp	For defining the study location
Parcel Maps Of Debre Berhan Zurya Woreda	Debre Berhan Zurya Woreda land Administration Office	.shp	Distinguish residential parcels from the others
Demographic data	CSA	.dbf	Know Subject population
Existing Health Institutions	Debre Berhan Zurya Woreda Health Office	.shp	After assessment of their existence on the ground directly taken for use
Road network map	Debre Berhan Road Authority Office	.shp	Input Data for Building a Road Network
Land use Map of Debre Berhan Zurya Woreda	Debre Berhan Zurya Woreda land Administration Office	.shp	Separate residential areas and further details
ATLAS of Debre Berhan Zurya Woreda	Debre Berhan Zurya Woreda land Administration Office	Print out	Get some written evidences of study area
Debre Berhan Health Institution Information	Debre Berhan Zurya Woreda Health Office	Print out	For details of health institutions

3. Findings of the Research

3.1. Results in Terms of Population

As tried to explain in the background statements about the study area, approximated population of 251,957 in both Debre Berhan and Basona Worana Woreda in total. The total entire area understudy is inhabited unevenly by this amount of population size in both urbanized and rural area. Most commonly in history human beings, peoples prefers living in urbanized area than rural of one's country and as a result of this, in the same way in urbanized areas and districts are densely populated than those that rural. Therefore, patterns of points are seen densely where citizens are collected around villages and townships. Figure 3 clearly shows the fact.

3.2. Result in Terms of Health Institutions

During Data collection period in both in both urban rural areas there are about 85 total number of health institutions in both urban and rural areas as shown in Figure 4 of which 64 are rural Health Posts (HPs), 18 lower, medium, primary and specialty clinics of which 1 is in rural village and 17 in Debre Berhan Town, 8 Health Centers (HCs) of which 5 are in rural villages and 3 are in Debre Berhan Town, 1 Primary Hospital (PH) in Debre Berhan Town and 1 Referral Hospital (RH) in Debre Berhan Town.
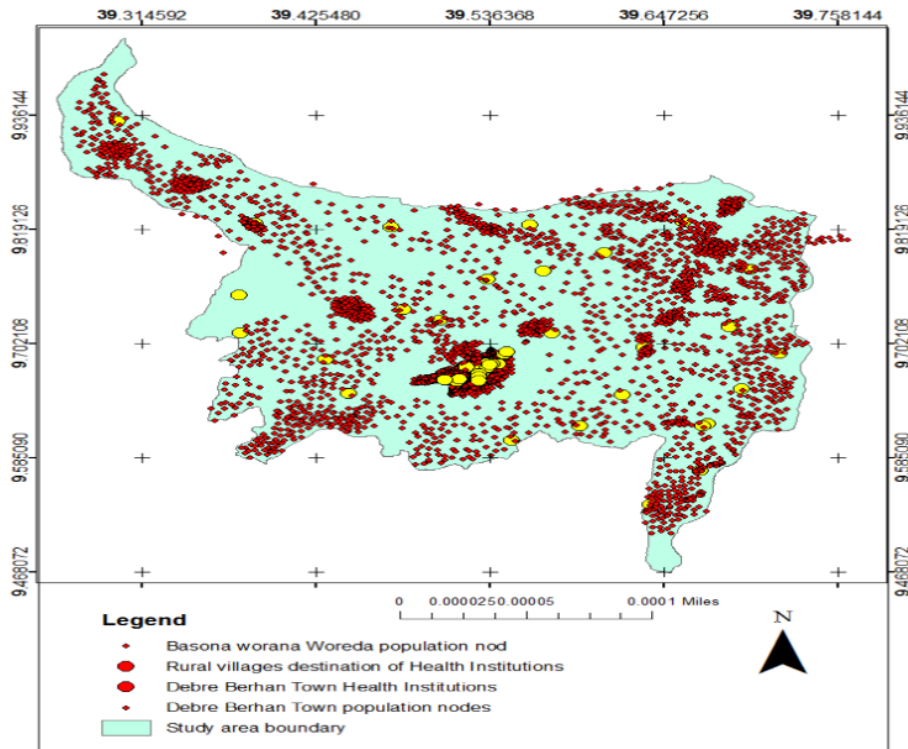

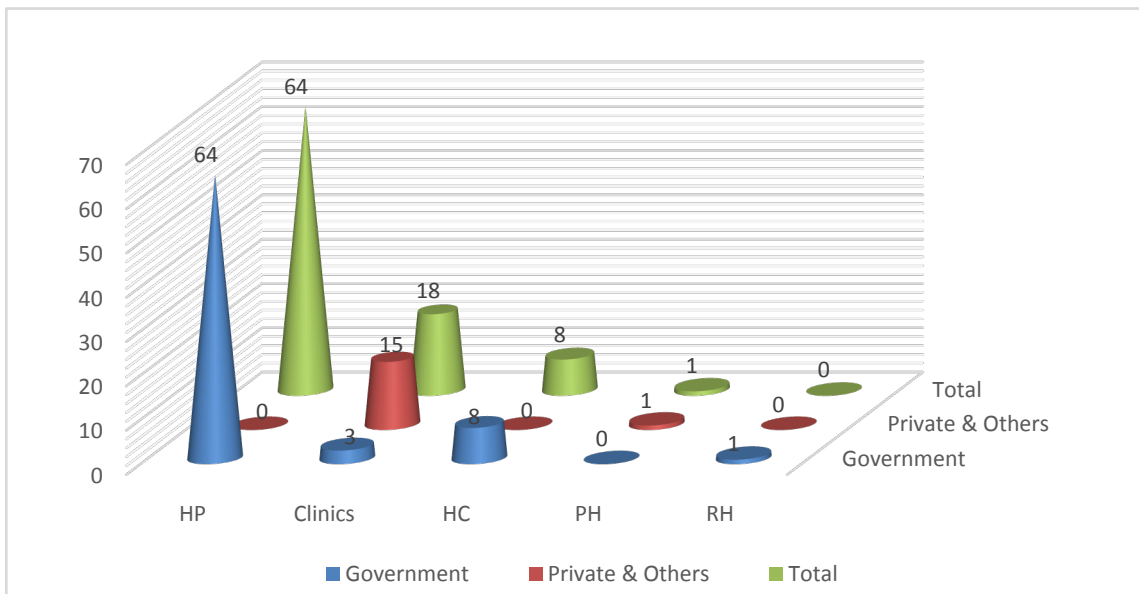**Figure 3.** Population distribution in the study area

Figure 4. Statistics of Health Institutions in the study area
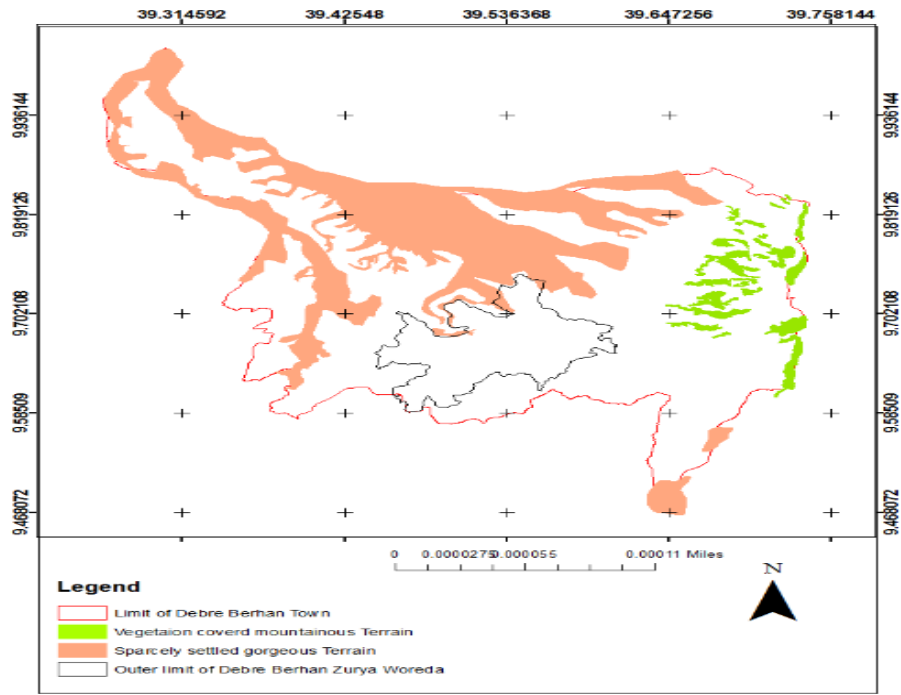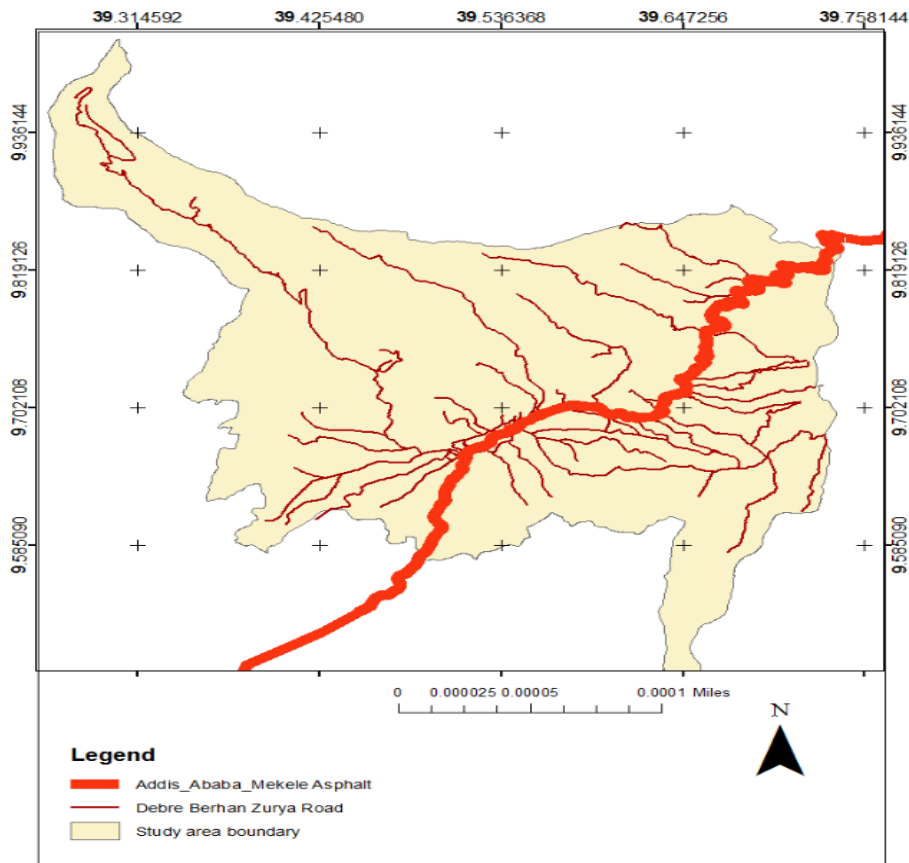
Figure 5. Geographical Terrain type

Figure 6. Road Network in the Woreda District

3.3. Result in Terms of Configuration of the Terrain

Two major terrain types are identified in the area which negatively impose impacts on human life. The area is widely characterized by gorgeous terrain type with steep slope in which large rivers and streams flow especially in the North-western region of the area and the second one is Hilly area regarded as hilly and ups and downs covered with dense vegetation.

3.4. Result as a Function of Road Network

Three types of roads are found in the entire area which are Asphalt type of National road connecting the Countries Capital Addis Ababa to Northern Regions

through Debre Berhan Town. This is the only asphalt road in the study area except Debre Berhan Town Few corridors. Study area is dominantly unpaved rural surface paths and secondly by Gravel type of rural roads with some paved and cobblestone roads in Debre Berhan Town.

4. Discussion

As can be observed series findings produced on the above different dedications and judgments can be taken among which the ratio of customer service distribution in the area. Key concepts of the study are spatial location and accessibility of the health institutions in the entire area are deeply investigated achievements are collected. As to the study of [5], unbalanced distribution patterns of health institutions and [9] accessibility, which is more than just the available supply the focal issues found. Physical access, availability, and acceptability of services [9] are other factors seen and found unsatisfactory in Debre Berhan Zurya woreda. For the healthcare to be accessible, healthcare must be relevant and effective for the needs of the population [9] and which is of high reality observed above under sub-titles 3.1 and 3.2. On the other side accessibility is measured by distance [10] and therefore, the maximum distance between the service and demand should be taken into account. Researchers found related situations in their study that all higher institutions like clinics and hospitals are only concentrated in Debre Berhan Town leaving behind the health posts only to rural community which is one-sided. The ratio of demand to supply of hospitals in rural population and area of 138,264 thousand and 1185.25Sq.kmrs for example is zero whereas for Debre Berhan Town whose population and area coverage are respectively 115,815 thousands and 146.27sq.kmrs, it is 2 to 115,815. This indicates that even though there are provisions of medical cares through HPs in population, rural citizens are still with dissatisfaction when compared with urbanized villages and Debre Berhan Town of the Study Area. The study by [11] claims the same issue indicating as 'distributional imbalances'. Therefore in this study the main findings came across are unbalanced spatial location of Health Institutions in former name, Debre Berhan Zurya Woreda but currently between Debre Town and Basona Worana woreda in level of services and frequency. It is obviously seen that as their names differ institutions are also extremely different in that low service providing HCs are left for rural communities while Clinics, PH and RH are all awarded to Debre Berhan Town. This Created biases and unjust among citizens depriving the right of rural population to access equally with urban population and totally committing to urban population. This is supported also in the case study by [12] stated as "rural areas and deprived communities still lack access to health services."

5. Conclusion

Spatial locations and assessments the Health institutions throughout Debre Berhan Zurya Woreda is broadly and deeply investigated and found significant implications for the government and the citizens for distribution and Access. Geographic Information System GIS and Global Positioning Systems (GPS) are among principally used technologies to identify problem Areas. Government and stake holders must use these Technologies for fair and reasonable distribution of Social services like health Institutions, Educational Institutions, and other related facilities. Debre Berhan Zurya Woreda Health institutions spatial distributions and Access are found greatly inconsistent. Results show that rural population is still out of access and satisfaction from the health institutions particularly from higher institutions such as Clinics, HCs and hospitals.

6. Recommendations

Researchers have the following general and specific recommendations for the relevant bodies:
- Before services are established, government stakeholders on social service sectors shall work on how scientifically services are distributed spatially and equally accessed by citizens among both rural and urbanized localities.
- Debre Berhan and North Shewa Zone administrations in joint shall work for equal wellbeing of both the rural and urban population of Debre Berhan Zurya Woreda.
- Further Studies of health institutions shall be applied in the study area to locate additional higher health institutions for particularly rural population of Debre Berhan Zurya Woreda.
- Health Posts (HPs) existing in the countrysides of Debre Berhan Zurya Woreda shall be furnished with equipments, Medical remedies, and Health professionals to reduce the large access and satisfaction gap between Rural and Urban Poulations.
- Road infrastructures currently are at very harsh conditions for the rural community to access both urban higher health institutions from remote areas and HPs at their nerby shall be constructed and maintained well.
- Affirmative Actions shall be taken in fever of those rural population in financial aspects to help them overcome transportation hardships because of lack of access equally with urban.

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