Geospatial Location-Allocation Approach to Optimize Healthcare Facilities in Peri-Urban dwellers in Mbeya City, Tanzania

Kizito August Ngowi¹, Christopher M.P William²

¹Civil Engineering Department, Mbeya University of Science and Technology
²Geography Department, University of Dar es Salaam,
Email: ¹augustkizito@gmail.com, ²willmpc@gmail.com

ABSTRACT

It is significant to health Planners to offer health services as efficiently and fairly as potential for the development of excellence living environmental. International standards endorse that healthcare facilities should be placed 5kms distance. However, such recommendations failed to take into attention the terrain, means of transport and the state of rural roads. In Mbeya city peri-urban, close to at least 1 child out of 7 dies before reaching one year and 120 children out of 1,000 also die before attaining five years as a results of delay getting proper treatment, poor transportation infrastructure, poor roads, rough terrain and longer waiting times. There is a need to increase geographical accessibility to these facilities. Specific targets of these study includes; to determine accessibility to healthcare centres in the subwards areas most disadvantaged with respect to Mbeya city peri-urban healthcare facilities, showing geographic distribution of health centers and to use Geographical Information System(GIS) to propose optimum locations where upcoming health centres should to be built. It is well recognized that locating health facilities appropriately is extremely important in order to increase their accessibility. The types of data used include: population data, based on 2012 National Population and Housing Census_General Report. Digital Elevation Model and the Location of Health Facilities. Findings showed that the total number of healthcare facilities available from the study area were three, among the six studied wards, only 3 wards; Iziwa, Itagano and Mwasenkwa had only one public dispensary serve the entire sub wards. The findings also revealed that out of 14,166 residents in the study area, 7,436 of them have no healthcare facilities available, and public and private transport are both inadequate. Only 51% of the population can access the existing healthcare facilities within a distance of 5km. Construction of new healthcare facilities at Tembela, Mwasanga and Iduda was found to help improving accessibility to 96.7% from public dispensary within the sub wards. This eventually can decrease the cost, pain and more so the number of death in the sub ward related to delays in accessing appropriate medical concern.

Keywords: Geographical accessibility, Location-Allocation approach, Healthcare facilities, maximum coverage, optimum location.
1.0 INTRODUCTION

Worldwide, struggle has been focused by the applicable authorities to ensure that native people are provided with appropriate and accessible healthcare services. However, wellbeing of people and spatial accessibility to healthcare facilities is important feature prompting economic growth and prosperity of any nation. This can be exemplified by the resolution of the World Health Organization in its 58th World health Assembly. At that time, (World Health Organization WHO2005) called upon all the nations in the world to transfer towards having national or universal attention in terms of health services. With this, all individuals should have “access to promotive, preventive, curative, and rehabilitative health intervention at affordable costs (WHO2005).
To achieve this approach is to ensure that healthcare centers and other significant health facilities are equally distributed and optimally located so people can simply access them. Definitely, the cost of accessing healthcare hinges on numerous characteristics among them distance that one travels to access health care services. The existing situation at Mbeya city peri-urban for more than 15 years, close to at least 1 child out of 7 dies before reaching one year and 120 children out of 1,000 also die before attaining five years as a result of delay getting proper treatment, poor transportation infrastructure, poor roads, rough terrain and longer waiting times (Mbeya City Council MCC, 2007). However, there are still inconsistencies in the distribution and accessibility of such services. Things are made poorer due to lack of satisfactory and good roads infrastructure, poor terrain and longer waiting times.

In Mbeya City peri-urban poor road infrastructure, rough terrain coupled with lack of proper means of transports makes it difficult for the residents to access proper healthcare services within the recommended distance or time. Studies conducted in Tanzania, for instance, (Ahmed 2004) indicates that over 70% of the population lives in grossly overcrowded informal settlements resulting in chronic poverty and unhealthy living conditions over the decades. This situation has been noted in Mbeya City peri-urban where this situation currently exists like in any other areas where there is poor access to the health infrastructure.

Despite the effort and initiatives taken by the government through Ministry of Health to ensure that every ward having at least one Dispensary and all medical facilities, yet this is still not enough and there is need to have a long-term plan and solution. To accomplish this, operational research improving access to health centers would continue to be of significant value to planners and decision makers. Scholars acknowledge that improving geographical accessibility to healthcare facilities is of the steps towards meeting the global recommendation of WHO (Turin 2010). To that effect, the present study purpose is to use Geographical Information Systems (GIS) Location-Allocation approach to improve geographical accessibility to healthcare services in Mbeya City peri-urban.
2. LITERATURE REVIEW

It has been established that GIS can be used to optimize access to health care. Various Literatures has talked about measuring spatial and outcomes of spatial measurement of accessibility as well as methods of measuring spatial accessibility to health care. GIS as a computer based system aids the integration and analysis of geographically referenced data. It has the ability to process data collected, store and retrieve data when needed, analyze and display data as maps. The geographic accessibility is anchored on how easily a health user can physically reach the provider’s location. When examining geographic accessibility to health care, the dimensions put into consideration are spatial and aspatial.

It is long time since 1960s location-allocation approaches have been useful to a variety of problematic perceptions, but with an overall form of structuring service facilities to fulfil demands in optimal ways (Farahani & Hekmatfar 2009). Location-Allocation approaches can be used to define the superlative locations for new facilities that offer services and commodities to users, and people in need of those supplies. Furthermore, location-allocation approaches is the process that selects the optimal locations of facilities from a traditional of applicant’s locations and concurrently allocate demands to these locations in the supreme efficient way, centered on the distribution of demands (Lea1973).

The location-allocation approaches determine the optimum locations by using several measurements that are based on travel distance, travel time or other forms of cost roles. The location-allocation analysis layer stores the inputs, parameters, and results for a given location-allocation problem Scholars have established a set of techniques for carrying out location-allocation illustrative.

These techniques target at discovery the precise sites for facility locations that can rise accessibility and decline the total weighted cost (e.g. travelling time, distance or other cost factors) (Noor AM, Alegana VA, Gathengi PW& Snow RW 2009). Aimed at real-world applications, researchers have used these techniques to find optimal locations for schools, hospitals, offices, warehouses, fire stations, day centers, post libraries, bank branches, waste disposal sites, and sites for monitoring scarce animals amongst others.
Meanwhile choosing the optimum locations and assigning demands to them depend on both the demands and the supplies, location-allocation analysis necessity to be resolute concurrently (Senzom 2011). This means that the location-allocation models encompass at the same time, the assortment of an established of locations for facilities and the task of a set of demands to these facilities in directive to locate and discovery the optimal locations. Once the affiliation between demands and supplies includes costs, or practice of incomes, the location allocation models try to attain at answers that usage the resources most successfully. The location-allocation representations, each comprises three key components:

a) the candidate locations for service facilities,
b) the demand locations and
c) a distance or time matrix property distances or traveling time between service facilities and demand locations (Samat, Shatar & Manan 2010).

Approachability to community health facilities necessitates that the superlative locations for hospitals and other healthcare facilities are appropriately located so that the populace can rapidly get services deprived of travelling extensive distances which has been related to harm of lives (Oppong 1994). The high quality of the greatest locations is one of the difficulties that face most native administrations and national regime in the world. Additional problem that these regimes facade is defining in what way several facilities should be placed within a certain area (Russell 2008). The location-allocation approach has been the single approach that most researchers, policy makers, city planners and local governments smear in directive to facilitate well-organized location of facilities.

GIS location-allocation model in improving accessibility to healthcare facilities, study conducted at Mt. Elgon Sub-Country, Machacos Kenya, (Luo & Wang 2003; Briggs & Elliot 1995) argues that, one of the major weaknesses to the implementation of GIS in a public health setting is disbelief that stems from the perception that GIS is simply a mapping tool. Although GIS output does normally appear as a geographical presentation, the tool is far more dominant than its basic mapping capabilities. GIS is being used in public health management and allocation of resources used in developing countries.
The use of GIS tool and spatial statistical measures e.g. Global spatial statistics offers a highly useful methodology to establish the degree to which current services meet the needs of the groups in need and indicate where new services will need to be established and existing services can be reduced in size or closed down and also propose the appropriate spatial accessibility to Health care facilities by local communities in Peri-urban areas. The Spatial distribution of population have been mapped to show how the residential population varies spatially as aims at filling the that gap

GIS identifying area for placement of a new health facility where maximum in population accessibility achieved, refine information from multiple observation at the micro level to simplify more macro level decision-making, deciding how to allocate healthcare resources is difficult and based on many epidemiology and sociogeographical, and ethical criteria (Briggs & Elliott 1995). The approaches (focused on the special efficiency defined by achieving the maximum population level-reduction impedance to care) of healthcare location and sometimes address spatial equity (defined as achieving equal distribution of access to care among population subgroups).

Also the studies conducted at regional context provided that appropriate spatial accessibility measures are seldom in use for effective health care services and planning in developing city context under the current off-the- self-GIS Environment. It further stipulates that some did not employ the use of GIS tool and even where it was employed which would have help to display the pattern of distribution from which the distance from one facility to the other can be determined. Therefore use spatial statistical measures of high spatial resolution data sets and (GIS) based spatial analysis, assessing “spatial accessibility”measures, derived from fine spatial resolution datasets, to characterize and reveal spatial variations in access to health care facilities and identify disadvantaged locations / local communities in a selected peri-urban areas in Mbeya city being the research gap to fill.

The numerous location-allocation approach used are; maximize coverage, minimize the impedance problem, maximize attendance, maximize market share, minimize facilities and mark market share. There are plentiful benefits of applying Geospatial location-allocation approach.
This technology offers Municipal Planners, Engineers and a well platform to judgmentally view and select the optimal location for community facilities (Oliveira & Bevan 2006). According to (Yeh & Chow 1997), it also aids decision makers to variety their choices successfully by investigative different scenarios produced underneath different expectations. All these are essential requirement in determining health service inconsistencies in Mbeya city. In spite of the fact that numerous researchers have applied the technology, there is no scholarship to the finest of the researcher’s knowledge that measured population terrain, size, state of roads and land cover features in suggesting optimal locations for supplementary facilities. These study intentions at filling that gap.

3.0 RESEARCH METHODOLOGY

3.1 Study Area

This study was carried out in Mbeya Region in peri-urban Mbeya City. Mbeya City is located in the Southwestern part of Tanzania. It is situated between latitudes 8°50’ and 8°57 south and longitudes 33°30’ and 35°35’ east. It has a total land area of 214 km² and borders Mbeya Rural District on all sides. Mbeya City is the headquarter of Mbeya region. Strategically the City is located in a Rift valley between two high mountain ranges (i.e. Mbeya Peak/Loleza and Uporoto Mountains) as shown in Figure 1.

![Figure 1: Location of Peri-Urban Areas in Mbeya City](image)

3.2 Types and Sources of Data

Both qualitative and quantitative primary and secondary data, were collected in examining spatial accessibility to healthcare facilities by local communities residing in peri-urban area of Mbeya City. Qualitative data used measures of types represented by a name, symbol, and number code. Qualitative data used in this study include age, sex, marital status education and
income. Quantitative data used in this study include measures of values, counts expressed as numbers (e.g. how many; how much; or how often). Other quantitative data used in this study include, number of healthcare facilities, number of healthcare personnel, number of road networks, number of peri-urban wards and number of population for each studied ward.

The primary data collected about accessibility to healthcare facilities is all about the ability of a population to get a certain continuous of healthcare services. This included, the proportion of the population using public and private transportation, speed limits, walking, bicycling, motorcycle, and cars by relating them to at fine spatial resolution.

These primary data were captured from the structured questionnaire that was administered to the heads of households. Information about levels of services/attractiveness of healthcare facilities travel impedance (distance, time, etc.) via transportation network, spatial accessibility from residential locations to locations of healthcare facilities was obtained through in-depth interviews and personal discussions conducted with the Key Informants. Information about transportation infrastructure network, land uses was acquired from Landsat TM Satellite Imagery of 2016 and Mbeya City Urban Planning department. Primary data were gathered from Mbeya City peri-urban households, key informants, and USGS Landsat archive.

On the other hand, information such as spatial accessibility to healthcare facilities in the peri-urban area was collected at all levels of services/attractiveness of healthcare facilities. Travel impedance, constraints facing the communities in the peri-urban area from elsewhere in the country and in the continent were collected from the available literature, internet, University of Dar es Salaam Library and from the Ministry of Health, Community Development Gender, Elderly, and Children. The secondary data supplemented what was observed in the field, comparing and informing more on assessing spatial accessibility. The dataset that was used in the study are summarized in Table 1 and information included are names of data source and year.

<table>
<thead>
<tr>
<th>Types Data</th>
<th>Sources of Data</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of healthcare facilities (health care centers)</td>
<td>Ministry of Health / collect using GPS</td>
<td>2018</td>
</tr>
<tr>
<td></td>
<td>Mbeya Urban Planning</td>
<td>2018</td>
</tr>
</tbody>
</table>
### 3.3 Data collection Methods and Techniques

This study used survey methods for data collection. The survey techniques include: In-depth interviews, and Structured Questionnaire Interview. Other methods were Remote Sensing and GIS Mapping and document review. To assess spatial accessibility to healthcare facilities, three main types of data were required: the location of the population and their main characteristics, the location of the healthcare facilities, and the spatial layout of the transportation system (e.g. road network).

#### 3.3.1 Remote Sensing and GIS Mapping

A physical survey of the settlement (Remote sensing and GIS Mapping) was done in order to assess the current situation in comparison to the former one. The material used was LANDSAT Satellite Dataof 2016 Geocoded with UTM projection, Arc 1960, Zone 36S of 30m spatial resolution. During this survey, observation of spatial accessibility to healthcare facilities by local communities in the peri-urban area, and how people expressed concern on the way the spatial accessibility behave was made. This enabled the preparation of Land use map, Population density, Healthcare facilities and Transport infrastructure. This observation helped the author to get a real impression of the people.

### 3.4 Data Processing

In practical application to improve accessibility to healthcare facilities in Mbeya City peri-urban, population size, terrain, state of roads and land use/cover factors in proposing optimum locations for additional facilities were the most critical importance factor to consider (Wang, 2003) explains "Measures of Spatial Accessibility to Healthcare in a GIS Environment."
DEM of the study area, the road shapefile of the same area, and the health facility shapefile of the area were used in analysis. In order to determine geographical accessibility, three factors that strongly influence how difficult a health seeking journey should be were used. These factors were; distance from the health facility, slope of the land and availability of road infrastructure (Luo and Wang, 2003). The three were overlaid in a computerized journey for determining the difficulty of traveling from one point (home) to another point (health facility).

The lower the difficulty incurred, the more geographically accessible a facility was deemed to the traveler. A reverse index was used to define geographical accessibility 1 denoting high accessibility and five denoting low accessibility (Guagliardo 2004). All data were checked in order to ensure consistency of information like Satellite Image with DEM, Slope, landform characteristics, Land use, and Road network of Mbeya City should be processed into usable information by using GIS Software.

To determine suitable locations for new Health facilities to disadvantaged group Multi-criteria evaluation approaches were used for identifying location – allocation techniques at finding the right sites for facility locations that can increase the accessibility and decrease the total weighted cost e.g. distance, traveling time or other cost factors were involved. (Guagliardo 2004). DEM of the study area, the road shapefile of the same area, and the health facility shapefile, Land use map of the area were analyzed.

Using populace data, centroids were produced for the 36 wards locations, which characterized the demand points. This was followed by creating a database where all the layers (population, roads, and existing health care facilities) were set aside.
To generate a new network geo-dataset, it was required that network analyst extension was checked. Then right clicked on road shape file and click on “New” to create “Network dataset”. The researcher opened the Network analysts and proceeded to “New Location Allocation”. A number of points are then populated from where facilities which in this situation represents the existing health care facilities are loaded into the model. At that juncture in the facility tab, nominated “Required” and not “Candidates” and accept the default.

The second features to be loaded were the demand point, which in this situation signifies the population centroids.
After loading health facilities and population, it was required to set some of the locational-location properties; in the layer property window, under “Analysis Settings” the “Travel From” was checked to “Demand to Facility “because individuals travel to healthcare facilities from their households to seek medical care.

When Network Analyst solves a location-allocation problem, it can calculate network costs from demand points to facilities or from facilities to demand points. To choose the type of model or analysis that suits this instance, in “Advanced Setting” the “Problem Type” was selected as “Maximize Coverage” because the tension is to maximize the population utilizing the existing health care facilities.

In addition, it chooses facilities such that all or the greater amount of demand is within a specified impedance cutoff. This property specifies the network cost attribute used to define the traversal cost along the elements of the network. Then, under “Facilities To Choose” the existing number of healthcare facilities were selected (70), the “Impedance Cut Off” denotes to either time of travel or the minimum distance of travel, in this case it was set to 5km which is the standard travel time to a health care facility according to WHO. The problem was then resolved to show the proportion of the population enclosed and those uncovered by the existing facilities.

To determine the superlative location, digital elevation model was used. The three major features that can be derived from DEM for building of new healthcare facilities; these are aspect, slope, and relief. Finally, it was significant to comprehend the land use and land cover of the study area. A 2016 Landsat image was processed using ENVI. Maximum likelihood classifier was used to produce the classes.

3.5 Environmental Setting

DEM of the study area, the road shapefile of the same area, and the health facility shapefile of the area were used in analysis. In order to determine geographical accessibility, three factors that strongly influence how difficult a health seeking journey should be were used. These factors were; distance from the health facility, slope of the land and availability of road infrastructure (Luo
&Wang, 2003). The three were overlaid in a computerized journey for determining the difficulty of traveling from one point (home) to another point (health facility).

The lower the difficulty incurred, the more geographically accessible a facility was deemed to the traveler. A reverse index was used to define geographical accessibility 1 denoting high accessibility and five denoting low accessibility (Guagliardo2004). All data were checked in order to ensure consistency of information like Satellite Image with DEM, Slope, landform characteristics, Land use, and Road network of Mbeya City should be processed into usable information by using GIS Software.

To determine suitable locations for new Health facilities to disadvantaged group Multi-criteria evaluation approaches were used for identifying location –allocation techniques at finding the right sites for facility locations that can increase the accessibility and decrease the total weighted cost e.g. distance, traveling time or other cost factors were involved. (Guagliardo 2004). DEM of the study area, the road shapefile of the same area, and the health facility shapefile, Land use map of the area were analyzed.

3.6 Elevation Data
The slope of the topography over which a health looking for trip occurred was distinguished from Topographical data. For this study, a digital elevation model (DEM) was used to reconstruct the topography of the land. This DEM was gathered from NASA’s Shuttle Radar Topography Mission and was the fourth version of a series of frequently enlightening global coverage elevation data. It had a resolution of 30n meters and was obtainable as raster grids from the Shuttle Radar Topographical Mission (SRTM) website (http://srtm.csi.cgiar.org).

This raster dataset came as a panchromatic image in signed 16-bit tiff format. Six SRTM grids covering the length and breadth of the country were downloaded and individually projected into WGS 84. From the resulting continuous DEM covering the country, the dataset of the study area was extracted using the Clip tool within the same toolset. This elevation data
formed the basis of determining how rugged the terrain was for any journey to access care services.

3.7 Deriving Slope
The DEM was input to the slope tool under the surface toolsets of the spatial analyst extension. From the raw DEM, the slope of the land over which a journey occurred was derived. A Z-factor of 0.00001 was used to harmonize, the planner coordinates were in degrees and elevation data in meters. This enabled the calculation of a gradient for each point in the Landscape (Wang 2014). The higher the gradient value assigned, the steeper the slope was. Therefore, for every point on the journey, the steepness of the slope was determined.

Source: Field Survey (2018)

From the figure above, the lower the gradient value assigned, the lower slope the suitable the landscape to propose a new facility for those disadvantaged group having no access (Guagliardo2004). Figure 4 shows Derived data slope.

Figure 4: Derived Data Slope
Source: Field Survey (2018)
The Figure above shows 9 classification of elevation ranging from very low, low (green), and middle (light green) high (yellow) very high (red) elevation whereby the higher the gradient value assigned, the steeper the slope was. Therefore, it indicates for every point on the journey, the steepness of the slope.

Therefore, the study employed Multicriteria evaluation to propose a suitable location for new Health facilities for the resident living more than 5km (disadvantaged groups) from Health services as stipulated by WHO

**Location-Allocation Methodology**

![Conceptual Framework adopted](image)

**Figure 5.** Conceptual Framework adopted

**Source:** Adapte...
From the analysis, it is evident that the sub-ward has a total of 70 health facilities. The findings showed that the total number of healthcare facilities available from the study area were three, among the six studied wards, only 3 wards, Iziwa, Itagano and Mwasenkwa had only one public dispensary. The findings also show that there is one doctor, two nurses and one midwife from the public dispensary but lack some diagnostic equipment, drugs and an insufficient number of skilled staff of which all have an effect on utilization and demand for healthcare.

Tembela Mwasanga and Iduda have no healthcare facilities among the six studied wards, which tends the community to travel long distance to secure medical services in Regional or Referral hospital located in urban center. It is evident that more than 96.7% of the healthcare facilities is located in urban areas. This is attributed to the fact that there is a lack of adequate human resources, also there are still inconsistencies in the distribution and accessibility of such services and things are made poorer due to lack of satisfactory and good roads infrastructure in the peri-urban areas.

A facility in a location-allocation analysis represents a candidate or required site, but in some cases, it represents a competing facility. The location-allocation solver chooses the best candidate facilities to allocate demand to in the most efficient way according to the problem type and criteria specified from Network Analyst tool _location-allocation, 70 facilities and 180 Demand points were selected as shown in Figure 6.

Figure 6: Located Demand point and Healthcare Facilities
Source: Field Survey (2018)
According to the 2012 National Census, Mbeya City Council had a total population of 385,279 in habitants, where the lowest population based on sub wards location was 2,334 while the highest was 18,443. In 2002 the population stood at 266,422 where the least populated sub wards location had 1,219 while the most populated sub ward had 7,958 people.

From the data above it evident that there was 41.2% increase in population over a ten years period. This absolutely has consequently has significances in terms of extending the accessible resources including health facilities. Figure 6 shows served and unserved population in peri-urban dwellers in Mbeya city.

In considering the terrain, DEM of the study area, the road shapefile of the same area, and the health facility shapefile of the area were used in analysis. In order to determine geographical accessibility, three factors that strongly influence how difficult a health seeking journey should be were used. These factors were; distance from the health facility, slope of the land and availability of road infrastructure (Luo & Wang 2003). The three were overlaid in a computerized journey for determining the difficulty of traveling from one point (home) to another point (health facility).
The lower the trouble incurred, the additional geographically accessible a facility was estimated to the traveler. An opposite index was used to express geographical accessibility signifying high accessibility and five-connotation low accessibility (Guagliardo 2004). All data were patterned in order to safeguard constancy of information like Satellite Image with DEM, Slope, landform characteristics, Land use, and Road network of Mbeya City should be processed into usable information by using GIS Software.

To determine appropriate locations for new Health facilities to deprived group Multi-criteria evaluation tactics were used for classifying location –allocation procedures. Also finding the precise locations for facility locations that can rise the accessibility and decrease the total weighted cost e.g. distance, traveling time or other cost factors were involved. (Guagliardo 2004). DEM of the study area, the road shapefile of the same area, and the health facility shapefile, Land use map of the area were analyzed as follows.

After considering terrain, population size, land use and land cover road network 2 optimum locations were arrive at. Ideally only 0.3% of the population in peri-urban can access the 70 existing health facilities within a distance of 5kms. Considering that the sub ward had approximately 14,166 people according to the 2012 National population census, the findings revealed that 96.9% of the total population (nearly 2,076 households) out of 2,143 households were living in disadvantaged locations, hotspot (low spatial accessibility) that is beyond 4kms, which is more than recommended distance to access healthcare facilities.

In addition, spatial accessibility index values and population counts indicate only 0.3% of the total population in the study area identified with high spatial accessibility. Construction of new healthcare facilities at Tembela and Iduda among the studied wards, increasing number of Health personnel’s, medical equipment is found to help in improving accessibility to 96.9%
Findings from Figure 8 showing Optimum location for new Health facilities at Tembela, Mwasanga and Iduda can be justified by having 586, 201 and 380 total population respectively, since it can been perceived from the investigation that the respective wards were geographically deprived with esteem to Health facilities. The optimum location of facilities at Tembela and Mwasanga wards as shown in Figure 7 shows that the gradient value is below 10%, which signifies the suitable built up area. This is also justified by

5. CONCLUSIONS AND RECOMMENDATIONS

This research paper has pinpointed that Geographic Information System may be used to find areas which are outermost off services network and select amenities inside them which would be advanced to improve fairness of admittance to healthcare services. Furthermore, the study concludes that Remote Sensing knowledge can be used to judgmentally appraise the delivery and accessibility of healthcare facilities. However, making it likely for professionals to find out the recent sites of health care midpoints and their attention, to find out which fragments of the study area (population) strength be extremely uncovered (or underserved) within the World Health Organization standard distance of 5 km and to treasure out the superlative locations to construct new health midpoints (location –allocation approach) to optimize Healthcare Facilities in Peri-Urban areas with the purpose of enhancing or improving geographic convenience to health hubs. The desire to maximize the whole
number of demands sheltered within the verge of provision distance or time by localizing the candidate facility nearby the populace density was attained (Donnell 2007). This is the need of any regime in providing its resident with social amenities and services. However, in establishing the methods that GIS usage can expand spatial access to Healthcare amenities in the peri-urban area. Spatial planning approaches that can categorize areas and populace that are not well aided by a specified set of provision. Health planners and policymakers should estimate the expected improvement in spatial performance. Also associated with proposed planning interventions as planning methods particularly emerging world where spatial settings are highly dynamic because of fast urbanization.

Furthermore, more struggles should be strengthened to build more health facilities to shelter all wards in Mbeya City peri-urban. There is need for acceptable urban planning establishment Private Public Partnership in the construction of more dispensaries, health centers, and hospitals in terms of location of major health facilities so that residents can have access to these facilities and services within a minimum distance.

The study also concludes that geographical accessibility of health amenities was an ultimate issue to reflect while planning for accessibility to Healthcare programmes, and that a GIS methodology such as the one created could give result support in these esteems to policy makers in the health segment.

Therefore, the study is suggestive of to retain the present locations and adding up some original locations especially Tembela, Mwasanga, Iduda and other peri-urban wards experiencing a shortage. The study also recommends that transport grants be measured as probable solution as well as advancement of targeted amenities in the peri-urban to offer services that are more inclusive.

The determination is to advance the effectiveness of the existing community system rather than going concluded the unrealistic, politically impracticable and exclusive procedure. In substituting or repositioning the existing ones, attempt to work on funding the cost of facilities and drugs so that the multitudes can enjoy providing facilities and accessing the hospitals will not be for the rich alone.
5.0 References

Amad 2012. “A GIS based Investigation of Spatial Accessibility to Healthcare Facilities by Local Communities within an Urban Fringe Area of Melbourne”

Ahmed, SJ 2004. Improving access to public health care services- A case study on Dar es Salaam, Tanzania.


Russell, C. 2008. “After-school programs (ASP) in South Carolina: Supply, demand and underserved areas” Proquest, South Carolina, USA.


