

Using positioning city hospitals, multi-criteria analysis method (Case study: Range, South of Tehran)

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Abstract

The growth of cities is one of the most important global phenomena, which is occurring under the influence of environmental factors on the human, economic and political, and giving services to citizens and the city are of the priorities of the urban planners and managers. To accomplish this, a variety of techniques have been used both classical and modern. Since the 1970s, the use of quantitative methods in problems locating utilities increased and each of these methods in addition to the advantages and disadvantages in this field is used to study how the spatial distribution centers in Range, South of Tehran has been studied as the case the system uses a multi -criteria analysis. The issue of site selection, service, and service centers in the city is better. The purpose of this study is locating the appropriate municipal hospital in south of Tehran, is analytical and descriptive methods and the type of application. To achieve this objective the integration of GIS and hierarchical method (AHP) and GIS was used, the required layers, including the proximity to compatible land uses, access to the communication network, proximity to fire stations, population density, distance from the existing medical centers, away from the path, away from fuel stations, distance learning centers, land slope, proximity to the city center and close to green areas in GIS environment and then paired comparisons were performed by Expert choice software finally, by weighting the criteria and by combining layers of information, the most suitable place to build a city hospital was located in this area.

Keywords: municipal hospital, positioning, GIs, AHP, Model (Fuzzy), south of Tehran

1. Introduction

There is not a detailed definition of the term locating but by taking on the definitions of space planning and urban land use planning we can obtain the concept of locating. So space planning is the distribution and affiliate organization and human activities in the area of the land. (Ziyari, 34:1380). Land Planning, and division and space sciences for various uses which is taken to make effective use of land, location, spatial properly and efficiently (Pour Mohammadi, 3:1382). Thus, positioning is considered as spatial and urban planning component and seeks the best conditions and facilities for citizens (Khodabakhshi, 12:1385). Humans have several needs and health is the first human society's basic need, hence to supply and control it with the aim of

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improving the quality of life and health of the citizens are of the most important tasks of the Government.

Urban growth in recent decades in our country has been in such a way that urban infrastructure needs of cities are not equipped with it. Tehran city as center of Tehran Province, as due to factors such as the migration of rural - urban, natural population growth, the excessive increase in population and physical growth of urban areas, faced with lack of planning. While the in terms of optimal distribution of space and place a fair arbiter for usage of public services especially clinical and health services quick and on time access is important to them , a proper atmosphere has not been considered. Usually establishment of any urban element in the position space-skeletal a special case of the city subjects to principles of Technique over construction work is e special in the case of observing the position of the functional efficiency and that element will be determined in the same place and otherwise might have problems in public services units' health and treatment (Azizi and colleagues, 1384).

Meanwhile health services today are as one of the urban infrastructure in order to develop the areas and aimed at raising the level of health and increasing life-prolonging activity of individuals and forces and, finally prevention of disease outbreaks and timely treatment... (Razavi, 1381: 150).

In this regard, during the last two decades a lot of research to design optimal treatment centers, hospitals and clinics have been conducted (Faizollahi et al, 1388: 191). Therefore the main task of urban planners is to determine the optimum location of urban centers so that all residents have access to them easily.

The industrial revolution occurrence in Europe caused the growth of urban populations in the world and accelerating of this growth has continued to the extent since that many urban centers did not have a sudden influx of immigrants with their implementation, and as a result of this growing trend, the city began to spread as unbalanced and a several problems, including in the areas of health, education, housing, health and employment in cities and balance in human and social relations between the Residents of cities and towns were facing lack of services, so in addition to the quantitative aspects (lack of service), qualitative aspects of the topic, namely the lack of an appropriate spatial distribution and positioning of non-compliance, the severity of the problems became doubled (Azizi, 6: 1384)

Iranian Rapid growth in urbanization in recent decades have been done in such a way that the urban space and infrastructure needs of cities are not equipped , the most significant effect on the growth of cities has accelerated , mixed distribution system planning services and the failure of the distribution is generally which are seen in all cities . In this context, to assign the optimal location and movement of structural elements is one of the most important tasks of urban planning (Hosseinzadeh et al: 2).

South of Tehran is also not excluded from this problem like the other cities of the country suffers lack of good access to utilities. In South of Tehran situation of health services - health and relationship comparing the surrounding lands, access roads and population centers in the lattice size and the ease and peace of mind - health of the importance are existing. In addition, determining the functional radius of each sphere of influence - care centers can determine the optimal location for this type of application.

Locating health centers is under the influence of several factors and variables that taking all of these factors and variables in the form of a traditional method, system, is very difficult or impossible. So given that the process of determining the desirability of a place - care centers needs considering multiple criteria, using multi -criteria analysis can be one of the manifestations of the models featured and Technology objectivity of the use of decision support

systems in establishment of health – treatment centers. In the present study we have tried to select South of Tehran as case study area, WLC model as one of the prominent multi criteria decision techniques (MCDM) to establishment of health – Care centers and suitable model of place prioritization schemes desirable are supposed to be tested.

2 - Purpose of Research

This paper utilizes multi criteria analysis to locate and track the optimal organization of health services - and especially health clinics in the city of Tehran has been paid. In terms of developing health applications of Tehran suffers the status of turmoil. The accumulation of application therapy in the Center and southwest of the city, as well as the immense health user rallying in the city center has caused the wings at Northwestern, southeastern and northeastern city suffer this shortage.

3 – Background of research

In numerous studies using multi -criteria analysis and GIS have been made such as: doctor Esfandiar Zebardast (2005) , Dr Alijani et al (2007) , and doctor Mohammad Rahim Rahnamai et al (2008) noted with respect to issues associated with locating a user study of a treatment that have been done by several approaches and now can be taken:

Almas pour (2001), in his master's thesis entitled, Application of GIS network analysis, spatial distribution and location of pharmacies (case study of Tehran 6th precinct) is discussed.

Mohammadi (1382) , in his master 's thesis entitled , evaluated and located health care centers using GIS (case study of Tehran 5th precinct) to issues such as municipal standards , evaluation and analysis of health services - Therapeutic area and the finally, the optimal location for a new health center and offers some suggestions.

Ebrahim -Zadeh et al (1388), in an article called spatial-place planning and organizing - where health care services using GIS (Zanjan Case Study sampling) and network analysis to determine the radius of action and distribution of hospitals and analysis of spatial data, concluded that the current location of most medical centers (hospitals) in Zanjan academic don't match standards and requirements of this application don't s match. Current requirement with respect to per capita urban centers in Zanjan is At least 7 hospitals , that the city government can extract out of 11 points from the GIS which can be used to correct these deficiencies. During a research work Feizollahi et al studied the model which was designed in a single hospital and had the capability to implement in hospital and due to its importance, in a hospital is recommended.

Hosseinzadeh studied a research, named spatial analysis and spatial distribution of health centers - Health and Home Care Branch in the city of Chalous with statistics and information about hospitals and the capabilities of GIS, medical centers in accordance with the criteria and Early results showed that all the places with medical centers in the city are not appropriate, and they can be the considered for other services used.

4 - Materials and Methods

A: The materials used

To determine suitable areas for construction of health centers in Tehran, a criterion A_i, the A_i, is required to act according to its location. Therefore in study the opinions of the expert

group and use resources were investigated, and criteria for locating treatment centers were considered.

In the study of basic city map on the scale of the digital map user, has been the status quo in urban were used and digital map of land prices as the base material, and with information about any of the layers in the criteria of therapeutic spaces, positioning of the layer of digital maps, the information required in the process of analysis were prepared. Furthermore, the necessity of using overlapping operations such as searching, spatial analysis, Geo-referencing, raster and scalar operations turned a point for the effective use of software ARCGIS 9.3 and IdrisiKlimanjaro provided in this study. Comprehensive summary of the detailed design of Tehran city in 2007, General Population and Housing Census in 2011 and the Municipal Information Archive of Other sources of information were used in this study. One of the most common methods of evaluation criteria – which has been used extensively in GIS, is weighted linear integration model. In this method a couple of different factors or methods are compared and weighed using CRITIC method. Decision makers directly assign weights of the relative importance to be to each attribute.

GIS-based weighted linear combination method comprises the following steps:

1. A set of evaluation criteria (layer of the map) and a set of possible options are specified.
2. Each layer of standard maps to be standardized.
3. We can determine the weights of criteria, ie we assign directly weighing the relative importance to each criterion map.
4. Layer of the map to create a standardized weight are created. (by the standard map layers multiplied by corresponding weights to them)

we obtain total scores in connection with any item by collective Overlapping the on standardized weighted maps and classify the options in terms of total functional scores . The option with the highest score (rank), and best known as the (Malchfsky, 1385: 339). Officially, the decision rule is used to evaluate each item or sub relation to:

Formula (1): $A_i = \sum_j w_j x_{ij}$

Where A_i , x_{ij} , representing the n th option score associated with alternative, j th and w_j , containing a standardized weight, so that $\sum w_j = 1$. Weights represent the relative importance of each attribute. Determining the maximum value

$i \rightarrow A_j$ highest priority is chosen, In this regard, like the regression fit is determined linearly. In this Research, operation, WLC in Idrisi Kilimanjaro using the MCE has been done.

As the model output of WLC, with a simple linear stretch (using the STREATCH) contour (255-0) have been standardized to facilitate comparing Options scores with optimal situation.

5. Introduction to the study area

Region 19 covers an area of 2031 hectares in Tehran, has 239,718 inhabitants and is the 71023 households (Statistical Center of Iran, 1390). This area in southern Tehran and the geographical position 51 degrees 22 minutes longitude and latitude is 35 degrees 37 minutes. The region has three districts within legal limits, two areas in the privacy and 14 neighborhood. Khani Abad district, Nematabad, bloom and Dolatkah of this area are famous neighborhoods. Region 19 of Tehran in adjacent areas, 17.16, 18 and 20 located north of the highway buds and highway Ayatollah Saeedi, south to Highway Azadegan, from West to Highway Ayatollah Saeedi and highway prisoners of war and from East to Highway Nawab Street Bahmanyar is limited. The region with the deployment in southern entrance of West Tehran, had a special place

in their city is home to some of the structural elements. Therefore, the detailed plan has been named the capital city of Tehran as an international gateway, the figure below shows the position of the study area. Evaluation of health centers show that users type in the status quo area is 18926 square meters to 0.08 square meters per capita. This User 0.1% of the total area, including the legal limit. Population covered hospital at least on a regional scale equal to 10,000 households and a population of 13,000 households (Pour-Mohammadi, 1382: 61), This is the case in most countries of the world in front of 45,000 to 50,000 people, a hospital with a radius of 1,500 meters is proposed Mlkrdy1000- (Razavi, 151: 1382). Thus, the functional radius of 1500 and 1000 meters for a hospital, only a limited part of the standard range of services for a hospital. So in the future due to population growth, regional development and increased migration to the region, lack of facilities and lack of hospitals in the region, creating new hospitals appears to be essential for the Region 19 in Tehran.

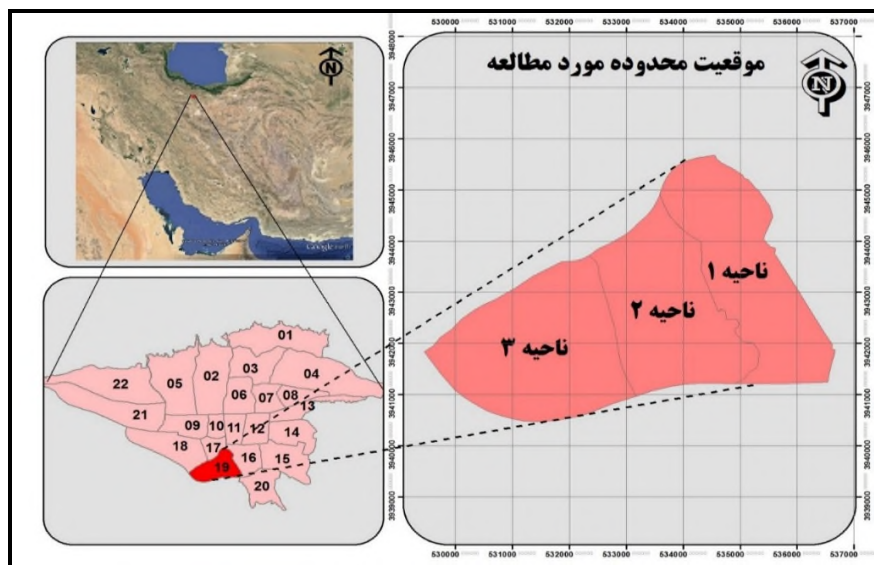


Figure 1: Map and location of the study area

6 - Criteria used in locating clinical centers

A: **Table (1)** Name of standard and justification

| Name of criteria | justification |
|---|--|
| 1 - Distance from industrial centers. (Weight: 106 /.), | These application is mainly in the city outskirts and severe environmental and sound pollution is produced. Therefore, the distance between clinical centers is necessary. |
| 2 - Proximity wit medical – health centers (Weight: 089 /.) | Quick access to health units for medical applications is essential. |
| 3 - proximity to green space | (Weight: 109 /.) , Bordering of this application with clinical centyers can be effective in terms of air sanity, preventing pollution, creating landscapes for peace of mind and vision, in improving the urban environment. |
| 4 - Distance from other medical centers (Weight: 139 /.) | Treatment areas should be separated from each other, somewhat not to interfere in each other's affairs. |
| 5 - Proximity to residential complexes (Weight: 114 /.) | Therapeutic application are compatible with residential centers, are close in land are ideal. |
| 6 –educational centers (weight: 129 /.). | Exercise and therapeutic centers are compatible with user training. |
| 7 - Access to communication (Weight: 102 /.) | Since clinical centers are established regardless of how vulnerable will be created, it will be harmful not only for safety but also to the problems of urban issues such as traffic. |
| 8 - Population density (weight: 11 /.) | Locating clinical centers in places with high population density makes therapeutic areas close to the centers of gravity and can meet the clinical needs of population |
| 9 - Being close to major centers (Weight: 12 /.) | Observing this criterion, in locating healthcare centers can makes better access to, better transport and reducing traffic and its consequences. |

Sources: Razavi (2002), Ziyari (2002), Pour-Mohammadi (2008 Cromley and Mclafferty, 2003), (Jordan, 2004)

B. Standard method of mapping

To analyze the compatibility of land use on the digital maps and map -related cost of land use, cultural , commercial, educational , rivers ... and ARCGIS environment were extracted and following the extraction of the coordinates of the specified rectangular area of the map extract criteria in the Idrisi Klimanjaro, imported and saved as raster maps to fit the needs for the next step by using the Distance factor , rather than extracted maps of criteria which are listed .

C. The standardization method of data

The different scales of measure map don't allow you to perform arithmetic operations on them ,thus domain-based method was used to eliminate the effect of different scales and convert all of them to a scale between zero to a standard compactness,. In this practice, the following equations are used. (Malchevski 2006, pp. 212 and 213):

Formula (2):

$$x'_{ij} = \frac{x_{ij} - x_j^{\min}}{x_j^{\max} - x_j^{\min}} \quad (1)$$

$$x'_{ij} = \frac{x_j^{\max} - x_{ij}}{x_j^{\max} - x_j^{\min}} \quad (2)$$

In the above equations, is the standardized score attribute of village indicates s the character raw in the village, indicating maximum score in relation to the attribute; represents the least score for attribute and markers associated. Indicates value amplitude of. The Standardized scores value can be placed between 0 and 1 value.

7. Analysis of the information

For the purposes of AHP analysis in GIS, sub-criteria must be mapped to a raster layer and valued between 1 to 9 based on fuzzy logic and quantitative scale 9 Prof. Hour, turned. Each of the criteria weighted by AHP and mapped using GIS was (2010: 204, Sener et al). Raster layers revaluation criteria, using a spatial analyst, GIS, due to the positioning and type of utility purpose was conducted. In this study, nine is considered a benchmark for positioning hospital. AHP is one of the most comprehensive system designed for decision-making with multiple criteria is defined as the following:

A decision on various criteria by which decisions can be adopted. This approach allows formulation of the problem as a hierarchy provides and also taking into account qualitative and quantitative criteria at issue. Judging is based on the analytic hierarchy process, the result is a relative judgment can vary from one person to another. In addition it does not require cumbersome mathematics, so it is easy and can effectively control both quantitative and qualitative data.

Next in importance AHP common time coefficient criteria and sub criteria, coefficient of options, calculate the final score and evaluate adaptation options involve judgments are reasonable, Of course, in this study, only the weighting criteria used in the software Expert Choice. The weighting the criteria with AHP method in the table below:

Table 2: The weighting the criteria in AHP method

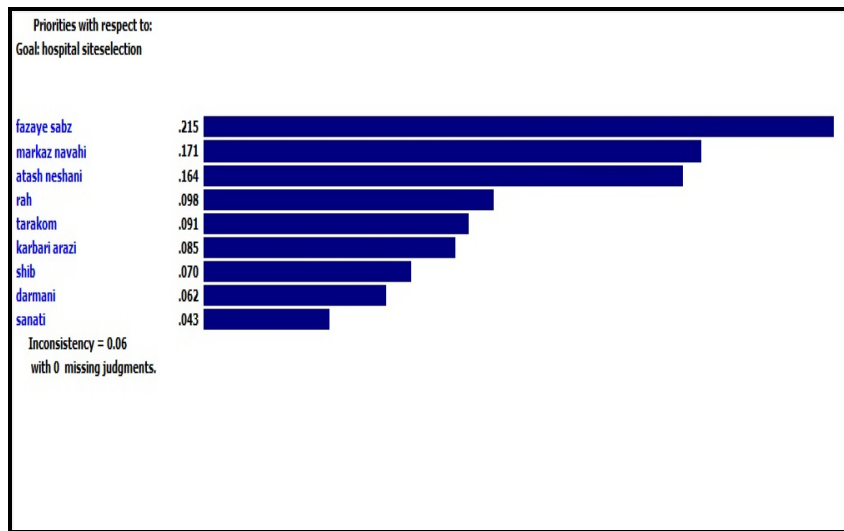
| Preferences | numerical value |
|--|-----------------|
| Very little or absolutely good or absolutely more important than | 9 |
| Rather important or very strong utility | 7 |
| Rather important or powerful utility | 5 |
| Or a little bit more or a little bit better | 3 |
| Preference or importance or the same utility | 1 |
| Distances between strong preferences | 6-4-2 |

Source: (Authors)

To implement the method of AHP, and the layers, binary matrix was used to measure two parameters to be compared with each other in pairs, scoring criteria and between 1 and 9, respectively. Criteria for determining the relative importance of research, the group AHP hierarchical technique is used. For such a comparison will need to gather information from officials in the region. In order to quantify the value judgments and verbal subjects, a questionnaire was provided to five experts and city officials. This will allow decision makers free from any external influence, focus only on the comparison of the two criteria. In addition Pair wise comparison, because respondents are just two of the measures, the decision makes sense. So weighting process utilizes the comments of officials and authors of studies have been done. The results of the weight criteria is given in Figure 2. Compare adjustment factor is 0.0644 criteria have been less than acceptable and appropriate AHP is 0.1. For information layers are green spaces, distance from fire stations, on the streets and main roads, and distance from district centers, with increasing distance points and the gap has been awarded more points.

For layers away from industrial centers, distance from health care centers in the photo above is true, that with increasing distance more points and the gap is assigned a lower rating, Given that areas with less steep gradient layer to build hospitals have been more appropriate rate, Thus, areas with slopes less steep areas more points and more points are less. For land use and land suitability on the basis of economic value is intended to create a hospital. For example, Bayer's profile on the basis of economic value to business users based on the economic value of less points higher and higher, the less points are given. Given that one of the goals of the hospital location, benefiting the majority of the population, population density layer Scoring is done, so that way more point's neighborhoods with higher density and lower density neighborhoods have received less points.

Figure 2: weighting criteria using AHP



After the previous steps and weighting the criteria, layers of each of the criteria obtained by multiplying the weight of AHP method was valued in layers. And through a phased approach, was prepared and the importance of each criterion according to the index, the layers via Raster Calculator command in ARC GIS software were overlapping.

The value of information layers, all layers of information should be combined effectively in positioning. The combined layers, layer or output can be achieved by combining two or more of the input layer. The layer attributes assigned to each position in the output layer is a function of the value of the input layer (Farajzadeh, 1384: 18). This is located in the center of GIS analysis, combining data from different space to create a new space element. This can be geo-spatial practice that combines multiple layers to generate new information defined. Finally, raster layers, with a coefficient of their importance, the final positioning in the form of raster map, obtained the higher rated areas, more utility for locating. After selection and location of the most important issues that should be considered by the Geographic Information System, to what extent is this issue that the designated areas are the facts and circumstances of the region?

To check this, right and wrong observation and field studies can reveal localized areas, Finally, after the implementation of the results of positioning a reality in our study area, And taking into account all the parameters in the process of site selection, then 5 locations to create appropriate hospital was diagnosed. That it's output in Figure (3) is shown.

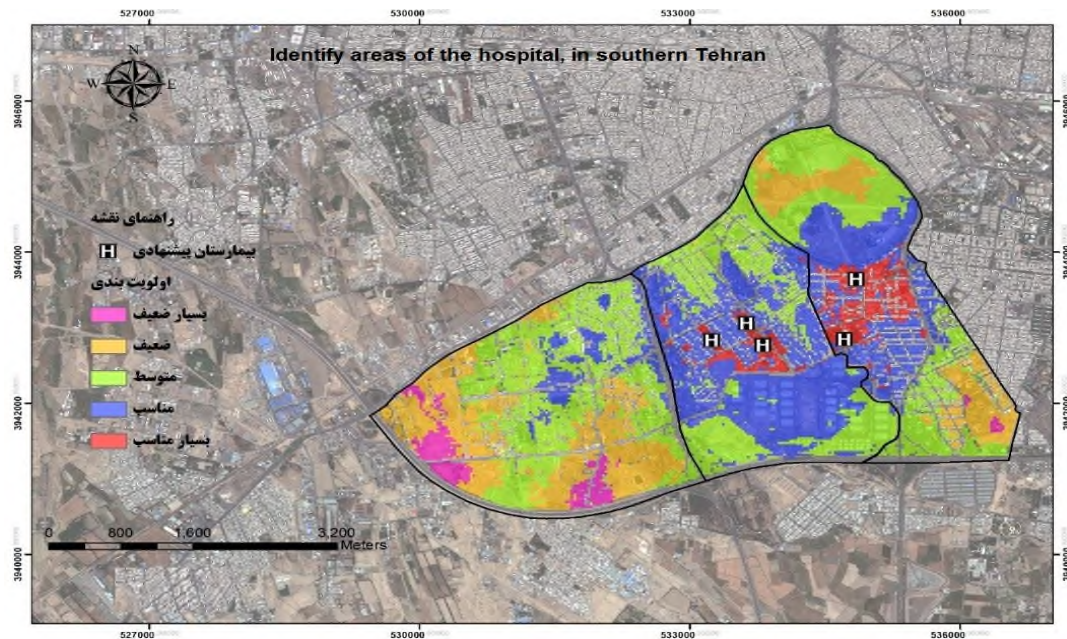


Figure 3: map positioning hospitals in Region 19 in Tehran

8 – Conclusion

The analysis of results show that the use of the analytic hierarchy process (AHP) with Arc GIS software can serve as a powerful tool to engage the different criteria for locating treatment centers.

In The present research due to the considered per capita, for user therapy according to a study plan at work is intended for the user land area comprehensive plan of in southern Tehran, the allocated land area to clinical sector in the present status was compared to the results of the comparison, and indicates the negative balance. In addition to necessity of equipment and development of user therapy the pertinent comparison indicates a gap between the current area and the area required by user therapy, and the result indicates the importance of qualification of user therapeutic fitness for the allocating user therapy. In this regard, the amount allocated to land suitability for therapeutic use, was measured with a series of measures which were mentioned in the article. Since there is no hospital in the southern city of Tehran seems necessary to create a hospital. At the end of the study, data collection required, provide the necessary information layers using Analytical Hierarchy Process, five were identified as suitable place to build the hospital.

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