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Research Article

Evaluation Of the Main Transportation Between Routes Between Hospitals in The City of Khartoum Using Geographic Information Systems (A Study in Transportation Geography)

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Abstract

The work of this research to evaluate the existing state of Khartoum hospitals distribution, so it has been necessary data collection to look like roads, hospitals, land use and population density in the region and analyzed using arc map10.2 gis -geographic information systems- to gain access to a number of results that the distance between hospitals and main roads less than the distance standard also confined to hospitals in convergent spaces It is also standard distances do not agree and for the population, according to an analysis of the intensity Kernel said the results far from health facilities are basically designed to serve the opulation. By observing the distribution of residential areas, demographic, commercial and other uses of land in the map also shows that this distribution _distribution hospitals Khartoum_ existing scattered and without the approval of the standards as required and not serve the population.

Keywords

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Introduction

Back Ground the Topic

Geographical Information System (GIS from now on) is able to bridge the gap between curiosity-driven science and practical problem solving. This is already done for several areas of societal issues and of scientific fields like, for instance archaeology, geology, topography, demographics, development and landscape architecture etc. In those fields GIS plays a very important role either directly or as an aid instrument for mapping and analyzing data and revealing new patterns that could lead to better understanding of knowledge that might already exist or generate new knowledge that needs further consideration GIS, analytical hierarchy process, and multiattribute assessment and evaluation techniques were used to examine attributes describing primary care need and identify areas that would benefit from increased access to primary care services. Attributes were identified by a collaborative partnership working within a practice-based research network using tenets of community-based participatory research. Maps were created based on socioeconomic status, population density, insurance status, and emergency department and primary care safety-net utilization. Individual and composite maps identified areas in our community with the greatest need for increased access to primary care services. Hospitals are one of the most important infrastructural objects. The increasing population, especially in developing countries, amplifies the demand for new hospitals. Hospitals are usually funded by the public sectors, by profit or nonprofit health organizations, charities, insurance companies or even religious orders. No matter who provides the answer, where to locate a new hospital is an important question to ask. Hospital site selection plays a vital role in the hospital construction and management. From aspect of the government, appropriate hospital site selection will help optimize the allocation of medical resources, matching the provision of health care with the social and economic demands, coordinating the urban and rural health service development, and easing social contradictions. From aspect of the citizen, proper hospital site selection will improve access to the health care, reduce the time of rescue, satisfy people's medical needs as well as enhance the quality of life. From the aspect of the investors and operators of the hospital, optimum hospital site selection will definitely be cost saving on capital strategy. It is an inevitable trend for hospitals to adopt cost accounting in order to adapt to the development of the market economy. Besides, better hospital site selection will promote the strategy of brand, marketing, differentiation and human resource, and enhance the competitiveness.

Problem of the Research

I. inadequacy of the hospital sites with the number of people in the region
II. Noise Pollution
III. disabling of traffic from hospitals pedestrians on a main road
IV. Bad choice of hospitals, site of the facility near the airport

Objectives of the Research

The overall aim of this study intends to evaluate for existing hospitals by using arc GIS software:

I. Distribution of hospital in Khartoum city
II. To assessment the health care services already existing in the city of KHARTUOM
III. Health care environment and utilization
IV. The effects of hospitals in there's area

Justification for choosing the topic

Find out the distribution of hospitals in the state of Khartoum, the pattern was necessary to conduct the research and many of the analytical processes for hospitals located and their population distribution based on measurements of global and local.

Justification for choosing the area of study

Sudan is a big country and a great and has a large number of hospitals, but Khartoum state has

the largest number of residents Because health is the population chose the state of Khartoum to study the distribution of these Aiskiet in the state and the extent of its proximity to the population to an end required.

Purpose of the research

I. Get a map showing the distribution of hospitals in the state of Khartoum for evaluation
II. Find a basis for the selection of new hospitals sites according to local and international standards .

The Research Methodology

The methodologies and analyses for the site selection used in this study are: AHP, ROM, GIS-based MCA, necessity tests and sensitivity tests. Necessity tests check the necessity of factor criteria. Sensitivity tests assess the sensitivity of the result to the weights' change of factor criteria. The variables and weights are described below. The manipulation and analysis of data in a geographic information system is not automatically achieved.

Structure of the research

This study includes four chapters. Chapter one include Introductory chapter which include introduction about application of GIS in Distribution of hospital in Khartoum city, The Research Objectives to know good areas of hospitals, this chapter is include although Statement of the Research Problem to determined how can solvd for gain research objectives and finally The Research Methodology for arriving the result. While chapter two is theoretical framework and study area of the research. Chapter three is Research Methodology is involve the criterias of research, software, data , flow chart for analysis steps and map of the result. Then chapter four is result and discuss and final chapter five conclusion and recommendation.

Chapter Tow

Letrecher Review

Spatial analysis and assessment of projects is a wide range of applications in health care, from managing beds in a facility to global health risk assessment. Geographical Information Systems (GIS) have been used widely in many developed countries to map health-related events, and the results are used for planning of health services, and her I have some examples about hospitals and health care centers on the world.

In The City Of Pune

ANKITA MISRA, HARSHIKA KISHORE ,KETKI BAROT, they are studding A GIS BASED ANALYSIS OF HEALTH CARE SERVICESIN THE CITY OF PUNE objective of this study To analyze the health care services already existing in the city of Pune. To study the service area covered by each health centre using network analysis. . The These health analysis and studies can be grouped into three main areas, which are a. Different diseases b. Distribution of hospital in different areas c. Health care facility and utilization In this paper we have concentrated on the two points of distribution of hospitals and availability and utilization of health care facility .Analyzing distribution of hospitals is an important criterion in health care facility because every category of population should get access to the hospital facility optimally. Health care facility and utilization is concerned with all the issues that are related to the locations and facilities. These issues include the optimal location of hospitals and clinics, the relationship between existing locations and health care needs and assessment of hospitals and the assessment of facilities. This paper is focused on the City of PUNE and the distribution of hospitals in the region. We have tried to do a proximity and network for the hospitals in this region. Also we are going to study the population distribution and its relation with the availability of hospitals and clinics . By the end of our research we would recommend possible areas for the setting up of new hospitals and clinics.

In Haidian District of Beijing

Lina Zhou, Jie Wu in 2012 study for GIS-Based Multi-Criteria Analysis for Hospital Site Selection in Haidian District of Beijing This study Aims to select a site for building a new hospital in Haidian District of Beijing using GIS-based Multi-Criteria Analysis (MCA). Considering various factor criteria, Analytical Hierarchy Process (AHP) and Rank Order Method (ROM) are used here for weight setting. Compared to previous studies, instead of taking all the criteria into MCA process at one time to get the final results, firstly, this study performs two necessity tests and two sensitivity tests on the factor criteria. All tests are conducted with the AHP and ROM methods for the MCA process. After that, the candidate sites with maximum values are selected. Finally, taking into account the sites' ambient conditions and subjective parameters, the optimal site for the new hospital is decided. The methodologies and analyses for the site selection used in this study are: AHP, ROM, GIS-based MCA, necessity tests and sensitivity tests. Necessity tests check the necessity of factor criteria. Sensitivity tests assess the sensitivity of the result to the weights' change of factor criteria. The variables and weights are described below.

In the contiguous United States

Chris Wayne and ESRI–Olympia are Exploring Hospital Distribution Using Arc GIS of United States Spatial analysis has a wide range of applications in health care, from managing beds in a facility to global health risk assessment. This exercise looks at the distribution of hospitals in the contiguous United States relative to population. The following specific objectives:

I. Quantify hospital density within each HSA.
II. Compare hospital density in California (or another region) with that of the contiguous United States.
III. Compare the population characteristics of regions with high hospital density to the entire contiguous United States.
IV. Present your analysis as a map.

This exercise assumes that you know the basics of using ArcGIS how to start a map session and navigate in the ArcCatalog environment.

In a metropolitan city

Lee KS, Moon KJ. In May 2014 are study the Hospital distribution in a metropolitan city: assessment by a geographic information system grid modeling approach. An objective of this study is used to assess urban hospital distribution in Seoul, the capital of South Korea. A geographical information system (GIS) based analytical model was developed and applied to assess the situation in a metropolitan area with a population exceeding 10 million. Data for this analysis were obtained from multiple sources:-

the Korean Statistical Information Service.
the Korean Hospital Association,
the Statistical Geographical Information System

A grid of cells measuring 1 × 1 km was superimposed on the city map and a set of variables related to population, economy, mobility and housing were identified and measured for each cell. Socio-demographic variables were included to reflect the characteristics of each area. Analytical models were then developed using GIS software with the number of hospitals as the dependent variable. Applying multiple linear regression and geographically weighted regression models, three factors (highway and major arterial road areas; number of subway entrances; and row house areas) were statistically significant in explaining the variance of hospital distribution for each cell. The overall results show that GIS is a useful tool for analysing and understanding location strategies. This approach appears a useful source of information for decision-makers concerned with the distribution of hospitals and other health care centres in a city.

In The North-West Region, Romania

Şt. Bilaşco, S. Filip, P. Cocean, D. Petrea, I. Vescan,I. Fodorean In 1/2015 Do Are Researcher In The Evaluation Of Accessibility To Hospital Infrastructure
At Regional Scale By Using Gis Space Analysis Models:

THE NORTH-WEST REGION, ROMANIA Problem Of This Research Is The Easy Access Of The Population To Hospital Infrastructure Represents One Of The Main Preoccupations Of Local And the objectives is :- National authorities in the attempt to increase the degree of deliverance of quality medical services analysis of territorial distribution of various hospital categories city, clinical, teaching, emergency hospitals- has revealed some areas of deficit in what regards the availability of various types of medical assistance

Identifying the areas of deficit

The METHODOLOGYs of this research is exploitation of vector and raster database structures of GRID type by means of a series of singular models of spatial analysis that have been synthesized in a single complex model the main purpose of which is the scoring and representation of the degree of accessibility to hospital infrastructure from any point on the surface of the territory under scrutiny.

G.I.S. database

The database required in the process of spatial analysis has been established on the basis of thematic layers in vector and raster format, comprising access ways, building areas, hospitals etc., structured on three main types depending on the manner of their exploitation in the structure of the final model .

Spatial Analysis

Following the analysis of the database and considering the complexity of the structure in the final model we have decided to carry out the spatial analysis as two models (the calculation of access time to hospital infrastructure, in minutes, and identifying the areas of deficit from the point of view of access to hospital infrastructure for the two types of hospitals using the scoring technique), each displaying its own logical structure.

Chapter Three

This chapter is the research methodology

STUDY AREA

The study site selected for this research lies in Khartoum city between longitude 32.529831, and Latitude 15.564836. The location of study area indicated by Figure (3-1)

Figure (3-1): Location map of the study area

Materials

The data collected for this research includes the following:

I. Satellite imagery (e.g., Land sat with spatial 30 m spatial resolution).
II. Existing shape file (e.g., roads, hospitals, land use, land cover).
III. Population data.
IV. Topographic data (e.g, DEM with spatial resolution meter).

Methods of the data analysis

The following methods were used to analyze the collected datasets. The process was started by collecting data from the KHRTUOM Municipal Corporation. The collected data included the ward wise population data ,road maps, Boundary of Khartoum locality ,Land use ,Land cover , Dem image and the hospitals existing in the KHRTUOM City . The road map and the ward map was geo-referenced using the survey of Sudan.

Analysis of data

Proximity analysis for the roads and existing hospitals.(Buffer) Statistical analysis which includes (Pattern analysis to evaluate the distribution of the existing hospitals. Distance to and between the existing hospitals from the existing roads.

To provides information about the current land use of the study area.
To extract the information about the topographic of the study area (slope).
To obtain Analysis pattern about population density(kernel).

To observation hospitals distribution pattern use average nearest neighbor (EUCLIDEAN_DISTANCE).

Criteria of the model

The following criteria were used to evaluate the current distribution of the hospitals in the study area:

1- Should be located within highly populated area, ranged between (10000-15000).
2- Should be located near the existing roads.
3- Should be located far away from the other existing hospitals (about 9km).
4- Should be located in relatively flat area (approximately less than 10%) in slope.
5- Should be located within the other services areas.

Flow chart analysis

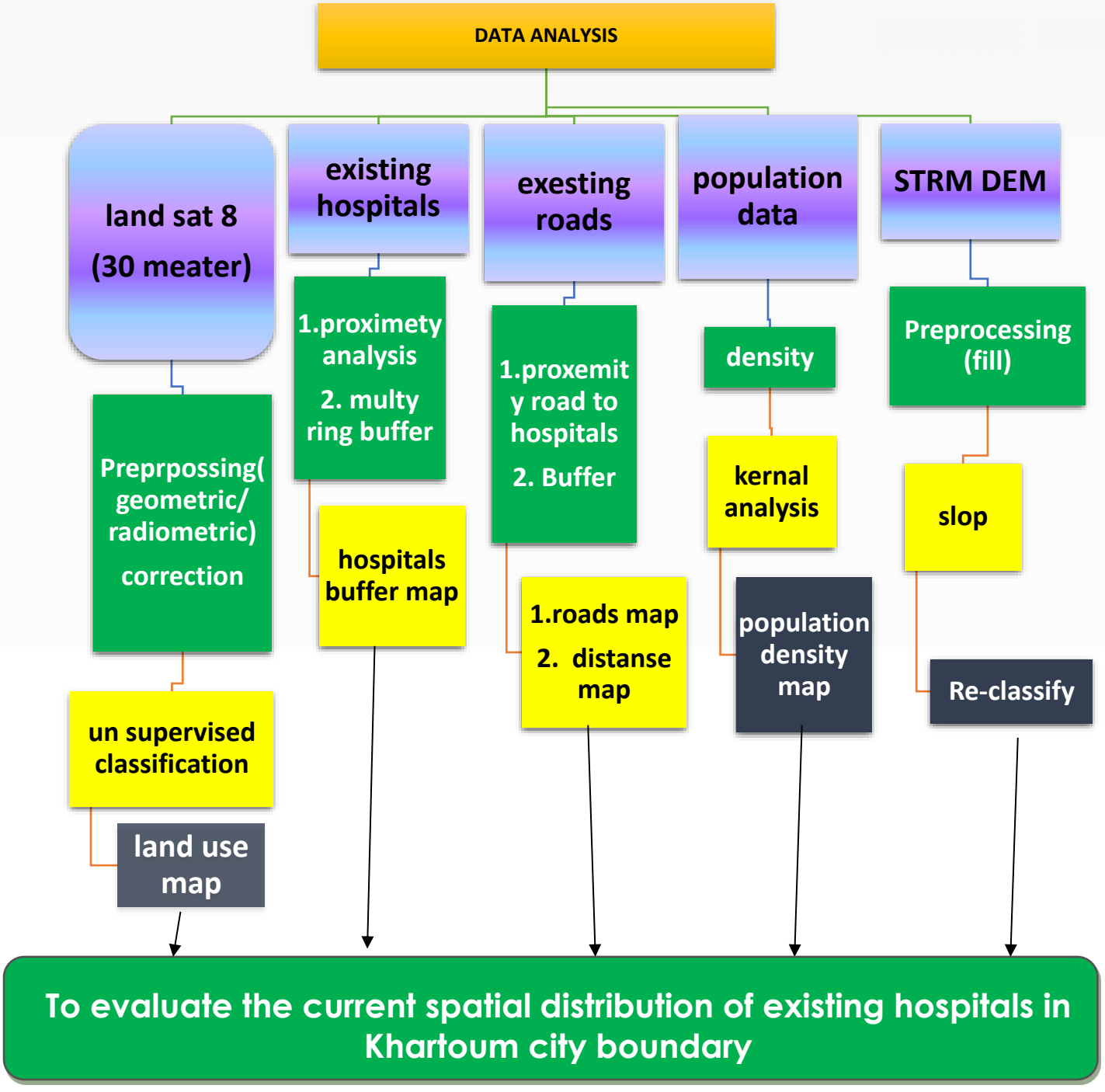

Figure (4-1): The locations of all hospitals

Chapter Four

Results and Discussion

Results

From the analysis of the geodata which includes (e.g., satellite image, GPCs locations, population figures, and services layers), I found that, according to **figure (4-1)** the locations of all hospitals were follow the dispersion pattern where the (P-value = 0.01), that mean there no standard for the distribution of the hospitals in the study area.

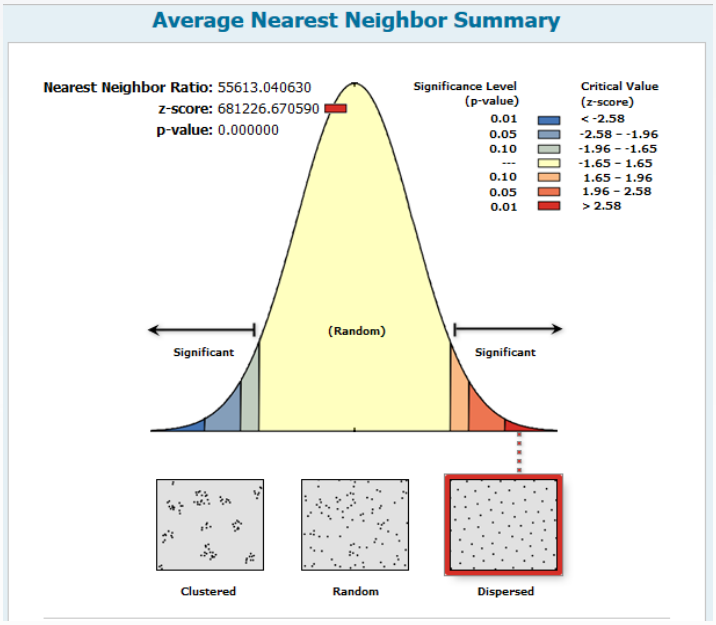

Figure (4.2) shows the land use of Khartoum locality area, which contains (hospitals, agriculture area, air port, air port runways, cemetery, commercial, educational, governmental, industrial, open space, parks recreational and residential). We find that the image of hospitals distributed unevenly between residential areas, shops, sire, mostly in nearby areas without some reference standard.

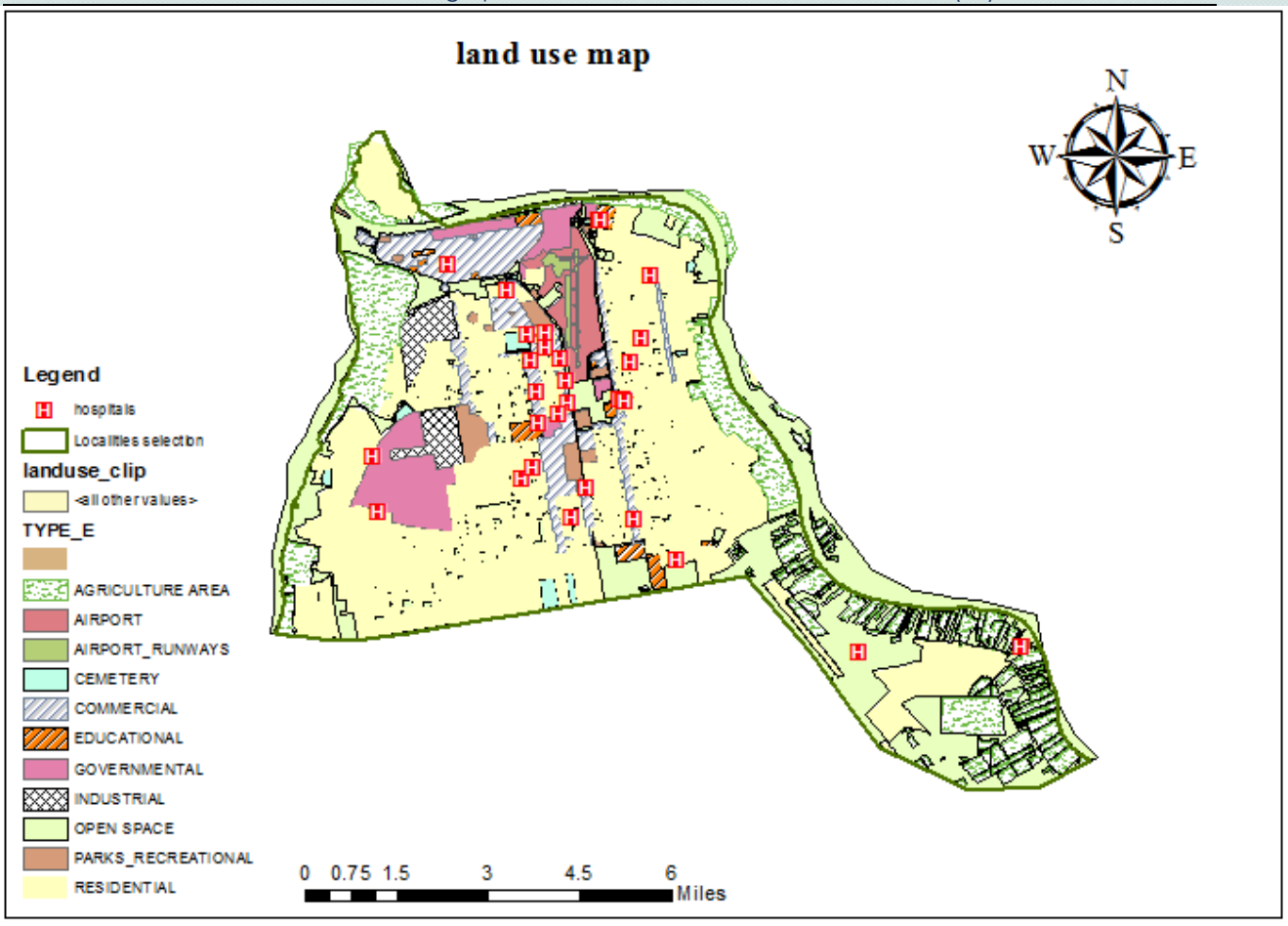

Figure (4-2): land use map

Figure (4-3) shows The roads used to calculate the minimum and maximum distance between hospitals and the main roads to estimate suitable hospitals location, and display hospitals in buffer zoon of main roads.

Hospitals divided into several types

- General hospitals: Contains all disciplines dealing with all diseases.
- Specialized hospitals: It specializes in treatment of certain types of diseases such as neurological and cardiac hospitals and hospitals in major cancer at the very least from the medicine, general surgery Uncle.
- A central hospital: general surgery and additional terms of reference, nose and throat and the generation of women General Medicine. General surgery and surgery Obstetrics and Gynecology, children and in addition to other disciplines such as anesthesia and nose and throat and eyes.
- Central hospitals specializations: same as well as neurological and urinary tract anatomy and medical tests and disease.
- Major hospitals: include centers for the study and scientific research as well as psychological illnesses or surgery and orthodontic and dermatologists.

Second, the planning and design standards for hospitals:
Planning standards for hospitals: the planning conditions for the site:
Preferably the multiplicity of access routes to the hospital in order to avoid congestion and especially for ambulances.
Hospital 40 m away from the main road to the hospital and 80 m from the public roads.

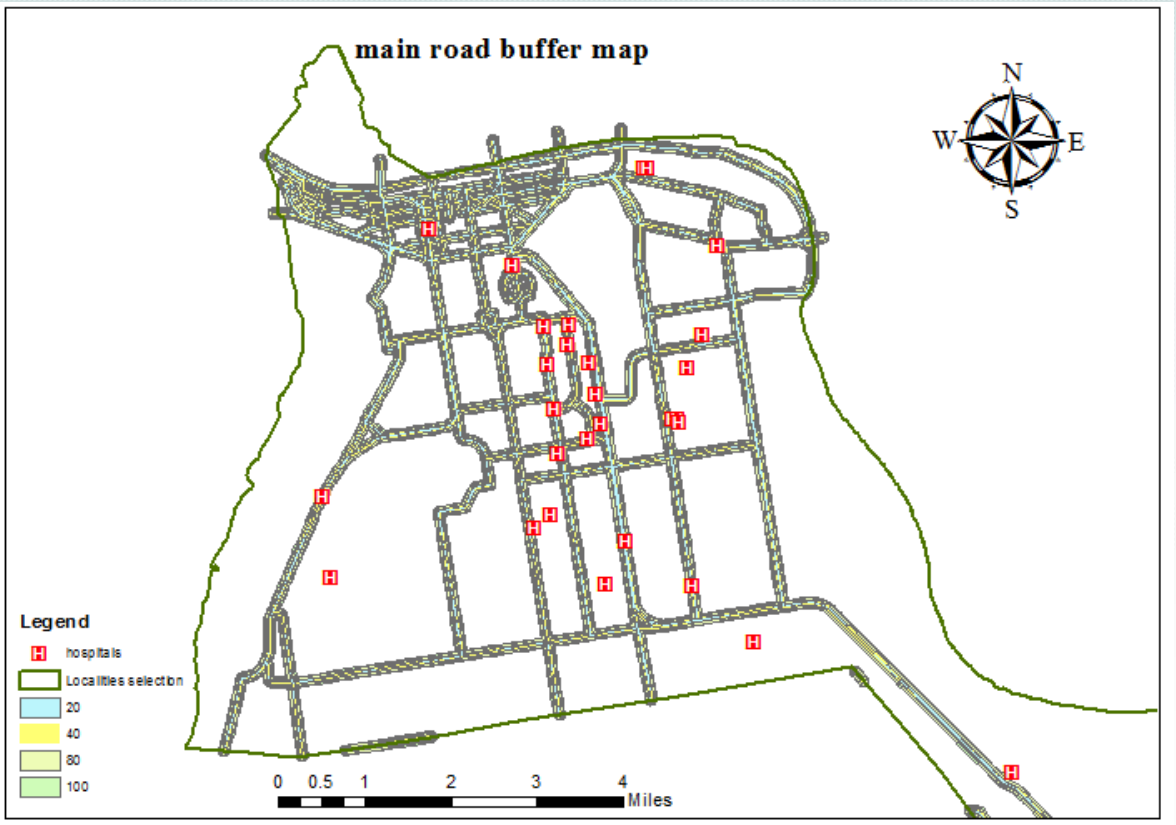

Figure (4-3): main road buffer

Figure (4-4) The buffer analysis results depict that the existing full within the distance of road (20-40-80-100m) appearing more of 20 hospitals located in20-40m zoning and 23-25 hospitals located in 80-100 m zoning from41 total number of hospitals.

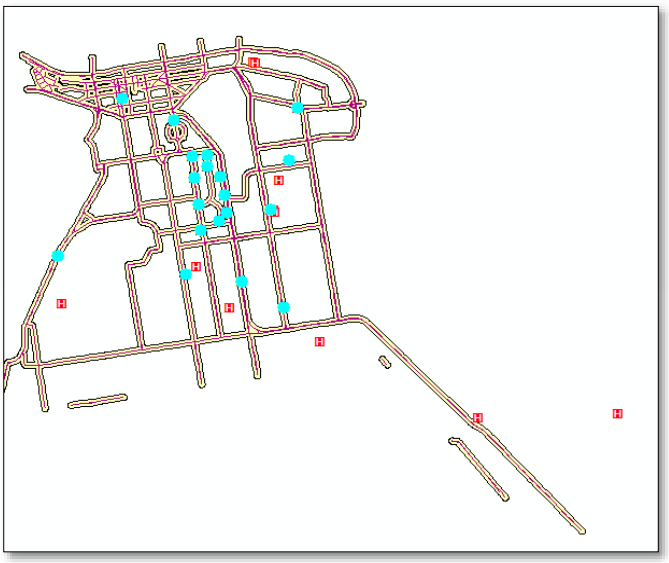

Figure (4-4): hospitals in buffer zoon

To explore the distance between hospitals and pattern of hospitals distribution was used multiple ring buffer method to view the amount of overlap between the existing hospital service areas. The impact of distance on the use of hospitals and other health care, and on health status, has not been well established. In the UK threshold distances of between 24 and 50 miles to specialist hospital services, 10 miles to screening services , 7 km (4 miles) to family planning clinics and 2.5 miles to primary care have all been used in reporting 'poor access', but there is little consensus and no strong theoretical or empirical basis for these choices. In Figure (4-5): observed distances between hospitals in the study area ,in rang about 1-3 mails Most hospitals are increasing in1mail

area from other . This distance far from the global standards for hospitals. for our study population are low, averaging just 4km to the closest hospital VS international standards.

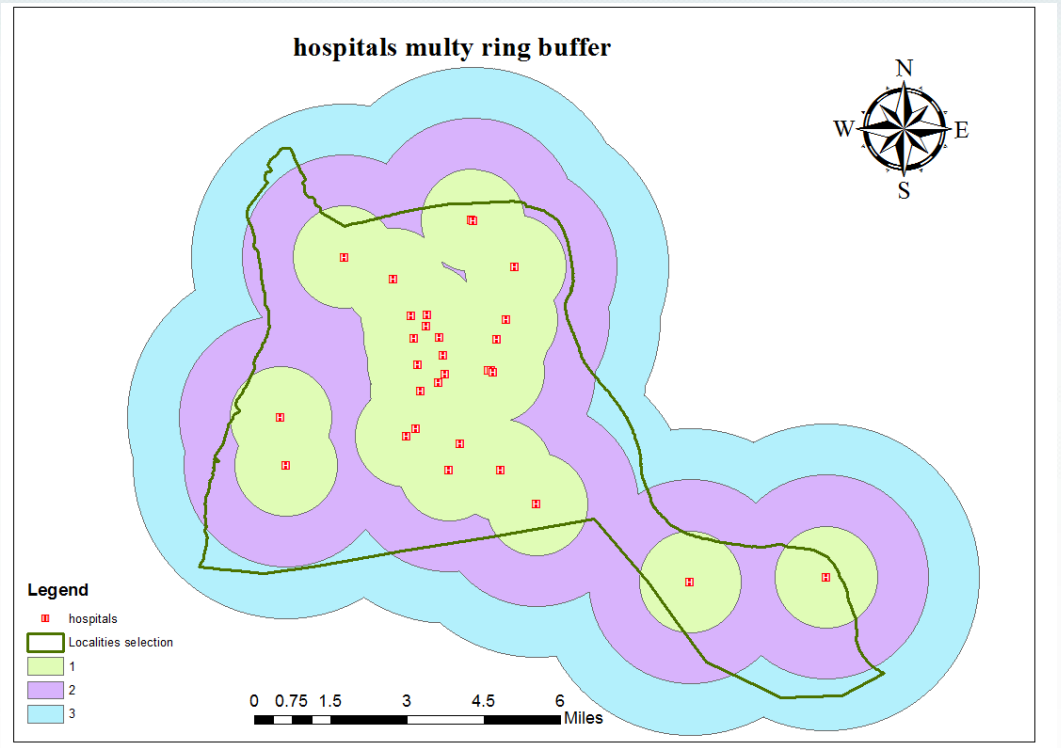

Figure (4-5): hospitals malty ring buffer

While figure (4.6) illustrate the main reason for the construction of any hospital which is the service medical residents in the area So the population density calculation to assess the existing distribution of hospitals according to the degree of population density for each zone

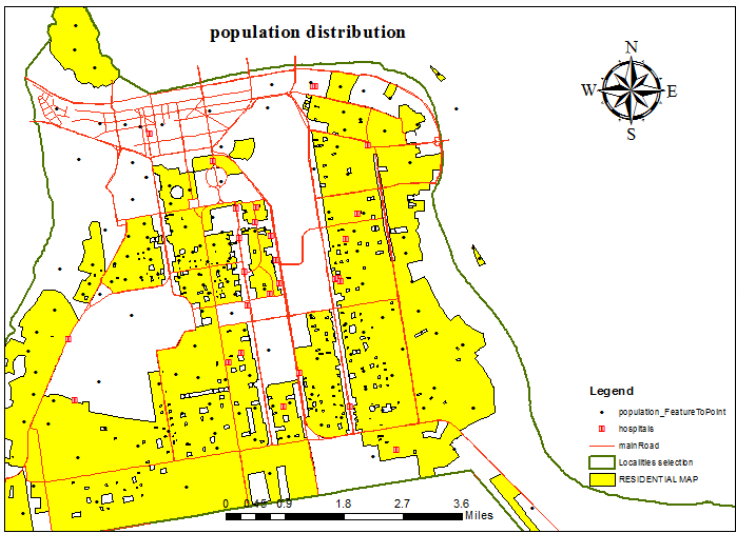

Figure (4-6): population distribution

Population distribution on Khartoum locality with residential area and hospitals appear the range of variance. After using kernel density tool to show density population in figure(4-7) the area VS hospitals to estimate the rang of hospitals utility to people in the area the result was unexpected.

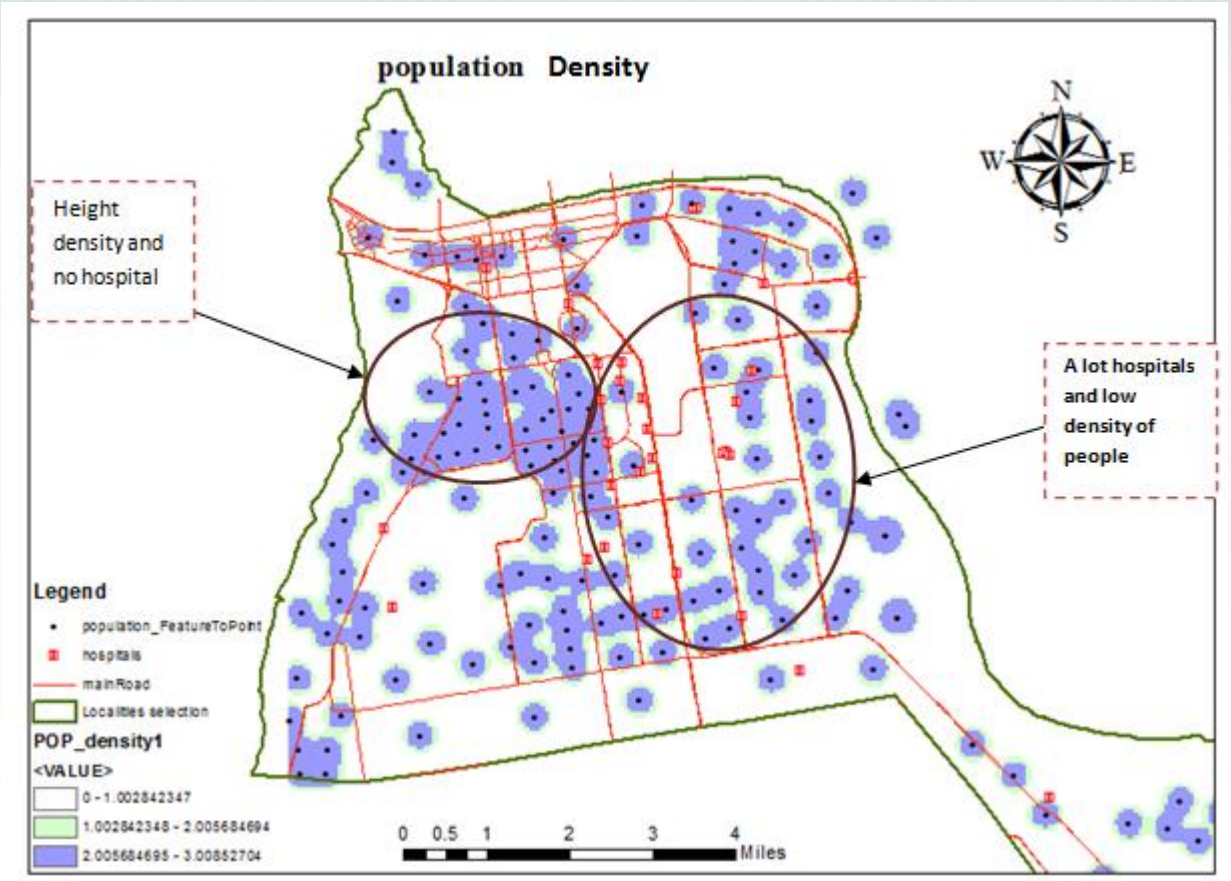

Figure (4-7): population density

figure(4-7) In above image can observe hospitals are distributed irregularly and by average Nearest Neighbor tool it confirms the hospitals are distributed its forms scattered.

Chapter Five

Conclusions

In the map of land use we noticed severe distress among hospitals and between hospitals and some shops and Mtqh airport and empty spaces, government buildings, distance from residential areas In the road map, we found that the distances are not conforming to standards, there are 21 hospitals in the Distance 20-40 meters and more than 23 hospitals 80-100mitr distance 72% of hospitals away from each other a distance of 1 mile or less is that the population distribution map shows the population gathered in the face and hospitals gathered on the other side shows how far and difficult access to hospitals. After analysis all this layers the study reveal that the current distribution of hospitals in Khartoum Locality does not follow any types of criteria and does not serve the medical needs of the population level imposed.'

Recommendations

I recommend in relation to the findings of the study the following:

1. Study population density of any region is held by the Hospital.
2. Arranging the distribution of hospitals in areas according to specialties.
3. Study the distances between the new standard hospitals and main streets.
4. Building hospitals suitable distance away from residential areas to avoid noise.

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