

The Islamic University Gaza  
Higher Education Deanship  
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الجامعة الإسلامية-غزة  
عمادة الدراسات العليا  
كلية الهندسة  
قسم الهندسة المدنية  
هندسة البنية التحتية

تقييم وتخطيط الخدمات الصحية في المحافظة الوسطي بقطاع غزة باستخدام نظم المعلومات  
الجغرافية

## The Assessment and Planning of Health Services in the Middle Governorate of the Gaza Strip Using Geographic Information System

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A Thesis Submitted in Partial Fulfillment of Requirements for the Degree of Master in Civil  
Engineering.

1436هـ-2014م

نموذج رقم (١)

## إقرار

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

تقييم وتخطيط الخدمات الصحية في المحافظة الوسطى بقطاع غزة باستخدام نظم المعلومات الجغرافية

The Assessment and Planning of Health Services in the Middle Governorate of the Gaza Strip Using Geographic Information System

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The work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification

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## نتيجة الحكم على أطروحة ماجستير

بناءً على موافقة شئون البحث العلمي والدراسات العليا بالجامعة الإسلامية بغزة على تشكيل لجنة الحكم على أطروحة الباحث/ خالد عبدالفتاح محمد العصار لنيل درجة الماجستير في كلية الهندسة قسم الهندسة المدنية - البنى التحتية وموضوعها:

تقييم وتخطيط الخدمات الصحية في المحافظة الوسطى بقطاع غزة باستخدام نظم المعلومات الجغرافية

### The Assessment and Planning of Health Services in the Middle Governorate of the Gaza Strip Using Geographic Information System

وبعد المناقشة العلنية التي تمت اليوم الثلاثاء 01 ربيع الأول 1436هـ، الموافق 2014/12/23م الساعة الثانية عشرة ظهراً بمبنى القدس، اجتمعت لجنة الحكم على الأطروحة والمكونة من:

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د. بسام عبد الرحمن تايه

وبعد المداولة أوصت اللجنة بمنح الباحث درجة الماجستير في كلية الهندسة / قسم الهندسة المدنية - البنى التحتية.

واللجنة إذ تمنحه هذه الدرجة فإنها توصيه بتقوى الله ولزوم طاعته وأن يسخر علمه في خدمة دينه ووطنه.

والله ولي التوفيق،،،

مساعد نائب الرئيس للبحث العلمي والدراسات العليا

أ.د. فؤاد علي العاجز



## DEDICATION

To the fountain of patience and optimism and hope.

To each of the following in the presence of God and His Messenger, my dear mother.

To the big heart my dear father.

To my dear wife.

To my children A\_fattah, Baraa and batoul.

To those who have demonstrated to me what is the most beautiful of life, my brothers and sisters.

To the people who paved our way of science and knowledge.

All our distinguished teachers.

To the taste of the most beautiful moments with my friends.

I dedicate this work.

## ACKNOWLEDGEMENT

I feel obliged to extend my sincere thanks and appreciation to my instructors in the Faculty of Engineering at the Islamic University, who were helpful and brace.

Special thanks to my supervisor Dr. Maher A. El-Hallaq who saved no effort in supporting me to complete this work in spite of the difficult circumstances.

My thanks to the discussion committee instructors Dr. Bassam Tayeh who honored me in their valuable discussion from which I benefit much.

Finally, thanks to all official organizations and persons who provided me with valuable information. I mention in particular; Ministry of Health, Ministry of Local Government, Dr. Essam Al Masri, Dr. Alaeddinne El Jamassi, Eng. Khaled Yazouri and Eng. Ahmed Albahnasawi.

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

" نَرْفَعُ دَرَجَاتٍ مِّنْ نَّشَأٍ وَفَوْقَ كُلِّ ذِي عِلْمٍ عَلِيمٌ "

(يوسف ٧٦)

## ملخص الدراسة

يعاني قطاع غزة من تزايد مضطرد في أعداد السكان وخاصة المحافظة الوسطي إضافة إلى ضعف الإمكانيات لدى وزارة الصحة الفلسطينية وقلة المنشآت الصحية في ظل الحصار الجائر والذي بدوره أدى إلى حرمان مناطق واسعة من المحافظة من الخدمات الصحية الأساسية مما يؤثر سلباً على الصحة العامة للمواطنين .

يتناول البحث بالدراسة والتحليل الوضع الصحي الحالي للمحافظة الوسطي، ويناقش من خلال الاستبيان فرضيات تساهم في مدى رضا المجتمع عن الخدمات الصحية، ومدى صحة هذه الفرضيات. حيث تم توزيع 110 استبانة، وتم الحصول على 98 استبانة بنسبة استرداد 89% حيث اتضح أن جميع مجالات الاستبيان كانت ذات دلالة احصائية عند مستوى معنوية  $\alpha = 0.05$ ، وهذا يعني أن هناك عدم رضا من قبل المجتمع عن توزيع الخدمات الصحية في المحافظة الوسطي.

كما يحتوي البحث على تقييم التوزيع الحالي للعيادات الصحية بناء على عدد السكان والمنطقة المخدومة حسب المعايير السعودية حيث تبين بأن المحافظة الوسطي بحاجة عاجلة إلى إنشاء ست عيادات في الوقت الحالي ، وبحاجة إلى إنشاء مستشفى تخصصي لعدم وجود أي مستشفى تخصصي بالمحافظة الوسطي.

تمت عملية اختيار الأماكن المناسبة للعيادات الجديد والمستشفى التخصصي باستخدام نظم المعلومات الجغرافية (GIS) وعملية التحليل المكاني متعدد المعايير.

عدة معايير مثل الكثافة السكانية، البعد عن المدارس والبعد عن الأسواق والبعد عن المقابر وعدة عوامل أخرى تم اتخاذها بعين الاعتبار.

تم إجراء هذا على أساس طريقة المحو فضلاً عن التحليل الضبابي وعملية المقارنة بين الطريقتين التي تم تنفيذها من أجل الوصول إلى أفضل المواقع لإنشاء مثل هذه المرافق.

وختاماً أوصى الباحث بإعطاء مزيد من الاهتمام بالوضع الصحي لسكان المحافظة من خلال تشكيل لجنة لوضع استراتيجية متكاملة للبدء بتشبيد تلك المرافق وخاصة المستشفى التخصصي.

## Abstract

Gaza Strip faces an increasing rate of population especially in the Middle Governorate. Because of unjust siege, lack of resources and health facilities, many places in the Governorate can't achieve such services.

This research aims to study and analyze the current health status in the Middle Governorate. The researcher discusses through the questionnaire hypotheses which contributes to offer a good degree of satisfaction on community health services, and the validity of these assumptions. Random sample is selected with size 110, and 98 questionnaire papers are received with (89%) response. The questionnaire is statistically significant at the abstract level  $\alpha = 0.05$ , and this means that there is no a satisfaction of community in distribution health services in the Middle Governorate.

The research also studies the assessment of the current distribution of the health clinics based on the region's underserved population according to Saudi standards. It is found that the Middle Governorate needs to build six new clinics at the current time, and construct a hospital due to the absence of any specialized hospital in the Middle Governorate.

The places of the new clinics and the specialized hospital are chosed by using (GIS) and the process of multi-criteria spatial analysis (SMCDA)

Several criteria such as population density, schools, markets, cemeteries and several other factors are taken into account.

This is made based on the Erase method as well as the Fuzzy analysis and comparison process between the two methods is performed in order to reach the best sites for the establishment of such facilities.

Finally, the researcher recommends giving more attention to the health status of the population of the Middle Governorate through the formation of a committee to develop an integrated strategy initiating construction the specialized hospital.



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## List of Abbreviations

ANOVA	ANalysis Of VAriance
EBAIS	Equipo Básico de Atención Integral en Salud
GIS	Geographic Information System
MCDM	Multiple Criteria Decision Making
MOH	Ministry Of Health
PCBS	Palestinian Central Bureau of Statistics
PPs	Private Providers
SMCDA	Spatial Multi Criteria Decision Analysis
SPSS	Statistical Package For Social Sciences
UNRWA	United Nations Relief and Works Agency

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## CHAPTER 1: INTRODUCTION

### 1.1 Scope

This chapter introduces a general background, problem statement, objectives, brief research methodology as well as thesis organization.

### 1.2 Background

Gaza Strip is a Palestinian region on the eastern coast of the Mediterranean Sea, which is in the form bar of a narrow north-east of the Sinai peninsula constitutes approximately 1.33% of historic Palestine (from the river to the sea). Gaza extends over an area of 360 square kilometers, where the length of 41 km, its width varies between 5 and 15 km. Gaza Strip defiance of Historic Palestine in the north and east, while Egypt is bordered to the south-west. (Wikipedia,2014)

The borders of the Middle Governorate are as follows: Wadi Gaza in the north, mills in the south, the Armistice agreement Line to the east and the Mediterranean Sea in the west. The population of the Middle Governorate is 260 thousand inhabitants. According to Palestinian Central Bureau of Statistics (PCBS 2007) distributed population of 62.8% lives in urban areas, 1% in rural areas while 36.3% in a camps.

The total area is about 59 thousand acres which half of it is residential areas and the other half is agricultural. The governorate consists of seven municipalities; Deir al-Balah, Zawaida, Wada al-salqa, Nusseirat, Bureij, Almsader and Almaghazi.



**Figure (1.1): location of the Middle Governorate**

Geographic information systems (GIS) are computerized systems capable of integrating, displaying and analysing large quantities of spatial data (Vine et al). GIS is a geospatial tool that can be utilized to identify and display geographic patterns of disease; assess environmental exposures; estimate incidence, prevalence, and survival statistics; and expose health disparities to communicate clearly with the public, business, and political leaders (NCI, 2006).

A trend in health policy, research, planning, and management is the increasingly important role of health informatics (Kurland and Gorr, 2006).

### **1.3 Problem Statement**

There are several problems that may occur at the present and the future, and it is encouraged to re-examine the current health situation and make proposals to solve these problems:

- The geographical distribution of health centers is unsuitable. The border areas are far from the main hospital of the Middle Governorate. Many roads of the Middle Governorate specially the roads distant to the main hospital are not paved so many patients need long time to arrive the hospital.
- The weak effectiveness of health centers and hospitals in the Middle Governorate limited number of medical staff for the population of the study area. The size and number of health centers do not fit with the residents of the Middle Governorate. Lack of tools and medical supplies in sufficient quantities to deal with any emergency.
- Opening many of health centers without dependence on good planning, which reflects negatively on the effectiveness of the health services to citizen. Lack of studies to show areas which are in urgent need for new centers. The inability of the Ministry of Health for the purchase of land to construct clinics and hospitals. Lack of financial resources for the construction of health centers. The construction of several health centers without relying on systematic studies.

### **1.4 Objectives**

This research aims to evaluate and analyze the health services in the Middle Governorate using geographic information system. To achieve this aim, the following objectives are to be determined:

- Assessment of the level of the current situation regarding the health services.
- Building up sufficient databases for health centers.
- Determining future plans and the nomination of the suitable best places.

### **1.5 Methodology**

This study comprises five main stages of work as follows:

### ***Stage I: Literature Review***

This Literature includes a number of local, Arab and international previous studies related to health services. There are three parts related to this topic; the first part presents criteria of health services, the second part shows previous local studies , and the third part displays previous international studies in the world.

### ***Stage II: Data Collection***

The data of the research obtained from relevant authorities such as Ministry of Health, municipalities, ministries, Scientific Research Affairs at the Islamic University of Gaza and others that include details and time series data about different influenced parameters and elements. etc.

### ***Stage III: Research Questionnaire***

The researcher targeted to analysis the current situation of health services in the Middle Governorate for the use of this analytical descriptive approach purpose. Data is collected through the questionnaire, which is distributed randomly to people in many areas in the Middle Governorate to achieve results.

### ***Stage IV: GIS Work***

This stage performs GIS analyses and links diagrams, data and databases as well as making planning issues of health services.

### ***Stage V: Conclusion and Recommendations***

Building a connection between what have been implemented and the result of GIS model, assessment of situation based on the available indicators and criteria will be made.

## **1.6 Thesis Organization**

This thesis includes six chapters and distributed as follows:

Chapter One presents the introduction chapter which involves scope, background, problem statement, aim and objectives and brief research methodology.

Chapter Two reviews briefly the literature related to the previous studies of GIS application for health services such as criteria of health services, the local studies, and the international studies.

Chapter Three presents the methodology of research, which passes through four stages such as literature review, data collection, questionnaire with analysis, and GIS work with related analysis.

Chapter Four presents research methodology, research population, the questionnaire that was used in the study and the way it was designed, pilot study, data collection, descriptive statistics, personal data analysis and hypothesis testing. The analysis of empirical data which is collected through the questionnaire in order to provide a real picture about the health services in the Middle Governorate. This chapter includes the hypothesis testing.

Chapter Five presents GIS work which includes data collection, criteria, analysis and the discussion of the results.

Chapter Six includes conclusion and recommendations in addition to some thoughts of future researches.

## CHAPTER 2: LITERATURE REVIEW

### 2.1 Scope

This chapter presents introduction, GIS relationship with health services, criteria of spatial planning of health services, previous local studies and previous international studies related to GIS health services.

### 2.2 Introduction

Health authorities have always aimed to provide health care for all residents using a fair access policy that is characterized as providing the right service at the right time in the right place (Jordan et al, 2004). Health care facilities at any region can be divided into two main types that are known as primary health centers and hospitals. The former provides basic health care services and the latter provides services for specialist health treatment (Murad, 2006). The provision of health facilities represents perhaps society's most obvious investment in the wellbeing of marginal populations with "the implicity that more of such services are desirable and will improve health" (Eyles and Woods, 1983). For underserved areas, this action improves physical access to the health delivery system. The introduction of a new health post or clinic in a previously underserved area, however, does not guarantee that people will optimally utilize it. Numerous studies in low-income countries have documented that underutilization of health services can be a dilemma in areas with relatively good locational accessibility. Without appropriate utilization, the effectiveness of a health service is severely limited. Underutilization of cosmopolitan health services for marginal populations in low-income countries has in part been attributed to the failure to adequately incorporate the concept of equity when designing or implementing health services. Generally, health planners have placed more importance on equality of health services than on equity. Equality is based on the mathematical division of available health resources equally among a given population, with possible modification for a demographic variable like age structure (Phillips, 1990).

### **2.3 GIS Relationship with Health Services**

GIS are automated systems for the capture, storage, retrieval, analysis and display of spatial data (Clarke et al.,1996). GIS can be used as a tool to assist in health research, in health education and in the planning, monitoring and evaluation of health programs. GIS allows mapping and analysis of spatial data, facilitates the progression from descriptive to analytical work and helps raise hypothesis about associations (Clarke et al.,1996).GIS has been used for epidemiological studies on geographical variation of disease occurrence, on access to health care, on health facility location planning and on optimal rooting of emergency services (Milligan , 2006; Bixby,1993). There is an increasing interest in GIS in health and social care research. GIS is a relatively recent technology, and it may not yet have been used to its full potential, especially in health systems research in developing countries. There are a few examples of the use of GIS for health systems research in developing countries.

### **2.4 Criteria Spatial Planning of Health Services**

Mean rates and planning standards developed technical standards that are the basis to determine the number and size of the scope of the impact of the different types of public services. The criteria that will be mentioned here are the criteria for the planning of health services used in Saudi Arabia due to the lack of any standards in the Palestinian Ministry of Health. The criteria of Saudi Arabia is adopted by most of the researches in this area in Palestine, which is believed to be suitable acceptable and in line with the social and economic environment that prevails in the Palestinian case. it includes:

#### **2.4.1 Primary Health Care Centers**

Primary Health Care Center is the nucleus of medical services, providing primary health care services at the neighborhood level residential neighborhoods, villages and work of health files for all families, located in the scope of the service to monitor the health status of members of each family and therapeutic and preventive services and switching them to specialized medical centers when necessary. The Center includes the examination rooms and lounges patients emergency room and sometimes the laboratory, a pharmacy, and ambulances with regard to the criteria for determining

the need for primary health care centers could be clarified by Table (2.1): (Guide for Planning standards for services (GPSS) (2005)).

**Table (2.1): The criteria for health care centers**

The statement	from	to
The population served by (capita)	4,000	15000
Service range (m)	—	800

Requirements sites for primary care centers includes the following (GPSS, 2005):

- Choice of site health center in place of the average of the neighborhood or among residential neighborhoods.
- The site is quiet and therefore must be far from schools and commercial markets.
- Be far from the noise and pollution, smoke, dust and environmental dangers.
- The site is on the main streets.
- Be easy accessible location.

#### 2.4.2 Public Hospitals

The public hospital basic level of health services, which extends the scope of its service to include the size of the population of up to 250,000 people and the public hospital to provide basic health services to cities and communities nearby, and should be available by the most different disciplines, and rooms for surgery and accessories, laboratories, and a coefficient of Medical Laboratory and X-ray and sections of the receiver and emergency the ambulance unit and night sleep of patients. The criteria for determining the need for public hospitals is illustrated by the table (2.2) (GPSS, 2005).

**Table (2.2): The criteria for public hospital**

The statement	from	to
The population served by	20,000	250,000
Service range (km)	—	20



### 2.4.3 The Specialized Hospitals

Hospitals that provide treatment and preventive services in a particular specialty (children - birth - Eyes - Fevers - psychological - pectoral) and serves a population of at least 150,000 people at the city level. The criteria for determining the need for specialist to the hospital is illustrated in Table (2.3) (GPSS, 2005).

**Table (2.3): The criteria for the specialized hospital**

The statement	from	to
The population served by	150,000	300,0000
Service range (km)	—	30

Favorite places beside the presence of health services are (GPSS, 2005):

- Gardens
- Open areas and quiet
- The natural environment
- Tourist villages
- Communities
- Universities Health clubs

Places non-preferred presence beside health services are (GPSS, 2005):

- Factories
- Stadiums Ponds and sewage treatment plants
- The intersection of the main roads.
- Cemeteries
- Workshops
- Markets

### 2.4.4 Pharmacies

the Ministry of Health through the Ministerial Decision No. (40-2008), where it identified census, which serves the pharmacy which is 3000 people and the distance separating between two pharmacies is 300 meters with the knowledge that this decision was made pursuant to the provisions of Article 18 of the system of

practicing pharmacists in Palestine. It gives power to the Minister of Health required the number of pharmacies in each city, taking into account the demographic distribution of the population.

## **2.5 Previous Local Studies**

Ahmad (2004) Spatial planning for health services in the suburbs of Jerusalem Eastern techniques using GIS. This study examines the efficiency and distribution of health services ( hospitals , health centers , pharmacies) in the province of Jerusalem. The region suffers from poor distribution of health services, where the process of the arrival of the region's population of some services is difficult, as have plagued the study of the impact of Israeli policies, which aims to besiege the Palestinian communities to confront such policies such as maintaining what?, and raise the efficiency of health services in the study area by dividing the study area to the areas partial, and work to raise the level of health services in each area , until you reach the sufficiency of health services to the population, as used in the study some of the theories and methods of geographic aimed to study the pattern of distribution of health services, also used GIS techniques in the process of planning and spatial management of health services, and through the creation of the so-called system of informational spatial private health services in the province of Jerusalem, as the study recommends the need to establish national standards for the planning of health services in Palestine, and the necessity of the establishment of administrative unit spatial belonging to the Department of Health Planning in the Palestinian Ministry of Health to work on the collection of information and the creation of a spatial database for health services .

Staiti (2009) Studies Spatial Planning of Health Services in Tulkarem City and its Suburbs using GIS. The main objective of this study is to analyze the reality of the current spatial distribution of health services, and their efficiency and suitability Spatial planning standards that meet the needs of the local community in the city of Tulkarem and its surroundings, as well as the submission of a proposal for a better spatial distribution and efficient health services in the study area , may help stakeholders and decision-makers to take appropriate steps for the development of this vital service. The study followed the methodology of the descriptive and

analytical approach building on the results of Census carried out by the Central Bureau of Statistics in 2007, and the results of the survey Field destruction done by the researcher for public health services, hospitals and health centers, including the health center for UNRWA in the Tulkarm refugee camp and pharmacies in the study area, in addition to the current structural plan for the study area as a basis in determining the areas of planning and calculating the area and population distribution was carried out by the analysis and assessment of the reality of the spatial distribution of health services by comparison Planning standards for health services in place in some neighboring countries, and through use a method related to the neighborhood and the scope of the impact of the service and the normal distribution by area and the number of population. Results of the analysis showed that the health services, especially in relation to health care centers Initial and pharmacies in the study area, suffer from poor distribution and inadequate, causing pressure service and adversely affect the level of health of the population. The study identified a shortage of places for the establishment of four health centers and a proposal for the establishment of nine new pharmacies in study area in specific locations using GIS applications, the study recommended a number of recommendations, the most important was the establishment of a general hospital in the region, The study also recommended the need to work on the development of this Urban centers respects, administrative and human needs and medical supplies to alleviate the technical Pressure on these centers and provide better service to the citizen. Furthermore the study recommended the rationalization of licensing of new pharmacies in densely pharmacies, so as to promote the opening of pharmacies in areas of need for the service and to achieve the spatial distribution more efficient. Finally, the study recommended developing a database of pharmacy at the Ministry of Health in order to facilitate follow-up and supervision and planning where to archive existing traditionally not achieve the minimum required for future planning.

Mashaqi (2008) Analysis and Evaluation for a locating Health, Education, Culture and Recreation Services in Nablus Governorate, the study aimed mainly to examine the compatibility of sites distribution of health services educational, cultural and entertainment with the criteria used globally , such as Saudi Arabia, and the study is

based on the methodology mainly on curriculum descriptive information gathering and possibilities available in Nablus, and analytical method using statistical analysis and spatial and evaluation of service locations used by the population. The results showed a gap in the number of residents in the communities in Nablus. 9 populations did not reach a population of 1,000 people, and this is one of the obstacles in the fair distribution of services in communities in the province, as the study results showed that the administrative services and government, as well as higher levels of health services and educational services are concentrated in the city of Nablus, which is a center for all residents of the province, and in some cases for the rest of the population of the provinces of the northern West Bank city of Nablus, where enjoys strong regional and distinct with the ocean. has proposed study the poles of growth , one in the northern part and the other in the southern part of Nablus. The study also recommended an increase of interest in the distribution of services and non-duplication in the same assembly.

Jerada (2012) Spatial analysis of governmental primary health care in Gaza Governorate. This study specified on spatial analysis and distribution of primary health care centers in Gaza, to know how these services been distributed in city, the main aim is the evaluation of the distribution and efficiency of it by using planning standard for these primary care services, and by adding new proposal planning for these services. To achieve this target, the concepts of governmental primary care planning have been studied by using GIS. This study depends on two approaches, describing and analysis of maintained information about Gaza and the results of urban and field scanning for population and care services in Gaze Governorate. The result of this study indicated that, Gaza suffers from lacking of health services, and most of this services are distributed without taking into account the population density, and approval planning standard because of some areas that have large population show a big crowds on primary health care centers that suffer lack of medical equipment and facilities. The study recommended to put clear plan to develop the health services in Gaza governorate by depending on standard planning and taking into account of population distribution in Gaza.

## 2.6 Previous International Studies

Murad (2006) performs a GIS application for health services at Jeddah city, explores the possibilities of using GIS for private hospitals at Jeddah city, Saudi Arabia. A GIS application is created to cover three main health planning issues which are distribution of health demand, classification of hospital patients and the definition of hospital service area. Each one of these issues is covered using several GIS functions including network analysis and overlay analysis. The former is used to produce drive time hospital service area and the latter is applied at the selected hospital to calculate the size of its served demand. GIS has several useful functions and tools that can be used in health planning field, uses some of these functions for one private hospital. These functions are used to help health planners on evaluating the spatial distribution of hospital demand and for defining hospital service area. All the produced models can be applied on any private or public hospital in Jeddah city. They can be used to build a spatial decision support system for hospitals in Jeddah city. There are several issues (challenges) that make such health policy difficult to be implemented. One of these issues is related to the relationship between distance to health services and the need for health care. The use of health services influenced also by other factors including financial status, time constrains, social inconveniences and the psychological stress of journey to the health service ( Bixby,2004).GIS has several techniques and functions that can be used for health service planning. Each one of these functions can be applied on different health related issues. For example, the issue of health accessibility can be modeled in GIS using simple functions such as buffer function or using spatial analytical functions such as spatial interaction technique. This study has selected three major hospital planning issues and uses GIS for analyzing these issues. The first issue is related to defining health demand location. GIS has different tools that can be used for defining any location on the map. One of these tools is called on-screen digitizing which is used by the presented study to capture and define health demand location at Jeddah city.

Deshpandea et al., (2003) Spatial pattern of private health care provision in Ujjain, India: a provider survey processed and analysed with GIS in developing countries like India, official information on private health care providers is scanty. This is an

obstacle for effective health care planning and policy development. Present a project aimed to enumerate, characterise and digitally map all private providers (PPs) using GIS in a rural district in India. The study shows how GIS can be used to create an improved basis for health services research. GIS has limitations in countries like India due to lack of valid routine data to enter into GIS as well as to competing demand for health care resources. The overall aim of the present study was to describe the geographical distribution of all private providers in Ujjain district and to explore urban–rural differences as well as association between the spatial pattern of private provision and basic geographical factors using GIS. No formal evaluation of the feasibility and utility of GIS was done as a part of the study. The focus on the technology as such was secondary to the data on health care provider distribution. Nevertheless, the study provided to test the potential for the GIS approach in field conditions in a developing country setting. The specific objectives of the study were:

- survey and characterise all private providers in the district.
- create a data-base of private providers and geo- physical characteristics of the district.
- display spatial pattern of the private providers.
- analyse distribution of private providers in relation to simple geographical variables (urban–rural location and distance to sealed roads).

Kinman (1999) evaluates the health service equity at a primary care clinic in Chilimarca, Bolivia. Policy makers and health planners generally support the concept of equitable health care. A focus on who can use a health service, or its potential access, will not necessarily lead to equitable care if people are not willing to avail themselves of the health services offered. Because equity is difficult to operationalize, outcome-based indicators such as the actual utilization of services are advocated as a means to measure equal access. Evaluation the utility of linking the concept of equity with a temporal and spatial analysis of clinic users at a micro scale, supplemented by a community survey. Various spatial scales were employed in the analysis. Utilization of the primary care clinic in Chilimarca, Bolivia varies considerably during the first 25 months of operation. Spatially, utilization shifted away from the targeted service area. Within the targeted service area, usage was concentrated in a

few blocks of the community and generally diminished with increasing distance from the clinic. The survey further revealed place of origin, length of residence, and language spoken at home as variables differentiating users from non-users. Failure to include the spatial dimension of utilization would lead to different conclusions if only aggregate data were employed. Spatial analysis of output measures is imperfect and does not necessarily deal with all of the access issues related to acceptability, and subsequently addressing, potential problems related to equal access

Foley (1995) assesses the applicability of GIS in a health and social care setting: planning services for informal carers in East Sussex, England. The stresses associated with caring have given rise to a number of short-term care services to provide respite to carers. The carers (Recognition & Services) Act of 1995 identified formally for the first time, the important role that unpaid carers provide across the community in Britain. The planning of combined health and social care services such as short-term care is a less developed application of GIS and examines awareness and application issues associated with the potential use of GIS to manage short-term care service planning for informal carers in East Sussex. The assessment of GIS awareness was carried out by using a semi-structured questionnaire approach and interviewing key local managers and planners across a number of agencies. GIS data was gathered from the agencies and developed within a GIS to build up a set of spatial databases of available services, location of users and additional geo-demographic and topographic information. The output from this system development was presented in turn at workshops with agencies associated with short-term care planning as well as users to help assess their perspectives on the potential use and value of GIS. A renewed emphasis on a planned approach to health care coupled with integrated/ joint working with social care creates a need for new approaches to planning. The feedback from planners and users, suggested that a number of key data elements attached to data-sharing may prove to be simultaneously progressive yet problematic, especially in the areas of ethics, confidentiality and informed consent. A critical response to the suitability of GIS as a tool to aid joint health and social care

Bixby (2004) Spatial access to health care in Costa Rica and its equity: a GIS-based study This study assembles GIS to relate the 2000 census population (demand) with an inventory of health facilities (supply). It assesses the equity in access to health care by Costa Ricans and the impact on it by the ongoing reform of the health sector. It uses traditional measurements of access based on the distance to the closest facility and proposes a more comprehensive index of accessibility that results from the aggregation of all facilities weighted by their size, proximity, and characteristics of both the population and the facility. The weighting factors of this index were determined with an econometric analysis of clinic choice in a national household sample. Half Costa Ricans reside less than 1km away from an outpatient care outlet and 5km away from a hospital. In equity terms, 12–14% of population are underserved according to three indicators: having an outpatient outlet within 4km, a hospital within 25km, and less than 0.2 MD yearly hours per person. Data shows substantial improvements in access (and equity) to outpatient care between 1994 and 2000. These improvements are linked to the health sector reform implemented since 1995. The share of the population whose access to outpatient health care (density indicator) was inequitable declined from 30% to 22% in pioneering areas where reform began in 1995–96. By contrast, in areas where reform has not occurred by 2001, the proportion underserved has slightly increased from 7% to 9%. Similar results come from a simpler index based on the distance to the nearest facility. Access to hospital care has held steady in this period. The reform achieved this result by targeting the least privileged population first, and by including such measures as new community medical offices and Basic Teams for Integrated Health Care (EBAIS) to work with these populations. The GIS platform developed for this study allows pinpointing communities with inadequate access to health care, where interventions to improve access would have the greatest impact. The study focused on producing complete, accurate data on a small number of key variables:

- geographic coordinates.
- type of facility (hospital, clinic, post, center, community health office).
- building area.
- MD hours hired for outpatient care.
- annual number of outpatient visits.



Kaneko et al, (2001) Visual localisation of community health needs to rational decision-making in public Health services. The objectives were to visualise the locations of community health needs and develop a community health needs assessment GIS for rational decision-making in public health services. We compiled census data, digital data of basic planning maps, digital data of topographic maps, contents of registers of medical and welfare facilities, and statistics of establishments into a geographical database; visualised geographical distributions of specific community health needs by integrating sets of indicators to reflect individual needs; and quantified their clustering by the nearest neighbour method. The database aggregated 3400 items of demographic, life and environmental factors. Thematic maps and clustering values showed different patterns of geographical distribution of the individual community needs. Means to match needs with services in smaller geographical units were discussed. This GIS will support appropriate resource allocation, intersectoral collaboration and greater transparency in planning and implementing services, by visualising locations of community health needs.

Higgs (2004) presents a literature review of the use of GIS-Based measures of access to Health Care services. The increasing availability of GIS in health organizations, together with the proliferation of spatially disaggregate data, has led to a number of studies that have been concerned with developing measures of access to health care services. The main aim is to review the use of GIS-based measures in exploring the relationship between geographic access, utilization, quality and health outcomes. The varieties of approaches taken by researchers concerned with teasing out the relative importance of geographical factors that may influence access are examined. To date, in the absence of detailed data on health utilisation patterns, much of this research has focused on developing measures of potential accessibility.

GIS has been used extensively in the health sector for a couple of decades (Higgs and Gould, 2001) In particular, there is a relatively large literature showing how GIS has been used to examine spatial patterns of disease and in environmental correlation studies through techniques such as spatial clustering. GIS has also been used to examine spatial patterns of health services and plan the location of new health

facilities (Gatrell and Senior,1999). Typically these studies involve the use of standard GIS functionality such as buffering (e.g., generating catchments at physical or travel time distances away from doctors surgeries or hospitals), overlay analysis (e.g., examining the location of patients in relation to such areas) and network analysis (using characteristics of a network such as travel speeds or public transport availability to gauge how long it takes patients to access a facility).

## CHAPTER 3: RESEARCH METHODOLOGY

### 3.1 Scope

This chapter presents the methodology of research, which is oriented into four stages; the first stage includes literature review, the second stage presents data collection, the third stage displays questionnaire with its corresponding analysis, and the fourth stage illustrates GIS work with its related analysis.

### 3.2 Research Methodology

This research aims to assess the current health status in the Middle Governorate and proposals for future areas that suffer from lack of services using GIS. In order to achieve the above objective, the research passes through five stages. Figure (3.1) shows a framework includes the overall methodology.

#### 3.2.1 Stage I: Literature Review

The first stage includes review of the literature that are based on preliminary data that have been collected through reading and research of relevant articles, books, the internet, and others. This stage presents a number of previous studies that relate to health services. There are four parts on this subject; presents the first part of an introduction to health services and the second part presents the general criteria for the selection of site health service centers and the third part presents the local studies and the final part presents the international studies that relate to this issue.

#### 3.2.2 Stage II: Data Collection

Data is collected by visiting number of institutions such as municipalities, the Ministry of Health, Ministry of Local Government, the Ministry of Planning, clinics, interview with professionals and specialists relevant in the field of statistics, and can organize the data collected in this research into four categories as follows:

- Places of health facilities and the type of provided service.
- boundaries of municipalities and neighborhoods.
- The number of people in the Middle Governorate .
- Planning standards for research.

### 3.2.3 Stage III: Questionnaire

The researcher targeted to make measurement of the extent of public satisfaction with the health services in the Middle Governorate. For this propose, the researcher used descriptive analytical method, Data is collected by a questionnaire that is distributed randomly to people in the Middle Governorate to achieve the results.

#### A) Population and Sample size

Survey is intended to estimate the true value of one or more population characteristics. In order to draw inference from a sample that will accurately reflect the population attention must be given to determine the needed sample size. Many efforts were done to determine the minimum sample size that accurately reflects the population characteristics. The central limit theorem is on the heart of these efforts. Kish (1995) showed that the minimum sample size can be calculated using the following Equation (3.1).

$$n = \frac{Z^2 \hat{p}(1 - \hat{p})}{e^2} \quad (3.1)$$

The study sample included residents of the Middle Governorate, totaling 250,000 person

P=0.5

Z factor=1.645

e =0.1

n= 67.65

#### B) Questionnaire Design and Content

A structured questionnaire is specially designed for the study and it consists of two groups:

The first group: Demographic data.

The second group: Questionnaire Paragraphs, that divided into three fields:

- Questions overall satisfaction for the health service
- Questions the required service and technical staff and appropriate equipment
- Questions of Distribution services appropriately

### **C) Statistical Analysis Tools**

Data analysis will be made utilizing (SPSS 20). The researcher would utilize many statistical tools such as Frequencies and Percentile, Alpha- Cronbach's Test, Pearson correlation coefficients, One sample t test, One way ANOVA, and Independent sample t test.

### **D) Questionnaire Analysis and Discussion**

The aim of this part is to analyze the empirical data which are collected through the questionnaire in order to provide a real picture about the current health status in the Middle Governorate. This chapter includes also the hypothesis testing.

#### **3.2.4 Stage IV: GIS Work and Analysis**

Based on data collecting, there are many steps should be performed to begin the first step to choose the best stations of the hospital and clinic. This stage can be organized into six categories as follows:

- Recognition of Basic Principles of GIS-Based MCDA.
- Identification of Feasible Sites.
- Identifying Assessment Objectives/Criteria (building attribute data for in the GIS layers).
- Processing of Raster Data Sets.
- Weighting Evaluation Criteria.
- Choosing the Best Stations of Hospital and Clinics.

The chart shown in Figure (3.1) illustrates the methodology of research.

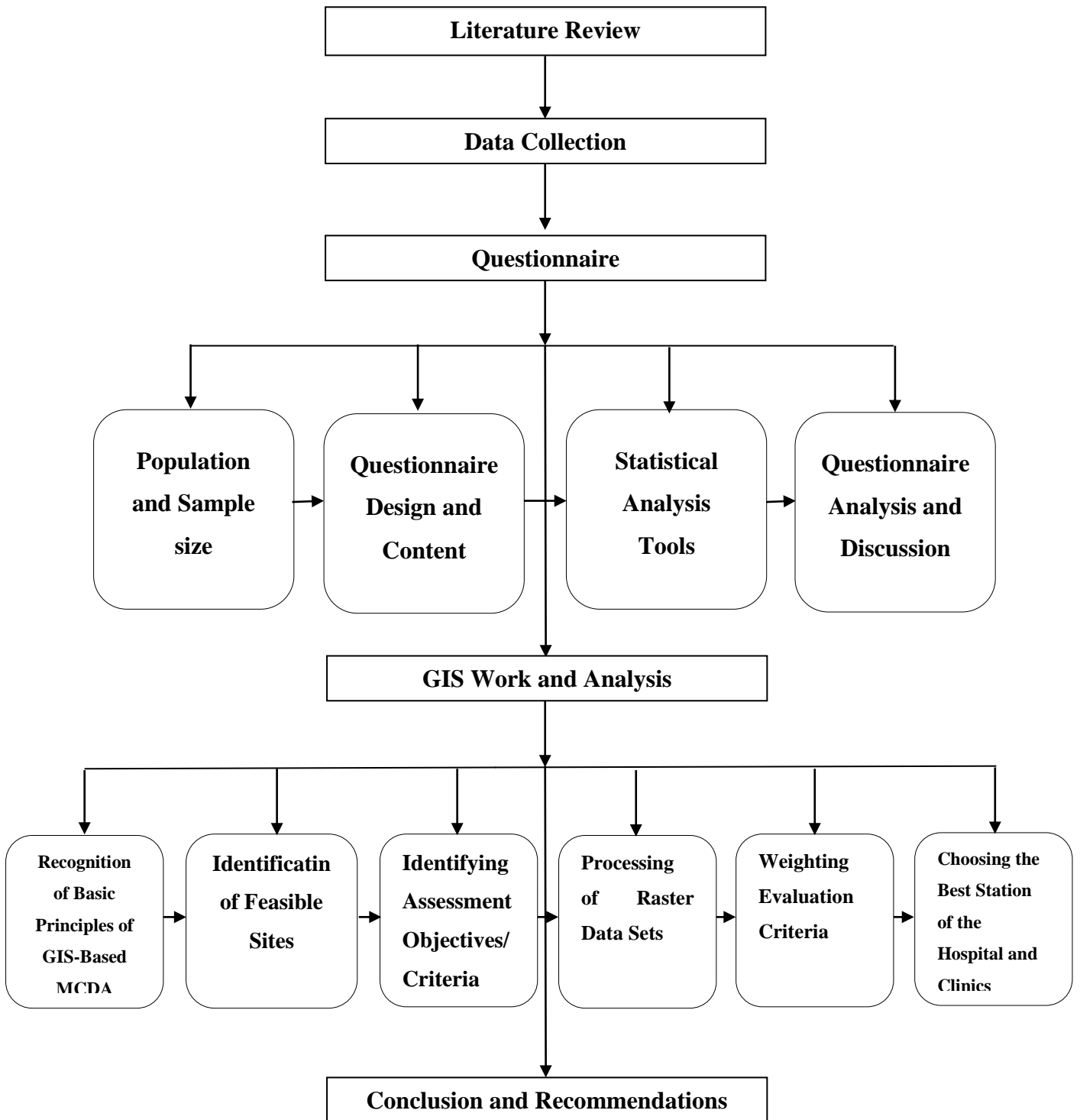


Figure (3.1):Research Methodology

## CHAPTER 4: QUESTIONNAIRE ANALYSIS AND RESULTS

### 4.1 Scope

This chapter presents the methodology of the study including the questionnaire methodology, population, the way it has been designed, pilot study, data collection, descriptive statistics, personal data analysis and hypothesis testing, analyzing the empirical data which is collected through the questionnaire in order to provide a real picture about the health situation in the Middle Governorate. This chapter also includes the hypothesis testing.

### 4.2 Questionnaire Methodology

The researcher targeted to make measurement of the extent of public satisfaction with the health services in the Middle Governorate. For this propose, the researcher uses descriptive analytical method, the collected data by questionnaire is distributed randomly to people in the Middle Governorate to achieve the results.

### 4.3 Data Collection

Data is collected through:

#### A) Secondary Data.

The secondary sources in collecting data such as books, journals, and internet, documents and other literature related to the research are collected.

#### B) Primary Data

Primary data are not available in secondary data sources by distributing a questionnaire, to study population in order to make measurement of the extent of public satisfaction with the health services in the Middle Governorate. the questionnaire survey seems to be most appropriate to collect data in the current study.

### 4.4 Population and Sample Size

Based on Equation 3.1, when  $\alpha = 0.05$ , random sample is selected with size 110, and the questionnaire is distributed to the research population and 98 questionnaire papers are received with (89%) response.

$$n = \frac{[1.645]^2 0.25}{0.1^2} = 68$$

## 4.5 Demographic Data

Research methodology depends on the analysis of data based on the use of descriptive analysis, by using the main program (SPSS).

### 4.5.1 Sample - Age

Table (4.1) show that 3.1% from the sample ages (Less than 20 years), and 46.9% from the sample ages (20-less than 30), and 30.6% from the sample ages (30-less than 40), and 15.3% from the sample ages (40-less than 50), and 4.1% from the sample ages (50-less than 60), and 1% from the sample ages (more than 60).It can be noted that the high rate of the sample ages is ranged into (20-less than 30).

**Table (4.1): Distribution of sample according to age**

Age	Frequency	Percentages
Less than 20 years	3	3.1
20-less than 30	45	45.9
30-less than 40	30	30.6
40-less than 50	15	15.3
50-less than 60	4	4.1
more than 60	1	1
<b>Total</b>	<b>98</b>	<b>100</b>

### 4.5.2 Sample - Level of Education

Table (4.2) shows that (10.2%) from the sample level of education have primary education, (33.6%) from the sample level of education have secondary education, (53.1%) from the sample have BSC. degree, and (2.1%) from the sample have high education.



**Table (4.2): Distribution of sample according to level of education**

Level of education	Frequency	Percentages
Primary	10	10.2
Secondary	33	33.6
Bachelor	52	53.1
High education	2	2.1

#### 4.5.3 Sample - Gender

Table (4.3) show that (67.34%) from the sample are male, and (32.6%) are female. This means that the study sample is well distributed with respect to gender.

**Table (4.3): Distribution of sample according to gender**

Gender	Frequency	Percentages
Male	66	67.34
Female	32	32.6
<b>Total</b>	<b>98</b>	<b>100</b>

#### 4.5.4 Sample -Job

Table (4.4) show that (24.5%) from the sample work at governmental sector, (19.4%) from the sample in private sector, (14.2%) from the sample are Workers, (31.6%) from the sample are unemployed, while (8.1%) from the sample are students, and (2%) from the sample their job (other than). This indicates that the majority from the sample are unemployed and governmental employee, because the unjust siege in that period.

**Table (4.4): Distribution of sample according to job**

<b>Job</b>	<b>Frequency</b>	<b>Percentages</b>
governmental employee	24	24.5
private employee	19	19.4
worker	14	14.2
unemployed	31	31.6
student	8	8.1
other than	2	2
<b>Total</b>	<b>98</b>	<b>100</b>

#### **4.5.5 Sample- Origin**

Table (4.5) clarify the name of City and zone that the study sample live in it. This indicates that the majority from the sample live in Nuseirat.

**Table (4.5): Distribution of sample according to origin**

<b>Sample- Origin</b>	<b>Frequency</b>	<b>Percentages</b>
Deir El Balah	21	21.4
Nuseirat	31	31.6
Zawaydeh	8	8.1
Bureij	22	22.4
Maghazi	11	11.2
ALmusaddar	2	2.0
WadialSelqa	3	3.0
<b>Total</b>	<b>98</b>	<b>100.0</b>

#### **4.6 The Questionnaire Design**

The questionnaire is designed in Arabic language, as most targeted population were unfamiliar with English language and to be more understandable. An English version and Arabic version are attached in Annex 1. Unnecessary personal data, complex and duplicated questions are avoided. The questionnaire is provided with a covering letter which explained the purpose of the study, the way of responding, the aim of the research and the confidentiality of the information in order to encourage the

respondents. A structured questionnaire is specially designed for the study and it consists of two groups:

The first group : Demographic data.

The second group: Questionnaire Paragraphs, that divided into three fields:

- Part One : about Questions overall concerning satisfaction for the health service.
- Part Two: about the required service and technical staff and appropriate equipment.
- Part Three: about Questions regarding whether the distribution services is appropriate.

#### 4.7 Data Measurement

In order to be able to select the appropriate method of analysis, the level of measurement must be understood. For each type of measurement, there is/are an appropriate method/s that can be applied and not others. In this research, ordinal scales were used. Ordinal scale is a ranking or a rating data that normally uses integers in ascending or descending order. The numbers assigned to the important (1, 2, 3, 4, 5) do not indicate that the interval between scales are equal, nor do they indicate absolute quantities. They are merely numerical labels. Based on Likert scale it has the following:

**Table (4.6): Likert Scale**

Item	Very much	Much	Moderately	Little	Very little
Scale	5	4	3	2	1

#### 4.8 Statistical Analysis Tools

The researcher would use data analysis both qualitative and quantitative data analysis methods. Data analysis will be made utilizing (SPSS 20). The researcher would utilize the following statistical tools:

- Frequencies and Percentile.
- Alpha- Cronbach's Test for measuring reliability of the items of the questionnaires.
- Person correlation coefficients for measuring validity of the items of the questionnaires.

- One sample t test, to determine if the mean of a paragraph is significantly different from a hypothesized value 3 (Middle value of Likert scale).
- One way ANOVA.
- Independent sample t test.

#### **4.9 Validity of Questionnaire**

Validity refers to the degree to which an instrument measures what it is supposed to be measuring. Validity has a number of different aspects and assessment approaches. Statistical validity is used to evaluating instrument validity, which include criterion-related validity and construct validity.

##### **4.9.1 Statistical Validity of the Questionnaire**

Validity refers to the degree to which an instrument measures what it is supposed to be measuring (Pilot and Hungler, 1985). Validity has a number of different aspects and assessment approaches. To insure the validity of the questionnaire, two statistical tests should be applied. The first test is Criterion-related validity test (Pearson test) which measures the correlation coefficient between each item in the field whole field. The second test is structure validity test (Pearson test) that used to test the validity of the questionnaire structure by testing the validity of each field and the validity of the whole questionnaire. It measures the correlation coefficient between one filed and all the fields of the questionnaire that have the same level of similar scale.

##### **4.9.2 Internal Validity**

Internal consistency of the questionnaire is measured by a scouting sample, which consisted of 20 questionnaires through measuring the correlation coefficients between each paragraph in one field and the whole filed.

##### **4.9.3 Structure Validity of the Questionnaire**

Structure validity is the second statistical test that used to test the validity of the questionnaire structure by testing the validity of each field and the validity of the whole questionnaire. It measures the correlation coefficient between one filed and all the fields of the questionnaire that have the same level of likert scale.

#### **4.10 Reliability of the Research**

The reliability of an instrument is the degree of consistency which measures the attribute; it is supposed to be measuring. The less variation an instrument produces in repeated measurements of an attribute, the higher its reliability. Reliability can be equated with the stability, consistency, or dependability of a measuring tool. The test is repeated to the same sample of people on two occasions and then compares the scores obtained by computing a reliability coefficient (Polit and Hunger, 1985).

#### **4.11 Cronbach's Coefficient Alpha**

This method is used to measuring the reliability of the questionnaire between each field and the mean of the whole fields of the questionnaire. The normal range of Cronbach's coefficient alpha value between 0.0 and + 1.0, and the higher values reflects a higher degree of internal consistency. The Cronbach's coefficient alpha was calculated for each field of the questionnaire.

#### **4.12 Internal Validity of the Fields**

The researcher assessed the fields' internal validity by calculating the correlation coefficients between each paragraph in one field and the whole field.

Table (4.7) clarifies the correlation coefficient of each paragraph of the first field "Questions about the overall satisfaction of the health service" and the total of the field. The p-values (Sig.) are less than 0.01, so the correlation coefficients of this field are significant at  $\alpha = 0.01$ , so it can be said that the paragraphs of this field are consistent and valid to measure what it was set for.

**Table (4.7): Correlation coefficient of part one**

No.	Paragraph	Pearson Correlation coefficient	p-value	Significance/ Not Significance
1.	The health center near your home has a high level service.	0.551	0.000	**
2.	Available suitable ambulatory services, where you live.	0.569	0.000	**
3.	Waiting time for doctors is short and appropriate.	0.601	0.000	**
4.	Number of doctors is enough for the number of patients whom received of the health center.	0.659	0.000	**
5.	The administration is concerned to the health center cleaning.	0.551	0.000	**

\*\* . Correlation is significant at the 0.01 level (1-tailed).

Table (4.8) clarifies the correlation coefficient for each paragraph of the second field "Questions concerning the required service and technical staff and appropriate equipment" and the total of the field. The p-values (Sig.) are less than 0.01, so the correlation coefficients of this field are significant at  $\alpha = 0.01$ , so it can be said that the paragraphs of this field are consistent and valid to measure what it was set for.

**Table (4.8): Correlation coefficient of part Two.**

No.	Paragraph	Pearson Correlation coefficient	p-value	Significance/ Not Significance
6.	Health facility has modern sophisticated equipment.	0.489	0.000	**
7.	Enjoy frame works operating in this facility with the required efficiency.	0.678	0.000	**
8.	There are facilities fit with the nature of the service provided	0.637	0.000	**
9.	The center includes all the required disciplines.	0.457	0.000	**
10.	The Center Pharmacy has all medicines prescribed by a doctor.	0.561	0.000	**
11.	There are places for a break time and waiting.	0.520	0.000	**
12.	The health center design fits the required service.	0.631	0.000	**
13.	Systems of public relations and effective communication.	0.590	0.000	**

\*\* . Correlation is significant at the 0.01 level (1-tailed).

Table (4.9) clarifies the correlation coefficient for each paragraph of the third field "Questions of Distribution services appropriately" and the total of the field. The p-values (Sig.) are less than 0.01, so the correlation coefficients of this field are significant at  $\alpha = 0.01$ , so it can be said that the paragraphs of this field are consistent and valid to measure what it was set for.

**Table (4.9): Correlation coefficient of part three.**

No.	Paragraph	Pearson Correlation coefficient	p-value	Significance/ Not Significance
14.	Health Centre has an appropriate accessible location.	0.698	0.000	**
15.	Easy access to the emergency department	0.731	0.000	**
16.	The distance to the health center is short.	0.733	0.000	**
17.	There is a fair distribution for pharmacies in your area	0.628	0.000	**
18.	The arrival of emergency teams to the area you live in is fast.	0.704	0.000	**
19.	The number of hospitals is enough to the population in The Middle Governorate	0.476	0.000	**
20.	Health laboratory service is available in your city	0.655	0.000	**

\*\* . Correlation is significant at the 0.01 level (1-tailed).

#### **4.13 Structure Validity of the Questionnaire**

The researcher assessed the fields' structure validity by calculating the correlation coefficients of each field of the questionnaire and the whole of questionnaire.

Table (4.10) clarifies the correlation coefficient for each field and the whole questionnaire. p-values (Sig.) are less than 0.01, so the correlation coefficients of all the fields are significant at  $\alpha= 0.01$ , so it can be said that the fields are valid to measure what it was set for to achieve the main aim of the study.



**Table (4.10): Structure Validity of the Questionnaire**

No.	Field	Pearson correlation coefficient	p-value	Significance/ Not Significance
1.	Questions about the overall satisfaction of the health service.	0.760	0.000	**
2.	Questions concerning the required service, technical staff and appropriate equipment	0.921	0.000	**
3.	Questions regarding whether the distribution services is appropriate.	0.834	0.000	**

#### 4.14 Reliability Statistics

Table (4.11) shows the values of Cronbach's Alpha for each field of the questionnaire and the entire questionnaire. For the fields, values of Cronbach's Alpha were in the range from 0.975 and 0.987, This range is considered high; the result ensures the reliability of each field of the questionnaire.

**Table (4.11): Cronbach's alpha test**

No.	Field	No. of Items	Cronbach's coefficient Alpha
1.	Questions about the overall satisfaction of the health service.	5	0.975
2.	Questions concerning the required service, technical staff and appropriate equipment	8	0.986
3.	Questions regarding whether the distribution services is appropriate.	7	0.987

Table (4.12) clarifies the correlation coefficient for each field of the questionnaire. The correlation coefficients of all field are significant at  $\alpha = 0.01$ , so it can be said that the fields are consistent and valid to measure what it was set for. The values in this Table are a comparison with Pearson correlation coefficient in the last Tables. The Thereby, it can be said that the researcher proved that the questionnaire was valid, reliable, and ready for distribution for the population sample.

**Table (4.12): Split Half Method.**

No.	Field	Correlation Coefficient	Spearman-Brown Correlation Coefficient
1.	Questions about the overall satisfaction of the health service.	0.382	0.552
2.	Questions concerning the required service, technical staff and appropriate equipment	0.750	0.857
3.	Questions regarding whether the distribution services is appropriate.	0.667	0.8

#### 4.15 Research Hypotheses

Hypothesis No. 1

Questions overall satisfaction for the health service

Table (4.13) shows the following results:

- ❖ The mean of paragraph No. 1 “The health center near your home has a high level service.” equals 2.99 (59.8%). Test value = -0.122 and P-value = 0.903 which is greater than  $\alpha = 0.05$ . The sign of the test is negative, so the mean of this paragraph is significantly smaller than the hypothesized value 3. This indicates that the respondents feel that the provided service is substandard.
- ❖ The mean of paragraph No. 2 “Available suitable ambulatory services, where you live.” equals 2.56 (51.1%). Test value = -3.569, and P-value = 0.001 which is smaller than the level of significance  $\alpha = 0.05$ . The sign of the test is negative, so the mean of this paragraph is significantly smaller than the hypothesized value 3. It shows that Ambulatory service is not sufficient breadth to the study area and the lack of the ambulatory points in areas far from urban centers.

- ❖ The mean of paragraph No. 3 “Waiting time for doctors is short and appropriate.” equals 2.83 (56.6%). Test value = -1.439, and P-value = 0.153 which is greater than the level of significance  $\alpha = 0.05$ . The sign of the test is negative, so the mean of this paragraph is significantly smaller than the hypothesized value 3. Because the centers health serves large numbers of patients in limited time.
- ❖ The mean of paragraph No. 4 “Number of doctors is enough for the number of patients whom received of the health center.” equals 2.6 (51.9%). Test value = -3.576, and P-value = 0.001 which is smaller than the level of significance  $\alpha = 0.05$ . The sign of the test is negative, so the mean of this paragraph is significantly smaller than the hypothesized value 3. Because the number of doctors is not commensurate with the number of patients
- ❖ The mean of paragraph No. 5 “The administration is concerned to the health center cleaning.” equals 3.67 (73.3%). Test value = 5.850, and P-value = 0.000 which is smaller than the level of significance  $\alpha = 0.05$ . The sign of the test is positive, so the mean of this field is significantly greater than the hypothesized value 3. Respondents see that the administration interest of hygiene is very high.
- ❖ The mean of the filed “Questions about the overall satisfaction for the health service” equals 2.93 (58.57%). Test value = -1.088, and P-value = 0.279 which is larger than the level of significance  $\alpha = 0.05$ . One can conclude that paragraph not differ statistically on neutral degree (moderate degree).
- ❖ Result of the hypothesis  
Questions overall satisfaction for the health service is significantly significant at 0.05 level.

**Table (4.13): Test values for Part One**

No.	Items	Mean	Weight mean	t-value	P-value
1.	The health center near your home has a high level service.	2.99	59.8	-.122	.903
2.	Available suitable ambulatory services, where you live.	2.56	51.1	-3.569	.001
3.	Waiting time for doctors is short and appropriate.	2.83	56.6	-1.439	.153
4.	Number of doctors is enough for the number of patients whom received of the health center.	2.60	51.9	-3.576	.001
5.	The administration is concerned to the health center cleaning.	3.67	73.3	5.850	.000
	Total	2.93	58.57	-1.088	0.279

Critical value of t at df "97" and significance level 0.01 equal 1.645

#### Hypothesis No. 2

Questions regarding wheather the required service, technical staff and equipment are appropriate is significantly significant at 0.01level.

Table (4.14): shows the following results

- ❖ The mean of paragraph No. 6 “Health facility has modern sophisticated equipment.” equals 2.45 (49.1%). Test value =-5.775, and P-value = 0.000 which is smaller than the level of significance  $\alpha = 0.05$ . The sign of the test is negative, so the mean of this paragraph is significantly smaller than the hypothesized value 3. Because of the Israeli blockade on the Gaza Strip and does not update the existing hardware.
- ❖ The mean of paragraph No. 7 “Enjoy frame works operating in this facility with the required efficiency.” equals 3.08 (61.6%). Test value =.824, and P-value = .412 which is greater than the level of significance  $\alpha = 0.05$ , The sign of the test is positive, so the mean of this paragraph is significantly greater than the

hypothesized value 3. One concludes that the respondents agreed to this paragraph

- ❖ The mean of paragraph No. 8 “There are facilities fit with the nature of the service provided” equals 2.85 (57%). Test value = -1.621, and P-value = 0.108 which is greater than the level of significance  $\alpha = 0.05$ . The sign of the test is negative, so the mean of this paragraph is significantly smaller than the hypothesized value 3. because most of the facilities are old and need to be developed.
- ❖ The mean of paragraph NO. 9 “The center includes all the required disciplines.” equals 2.29 (45.9%). Test value = -6.292, and P-value = 0.000 which is smaller than the level of significance  $\alpha = 0.05$ . The sign of the test is negative, so the mean of this paragraph is significantly smaller than the hypothesized value 3. because most of the health centers lacked many of the medical specialties.
- ❖ The mean of paragraph No. 10 “The Center Pharmacy has all medicines prescribed by a doctor.” equals 2.37 (47.5%). Test value = -5.850, and P-value = 0.000 which is smaller than the level of significance  $\alpha = 0.05$ . The sign of the test is negative, so the mean of this paragraph is significantly smaller than the hypothesized value 3. The respondents believe that there is a shortening of the Ministry of Health to provide medicine and patients depends on private pharmacies.
- ❖ The mean of paragraph No. 11 “There are places for a break time and waiting.” equals 3.09 (61.8%). Test value = 0.785, and P-value = 0.434 which is smaller than the level of significance  $\alpha = 0.05$ . The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. One concludes that the respondents agreed to this paragraph.
- ❖ The mean of paragraph No. 12 “The health center design fits the required service.” equals 2.88 (57.6%). Test value = -1.045, and P-value = 0.299 which is greater than the level of significance  $\alpha = 0.05$ . The sign of the test is negative, so the mean of this paragraph is significantly smaller than the hypothesized value 3. The respondents believe that the centers need to add to improved service.
- ❖ The mean of paragraph No. 13 “systems of public relations and effective communication.” equals 2.56 (51.1%). Test value = -3.863, and P-value = 0.000

which is smaller than the level of significance  $\alpha = 0.05$ . The sign of the test is negative, so the mean of this paragraph is significantly smaller than the hypothesized value 3. The health centers need to be developed toward communication with the community.

- ❖ The mean of the filed “Questions concerning the required service, technical staff and appropriate equipment” equals 2.79 (55.87%). Test value = -3.486, and P-value=0.001 which is smaller than the level of significance  $\alpha = 0.05$ . The sign of the test is negative, so the mean of this field is smaller than the hypothesized value 3. One concludes that the respondents disagreed to this filed.
- ❖ Result of the hypothesis  
Questions overall satisfaction for the health service is significantly significant at 0.05 level.

**Table (4.14): Test values of Questionnaire for Part Two.**

No.	Items	Mean	Weight mean	t-value	P-value
6	Health facility has modern sophisticated equipment.	2.45	49.1	-5.775	.000
7	Enjoy frame works operating in this facility with the required efficiency.	3.08	61.6	.824	.412
8	There are facilities fit with the nature of the service provided	2.85	57.0	-1.621	.108
9	The center includes all the required disciplines.	2.29	45.9	-6.292	.000
10	The Center Pharmacy has all medicines prescribed by a doctor.	2.37	47.5	-5.850	.000
11	There are places for a break time and waiting.	3.09	61.8	.785	.434
12	The health center design fits the required service.	2.88	57.6	-1.045	.299
13	System of public relations and effective communication	2.56	51.1	-3.863	.000
	<b>Total</b>	2.79	55.87	-3.486	0.001

### Hypothesis No. 3

Questions regarding whether the Distribution of services is appropriate.

Table (4.15): shows the following results:

- ❖ The mean of paragraph No. 14 “Health Centre has an appropriate accessible location.” equals 3.63(72.5%). Test value = 5.585, and P-value = 0.000 which is smaller than the level of significance  $\alpha = 0.05$ . The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. One concludes that the respondents agreed to this paragraph.
- ❖ The mean of paragraph No. 15 “Easily accessible to the emergency department.” equals 3.36 (67.3%). Test value = 3.371, and P-value = 0.001 which is smaller than the level of significance  $\alpha = 0.05$ . The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. One concludes that the respondents agreed to this paragraph.
- ❖ The mean of paragraph No. 16 “The distance to the health center is short.” equals 3.38 (67.7%). Test value = 3.460, and P-value = 0.001 which is smaller than the level of significance  $\alpha = 0.05$ . The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. One concludes that the respondents agreed that the appropriate distance.
- ❖ The mean of paragraph No. 17 “There is a fair distribution for pharmacies in your area.” equals 3.35 (67.1%). Test value = 2.958, and P-value = 0.004 which is smaller than the level of significance  $\alpha = 0.05$ . The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3; because of the large number of pharmacies in the Middle Governorate, which serves the citizens.
- ❖ The mean of paragraph No. 18 “The arrival of emergency teams to the area you live in is fast.” equals 2.91 (58.2%). Test value = -0.797, and P-value = 0.427 which is greater than the level of significance  $\alpha = 0.05$ . The sign of the test is negative, so the mean of this paragraph is significantly smaller than the hypothesized value 3; because of the lack of emergency centers in the Middle Governorate adequately.

- ❖ The mean of paragraph No. 19 “The number of hospitals is enough to the population in the Middle Governorate.” equals 2.36 (47.3%). Test value = -5.478, and P-value = 0.000 which is smaller than the level of significance  $\alpha = 0.05$ . The sign of the test is negative, so the mean of this paragraph is significantly smaller than the hypothesized value 3. The lack of a specialized hospital in the Middle Governorate where most of the respondents demand need to provide this hospital.
- ❖ The mean of paragraph No. 20 “Health laboratory service is available in your city.” equals 3.04 (60.8%). Test value = .332, and P-value = 0.741 which is greater than the level of significance  $\alpha = 0.05$ . The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3; because of the presence of a sufficient number of laboratories.
- ❖ The mean of the filed “Questions regarding wheather the distribution services is appropriate.” equals 3.12 (62.3%). Test value = 1.495, and P-value=0.138 which is greater than the level of significance  $\alpha = 0.05$ . The sign of the test is positive, so the mean of this field is significantly greater than the hypothesized value 3. One concludes that the respondents agreed to this filed.
- ❖ Result of the hypothesis  
Questions overall satisfaction for the health service are significantly significant at 0.05 level.



**Table (4.15): Test values for Part Three.**

No.	Items	Mean	Weight mean	t-value	P-value
14	Health Centre has an appropriate accessible location.	3.63	72.5	5.850	.000
15	Easy access to the emergency department	3.36	67.3	3.371	.001
16	The distance to the health center is short.	3.38	67.7	3.460	.001
17	There is a fair distribution for pharmacies in your area	3.35	67.1	2.958	.004
18	The arrival of emergency teams to the area you live in is fast.	2.91	58.2	-.797	.427
19	The number of hospitals is enough to the population in The Middle Governorate	2.36	47.3	-5.478	.000
20	Health laboratory service is available in your city	3.04	60.8	.332	.741
	<b>Total</b>	<b>3.12</b>	<b>62.3</b>	<b>1.495</b>	<b>0.138</b>

#### Hypothesis No. 4

There is statistically significant level  $\alpha = 0.05$  about distribution services appropriately due to age.

To test the hypothesis, one way ANOVA is used and the result is illustrated in Table (4.16) which shows that the p-value equal 0.194; which is greater than (0.05) and the value of F test equals 1.511; which is less than the value of critical value which is equal (2.32). That means there is no statistically significant difference at  $\alpha = 0.05$ , about distribution services appropriately due to age.

**Table (4.16): ANOVA test due to age**

Field	Sources	Sum of Squares	df	Mean Square	F value	Sig.(P-Value)
<b>Distribution services appropriately.</b>	Between Groups	4.279	5	0.856	1.511	0.194
	Within Groups	52.115	92	0.566		
	Total	56.394	97			

Critical value of F at df "5.29" and significance level 0.05 equal 2.33

Hypothesis No. 5

There is statistically significant level  $\alpha = 0.05$  about assessment of the health situation in the Middle Governorate due to the sample level of education.

To test the hypothesis, one way ANOVA test is used and the result is illustrated in Table (4.17) which shows that the p-value equal 0.688; which is greater than (0.05) and the value of F test equal 0.493. which is less than the value of critical value which is equal (3.09). That's means there is no statistically significant difference at  $\alpha = 0.05$ . about the assess the health situation in the Middle Governorate due to the sample level of education.

**Table (4.17): ANOVA Test due to level of education**

Field	Sources	Sum of Squares	df	Mean Square	F value	Sig.(P-Value)
<b>Distribution services appropriately.</b>	Between Groups	0.873	3	0.291	0.493	0.688
	Within Groups	55.521	94	0.591		
	Total	56.394	97			

Critical value of F at df "3.94" and significance level 0.05 equal 2.72

Hypothesis No. 6

There is statistically significant level  $\alpha = 0.05$  about the assessment of the health situation in the Middle Governorate due to the sample Job.

To test the hypothesis, one way ANOVA is used and the result is illustrated in Table (4.18) which shows that the p-value equal (0.606); which is greater than (0.05). The value of F test equal (0.726) which is less than the value of critical value which is equal (2.33), that's means there is no statistically significant difference at  $\alpha = 0.05$ , about the assessment of the health situation in the Middle Governorate due to the sample Job.

**Table (4.18): ANOVA Test due to job**

Field	Sources	Sum of Squares	df	Mean Square	F value	Sig. (P-Value)
Distribution services appropriately.	Between Groups	2.140	5	0.428	0.726	0.606
	Within Groups	54.254	92	0.590		
	<b>Total</b>	<b>56.394</b>	<b>97</b>			

Critical value of F at df "5.92" and significance level 0.05 equal 2.33

Hypothesis No. 7

There is statistically significant level  $\alpha = 0.05$  about assessment of the health situation in the Middle Governorate due to the sample gender. To test the hypothesis, the Independent Samples Test and the result is illustrated in Table(4.19)which shows that the p-value equals 0.94which is greater than 0.05 and the absolute value of t test equals -2.174which is less than the value of critical value which is equal (1.98).That means there is no statistically significant difference at  $\alpha = 0.05$ .

**Table (4.19): Independent samples test due to gender**

Field	Gender	N	Mean	Std. Deviation	T	P-value
Distribution services appropriately	Male	68	2.60	0.429	-2.174	0.94
	Female	30	2.8	0.403		

Critical value of t at df "96" and significance level 0.05 equal 1.98

#### 4.16 Summary

The questionnaire is used to measuring people opinions toward the evaluation of the health services in the Middle Governorate. A structured questionnaire consisted of two groups; the first group is demographic data, and the second group involves questionnaire paragraphs, that are divided into three parts such as questions about the overall satisfaction of the health service, questions about the required service, technical staff and appropriate equipment and questions about distribution services appropriately. Random sample is selected with size 110, and 98 questionnaire papers are received with (89%) response. By using Pearson correlation coefficients, and Alpha Cronbach's tests, the researcher proved that the questionnaire is valid, reliable, and ready for distribution for the population sample. One sample t test is used to determine if the mean of a paragraph is significantly different from a hypothesized value 3 (Middle value of Likert scale). So that all fields of the questionnaire is significantly significant at  $\alpha = 0.05$  level in evaluating the health services. One way ANOVA, and Independent Samples tests are presented that is no statistically significant difference about measuring the opinions of people in evaluating the health services in the Middle Governorate due to age, level of education, job, and gender.

The results of the questionnaire show that:

Part One: questions about the overall satisfaction of the health service conclude that paragraph doesn't statistically on neutral degree (moderate degree).

Part Two: questions concerning the required service, technical staff and appropriate equipment are smaller than the hypothesized value 3. One concludes that the respondents disagreed to this filed.

Part Three: questions regarding wheather the distribution of services is appropriate is significantly greater than the hypothesized value 3. One concludes that the respondents agreed to this filed.

## CHAPTER 5: ASSESSMENT AND PLANNING OF HEALTH SERVICES

### 5.1 Scope

This chapter presents GIS work that aims to evaluate and analyze the health services in the Middle governorate into Gaza Strip. This is based on collected data and certain criteria by using GIS, then analyses obtained data to choose the best place to set up a specialized hospital and clinics in areas that suffer from a lack of service.

### 5.2 Methodology and Criteria Evaluation

The chart shown in Figure (5.1) illustrates the methodology of research as follows:

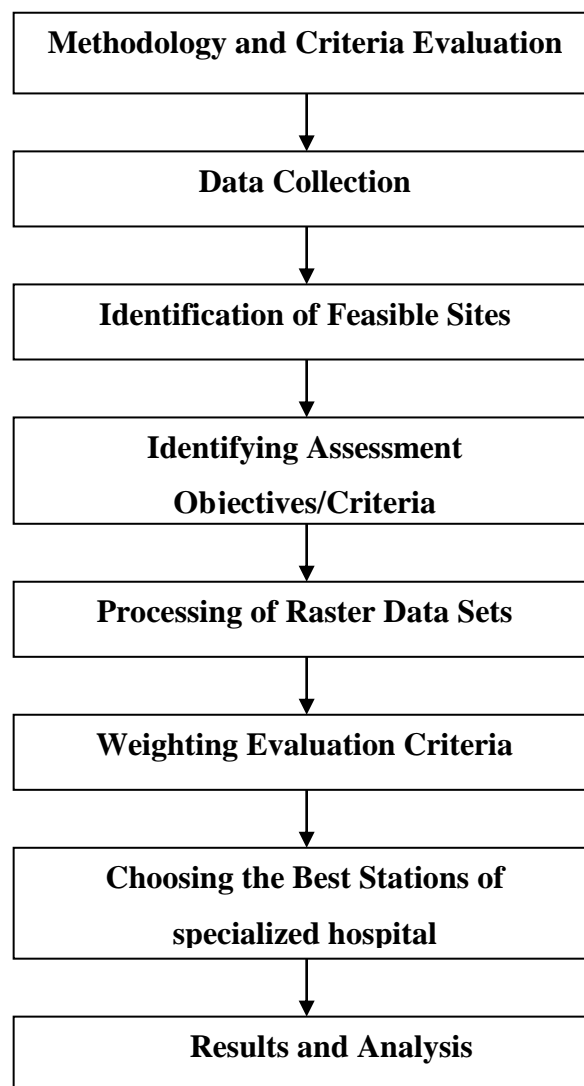


Figure (5.1): Methodology and Evaluation Criteria

### 5.3 Data Collected

The data assembled in this research can be organized into six categories as follows:

- the Middle governorate population.
- health places in the Middle governorate.
- the Middle governorate streets.
- the Middle governorate land use.
- School in the Middle governorate.
- Planning standards related to research.

### 5.4 The Middle Governorate Population

The Middle Governorate is one of sixteen Governorates under the Palestinian National Authority. Its total land area consists of 56 sq. kilometers. According to the Palestinian Central Bureau of Statistics (PCBS, 2007), in (2014) is expected to be 255,705 inhabitants. distributed between seven localities. The governorate consists of seven municipalities; Deir al-Balah, Zawaida, Wada al-salqa, Nusseirat, Bureij, Almsader and Almaghazi see Figure (5.2).

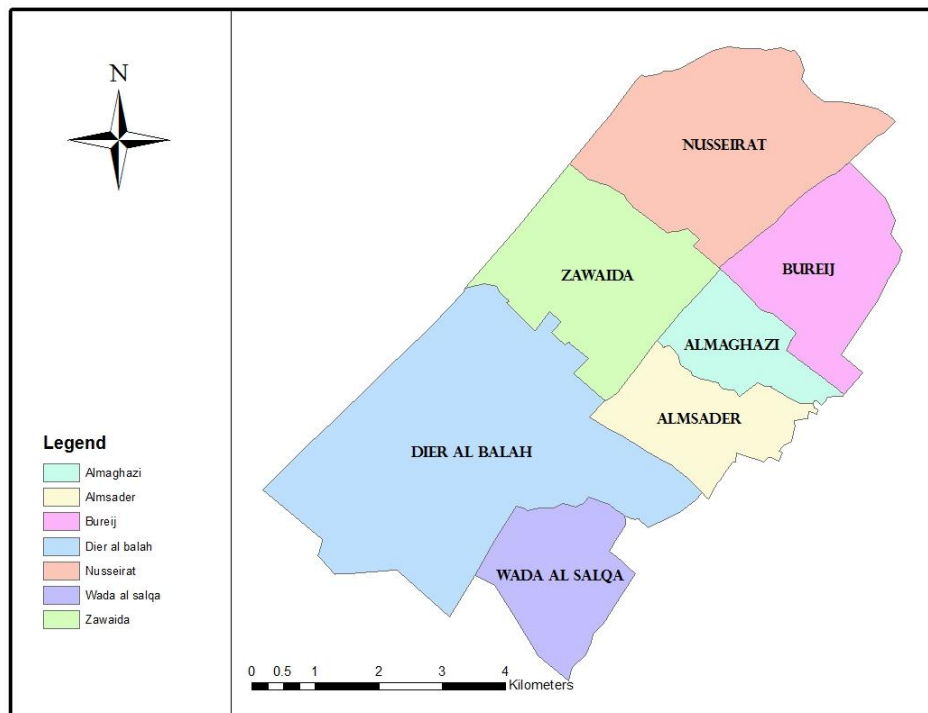


Figure (5.2): Municipalities of the Middle Governorate

**Table (5.1): Summarizes the Population and area of each municipalities**

<b>Municipalities</b>	<b>Population (Inhabitant)</b>	<b>Area (donum)</b>	<b>Density (person/donum)</b>
Deir al-Balah	75,736	16818.7	4.5
Nusseirat	80,566	9645.75	8.35
Bureij	42,119	5332.5	7.89
Almaghazi	28,132	2895.6	9.72
Zawaida	21,074	7091.5	2.97
Almsader	2,330	4004.1	0.581
Wada al-salqa	5,748	4230.9	1.36

### **5.5 Documentation of Health Services in the Middle Governorate by GIS**

the Middle Governorate has many health facilities such as hospitals, government clinics, and UNRWA clinics, private centers and pharmacies, laboratories and emergency centers .

Table (5.2) shows these types of facilities and the number of each of them in the Middle Governorate.

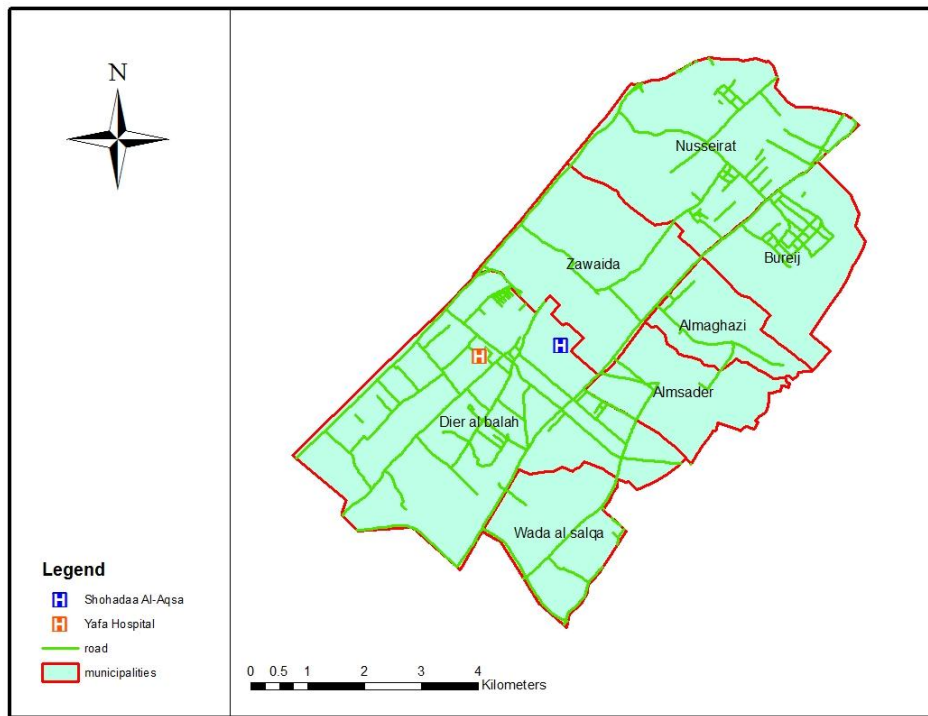
**Table (5.2): Health centers in the Middle Governorate**

<b>Health centers</b>	<b>Number</b>
hospitals	2
government clinics	13
UNRWA clinics	5
private centers	10
pharmacies	85
laboratories	23
emergency centers	5

#### **5.5.1 Hospital in the Middle Governorate**

There are two hospitals in the Middle Governorate; one is a governmental hospital and the other a private hospital, and there is no specialized hospital in the Governorate.

Figure (5.3) shows the distribution of these two hospitals in the Governorate while Table (5.3) Shows the coordinate of each hospitals.



**Figure (5.3): Hospitals in the Middle Governorate**

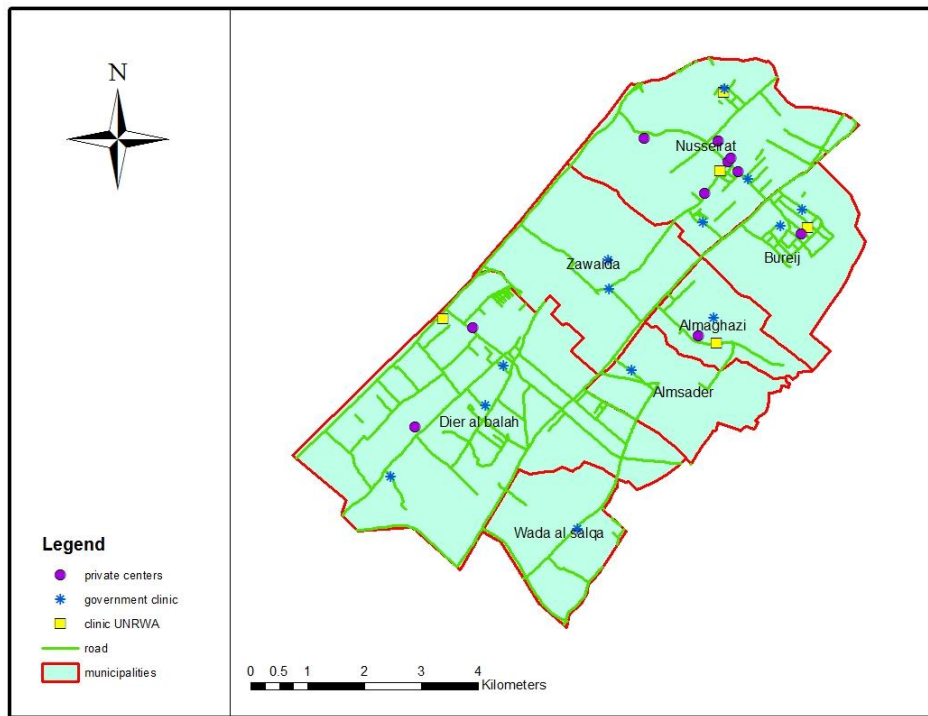
**Table (5.3): location in the Middle Governorate**

NO	Hospital	City	E_WGS48_Deg,Min,sec	N_WGS48_Deg,Min,sec
1	Aqsa Hospital	Deir al-Balah	34°21' 33.169" E	31° 25' 10.616" N
2	Yafa Hospital	Deir al-Balah	34°20' 39.522" E	31° 25' 04.113" N

### 5.5.2 Health Centers in the Middle Governorate

There are thirteen governmental clinic, five UNRWA clinics and ten private centers. Figure (5.4) shows the distribution of the clinics in the Governorate, while the coordinate of governmental clinic, UNRWA clinics and private centers are shown in Annex 3.

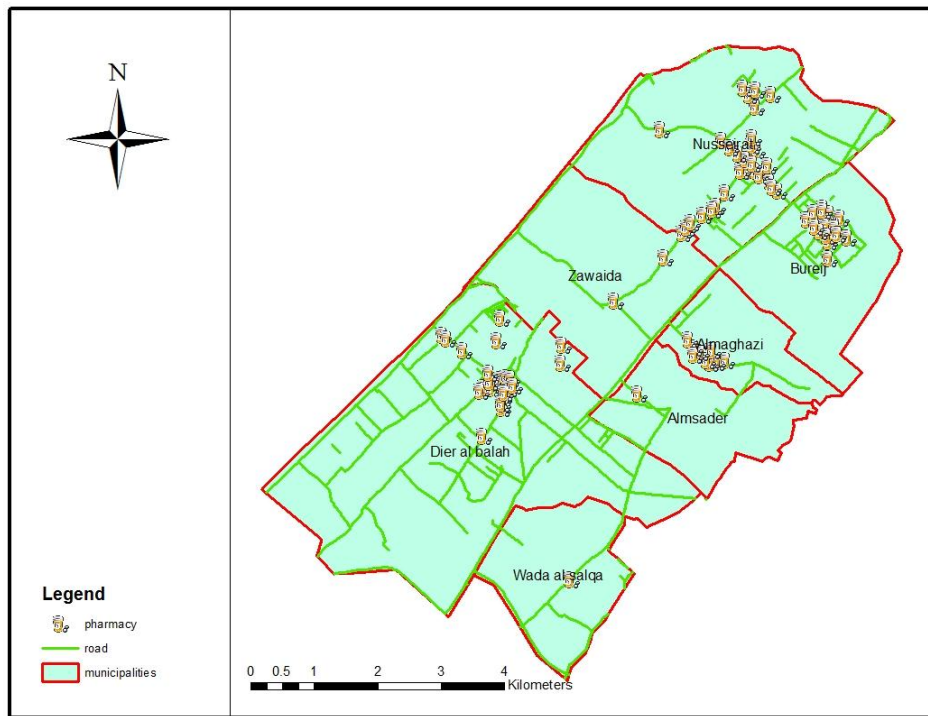




**Figure (5.4): Clinics in the Middle Governorate.**

### 5.5.3 Pharmacies in the Middle Governorate

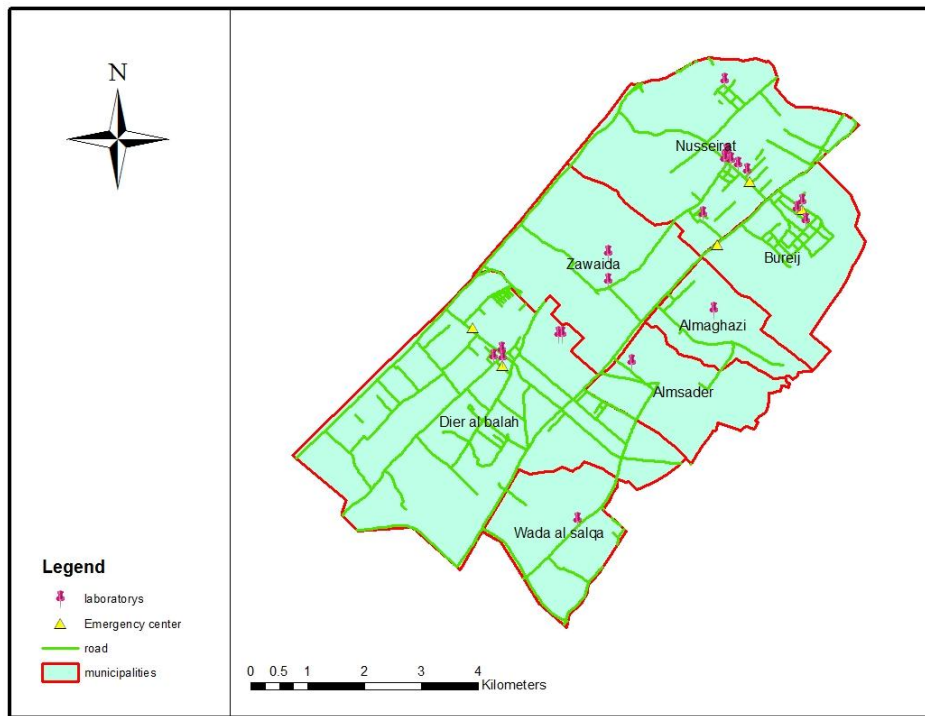
Figure (5.5) shows the distribution of the Pharmacies in the Governorate, while the coordinates of Pharmacies are shown in Annex 4, As shown in Figure the distribution of pharmacies are unfair where accumulate pharmacies in city centers and on the main streets and lacks in the rest of the areas for the existed pharmacies.



**Figure (5.5): Pharmacies in the Middle Governorate.**

#### **5.5.4 Laboratories and Emergency Centers in the Middle Governorate.**

Figure (5.6) shows the distribution of the Laboratories and Emergency Centers in the Governorate, while the coordinates of Pharmacies are shown in Annex 5, As shown in Figure the distribution of Laboratories and Emergency Centers are unfair where accumulate in city centers and on the main streets and lacks in the rest of the areas.



**Figure (5.6): Emergency centers and Laboratories in the Middle Governorate.**

## 5.6 Assessment of the Current Situation of Health Services.

The following subsections are outlined to evaluate the health situation in the Middle Governorate for each type of health facilities according to the chosen criteria.

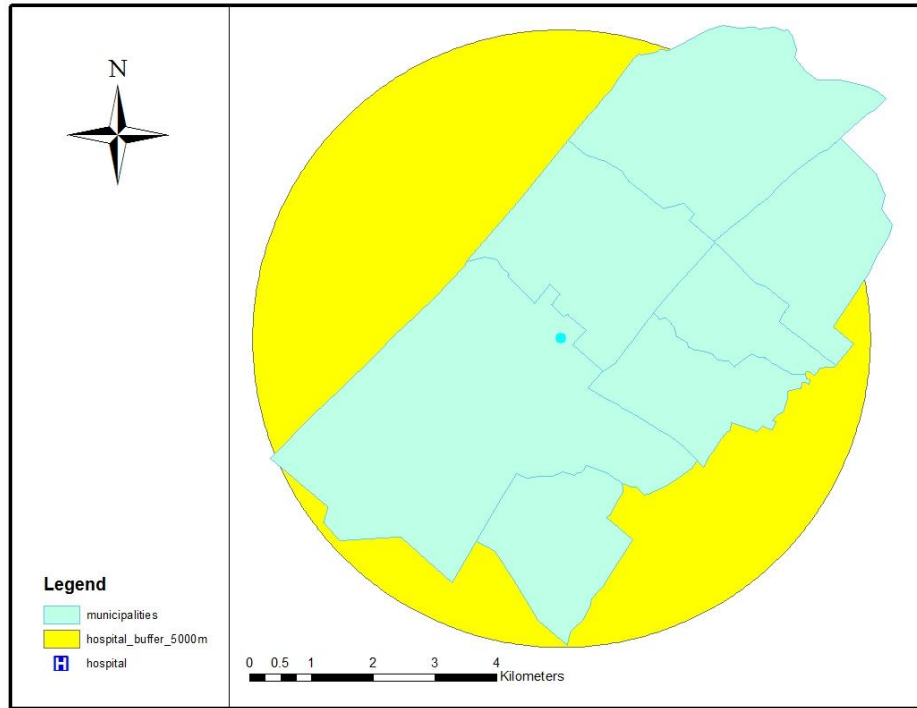
### 5.6.1 hospitals

There is in the Middle Governorate; one public hospital and another private, and that's enough by Saudi standards..

**Table (5.4): the criteria for public hospital according to Saudi standards**

The statement	from	to
The population served by	20,000	250,000
Service range (km)	_____	20

Figure (5.7) shows the Location of Aqsa Hospital, where is covered the Middle Governorate of distance five kilometers.



**Figure (5.7): Buffer of Alqsa Hospital (5000 m).**

### 5.6.2 Clinics Assessment

There are thirteen governmental clinics in the Governorate. According to Saudi standards, There is a clear lack of health clinics. That's there is a great need to other new six Clinics.

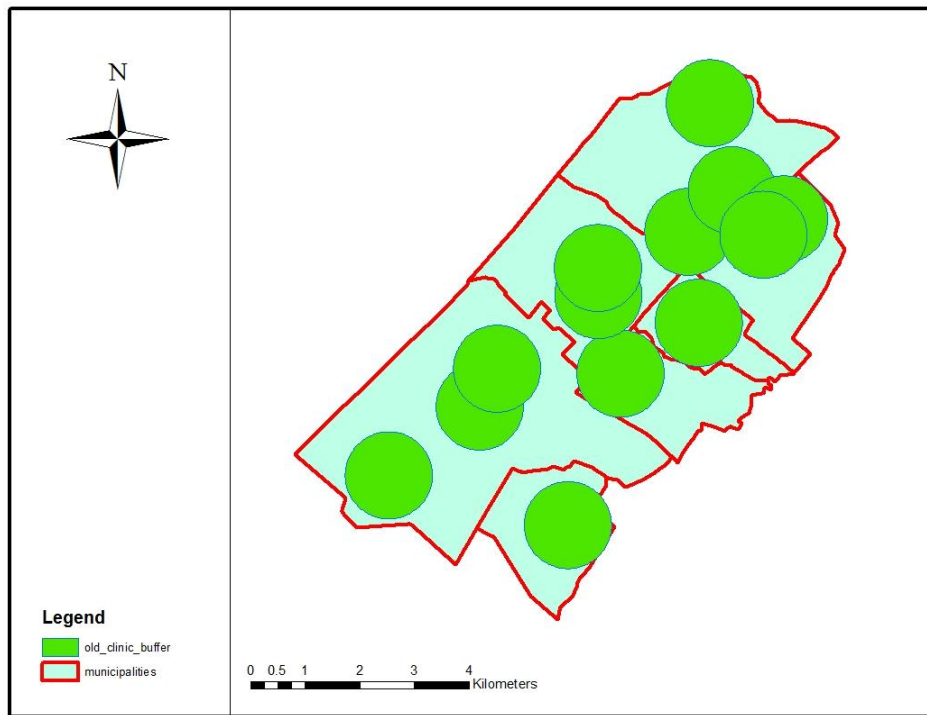
**Table (5.5): The clinics required in the Middle Governorate.**

Name	Population (Inhabitant)	Clinics required availability	The number of Clinics available	Clinics required
Deir al-Balah	75,736	5	3	2
Nusseirat	80,566	5	3	2
Bureij	42,119	3	2	1
Almaghazi	28,132	2	1	1
Zawaida	21,074	2	2	0
Almsader	2,330	1	1	0
Wada al-salqa	5,748	1	1	0

**Table (5.6): The criteria for clinics.**

The statement	from	to
The population served by	4,000	15,000
Service range (m)	—	800

Figure (5.8) shows the Location and the buffer 800m of the Governmental clinics, As shown in the Figure that there is a non-serviced areas of Government clinics.



**Figure (5.8): The buffer (800m) of the Governmental clinic.**

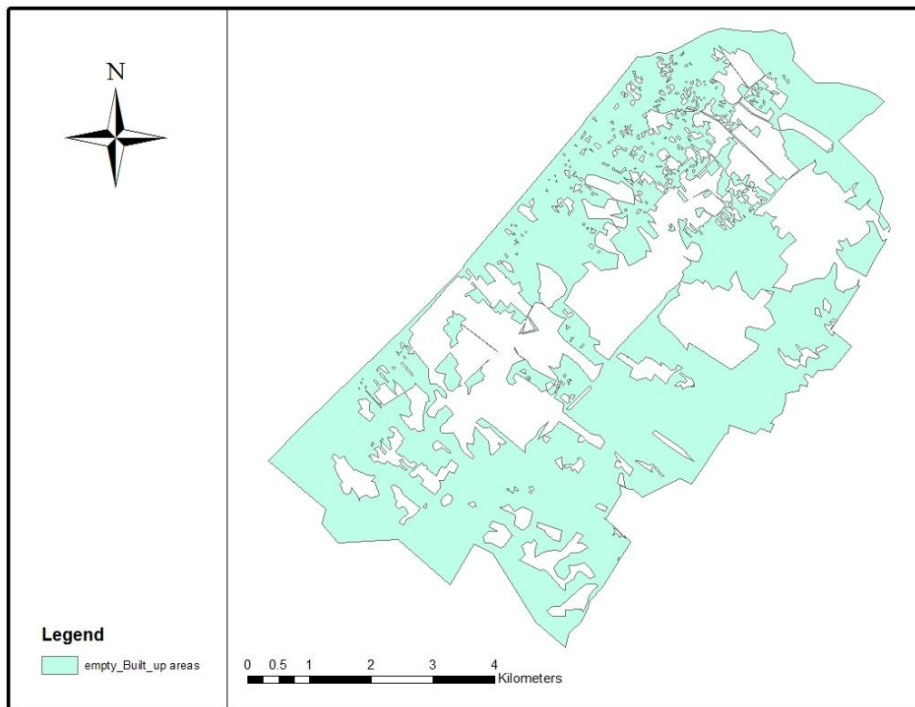
### 5.6.3 Pharmacies Assessment

There are in the Middle Governorate Eighty-five Pharmacies which cover the Middle Governorate's population by the standards of the Palestinian Health Ministry, and because of that these pharmacies are commercial in nature, it is concentrated in vital areas to see so this distribution is unfair.

## 5.7 Future Planning for Areas that Need Services

### 5.7.1 Planning of New Clinics

The GIS method of erase is used to removing the built up areas in the Middle Governorate and keep other Areas, as shown in Figure (5.9)



**Figure (5.9): The Erase of built up areas**

The GIS method of erase is used to removing major road areas in the Middle Governorate for distance of 100 meters and keep other areas, as shown in Figure (5.10).



**Figure (5.10): The Erase of major road areas**

The GIS method of erase is used to removing the school areas in the Middle Governorate for distance of 200 meters and keep other areas, as shown in Figure (5.11)



**Figure (5.11): The Erase of school areas**

The GIS method of erase is used to removing the areas of the markets in the Middle Governorate for distance of 200 meters and keep other areas, as shown in Figure (5.12).



**Figure (5.12): The Erase of market areas**

The GIS method of erase is used to removing the Delimiting line areas for distance of 1000 meters and keep other areas, as shown in Figure (5.13)



**Figure (5.13): The Erase of the Delimiting line areas**

The GIS method of erase is used to removing the area of cemeteries in the Middle Governorate for distance of 200 meters and keep other areas, as shown in Figure (5.14).



**Figure (5.14): The Erase of the cemeteries areas**



The GIS method of erase is used to removing the buffer of the old clinic in the Middle Governorate for distance of 800 meters and keep other areas, as shown in Figure (5.15).



**Figure (5.15): The Erase of the buffer of the old clinic**

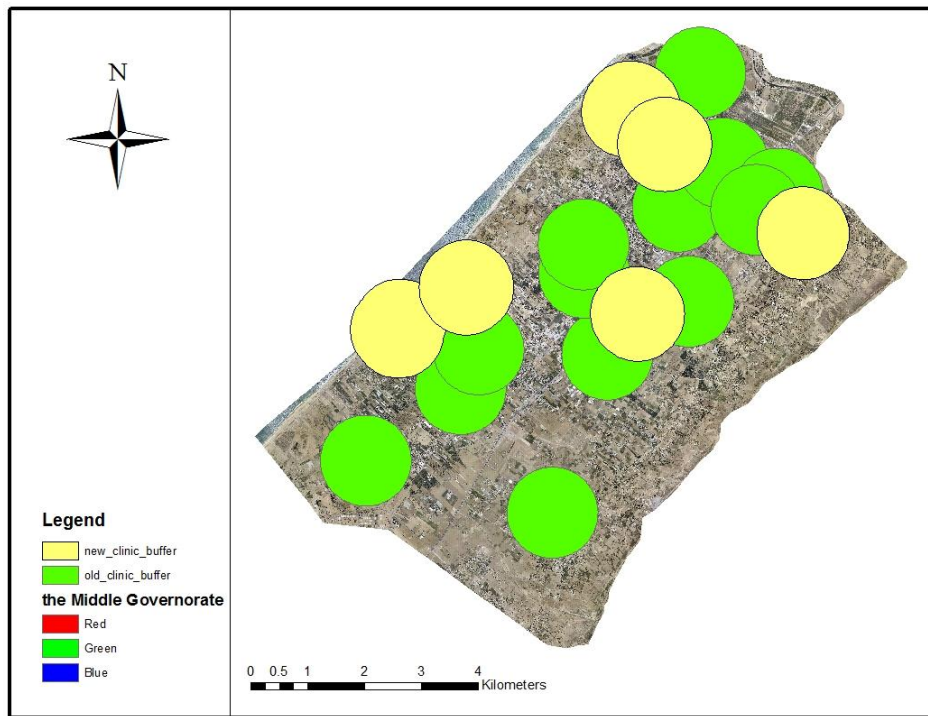
The pieces of empty land area is more than 2000 square meters and then the criteria and weights are applied, which proposed and approved as shown in Annex 2 distributing to a number of Academic staff for evaluation and give recommendation. And then the best six places necessary for the clinics in the Middle Governorate are determined. as shown in the Figure (5.17)



**Figure (5.16): The Erase of the empty area >2000m**

**Table (5.7): The Criteria, Weight and Internal weight to choose the new clinic**

No.	Criteria	Weight (%)	Internal weight (%)
1	Old clinic	20	800m=15 1200m =25 >1200m=60
2	The main streets	20	200m=60 300m=30 >300m=10
3	Delimiting line	15	800m=15 1000m=30 >1000m=45
4	cemeteries	15	200m=20 300m=30 >300m=50
5	market	15	250m=20 350m=35 >350m=45
6	school	15	250m=10 350m=30 >350m=60



**Figure (5.17): The served areas by the new and old clinics**

### **5.7.2 Planning of New Specialized Hospital**

This is to choose the best place of a specialized hospital in the Middle Governorate using two methods: the SMCDA method and Fuzzy Logic method. Then, a comparison of results.

#### **A) Erase Method**

The GIS method of erase is used to remove the built-up areas in the Middle Governorate and keep other areas, as shown in Figure (5.18)



**Figure (5.18): The Erase of built up areas**

The GIS method of erase is used to removing the major road in the Middle Governorate and keep other areas, as shown in Figure (5.19)



**Figure (5.19): The Erase of major road areas**

The GIS method of erase is used to removing the market in the Middle Governorate and keep other areas, as shown in Figure (5.20)



**Figure (5.20): The Erase of market areas**

The GIS method of erase is used to removing the Delimiting line in the Middle Governorate for a distance of 1000 meters. and keep other areas, as shown in Figure (5.21)



**Figure (5.21): The Erase of Delimiting line areas**

The GIS method of erase is used to removing the landfill in the Middle Governorate for a distance of 250 meters. and keep other areas, as shown in Figure (5.22)



**Figure (5.22): The Erase of landfill areas**

The GIS method of erase is used to removing the sea line in the Middle Governorate for a distance of 200 meters. and keep other areas, as shown in Figure (5.23)



**Figure (5.23): The Erase of sea line areas**

The GIS method of erase is used to removing the cemeteries in the Middle Governorate for a distance of 250 meters. and keep other areas, as shown in Figure (5.24)



**Figure (5.24): The Erase of cemeteries areas**

The GIS method of erase is used to removing the campus of Wadi Gaza in the Middle Governorate for a distance of 300 meters. and keep other areas, as shown in Figure (5.25)



**Figure (5.25): The Erase of Wadi Gaza areas**

The GIS method of erase is used to removing the campus of Industrial area in the Middle Governorate for a distance of 200meters. and keep other areas, as shown in Figure (5.26)



**Figure (5.26): The Erase of industrial areas**

The pieces of empty land area is more than 10000 square meters and then the criteria and weights are applied, which proposed and approved as shown in Annex 2 distributing to a number of Academic staff for evaluation and giving recommendation. And then the best place for the a specialized hospital in the Middle Governorate is determined.

**For example:**

as shown in Table (5.8)

- To be far from the landfill to 20%
  - Places a distance of 250m from the campus of the landfill will be given 25% from the 20%.
  - Places a distance of 400m from the campus of the landfill will be given 30% from the 20%.
  - Places which is greater than 400 m away from the campus of the landfill will be given 55% from the 20%

Then collect all the criteria according to the criteria applied, and so the best place showing in terms ratios of importance that applied. As shown in the Figure (5.27).



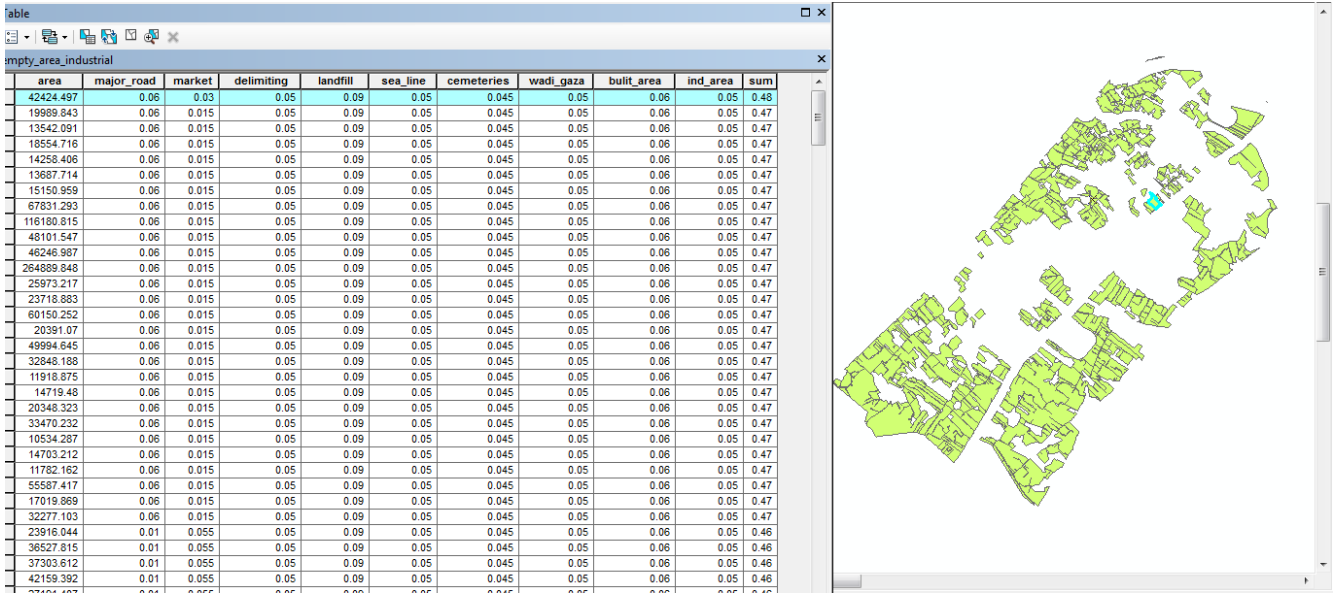


Figure (5.27): The best place of the specialized hospital

Table(5.8):the Criteria, Weight and Internal weight to choose the specialized hospital.

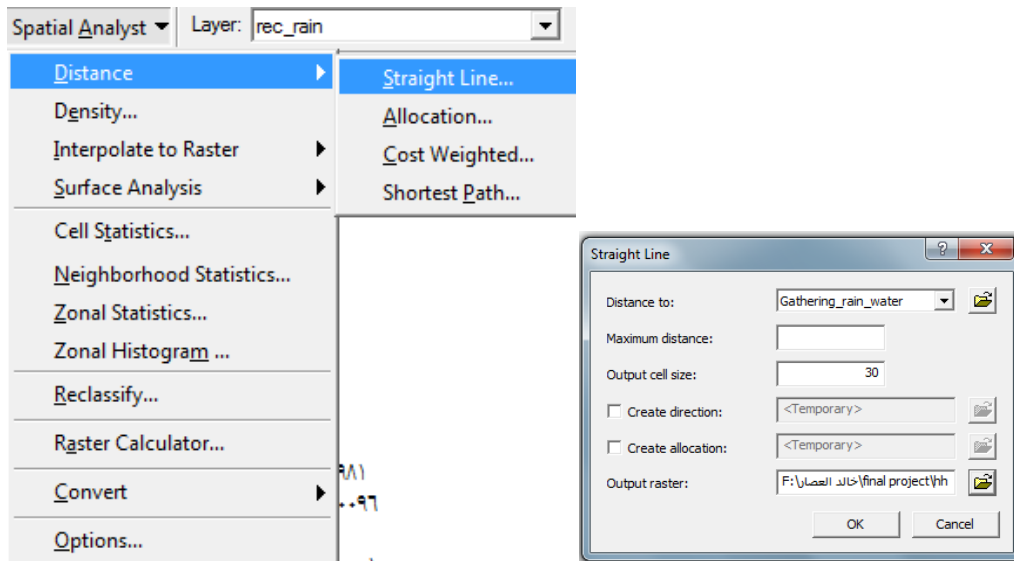
No.	Criteria	Weight (%)	Internal weight
1	landfill	20	250m=25 400m =30 >400m=45
2	The main streets	10	100m=60 200m=30 >200m=10
3	Delimiting line	10	1000m=20 1200m=30 >1200m=50
4	cemeteries	10	250m=15 400m=30 >400m=55
5	market	10	200m=15 300m=30 >300m=55

No.	Criteria	Weight (%)	Internal weight
6	Sea line	10	200m=20 300m=30 >300m=50
7	Wadi Gaza	10	300m=20 400m=30 >400m=50
8	Industrial area	10	200m=20 400m=30 >400m=50
9	Built up area	10	100m=60 200m=30 >200m=10
<b>Total</b>		<b>100</b>	

## B) Fuzzy Logic Method

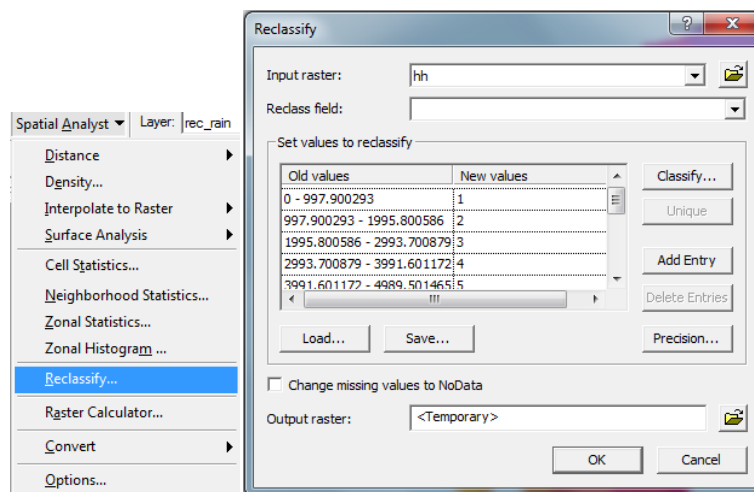
Fuzzy logic refers to a large subject dealing with a set of methods to characterize and quantify uncertainty in engineering systems that arise from ambiguity, imprecision, fuzziness, and lack of knowledge. Fuzzy logic is a reasoning system based on a foundation of fuzzy set theory, an extension of classical set theory, where set membership can be partial as opposed to all or none, as in the binary features of classical logic.

Fuzzy logic is a relatively new discipline in which major advances have been made over the last decade or so with regard to theory and applications.



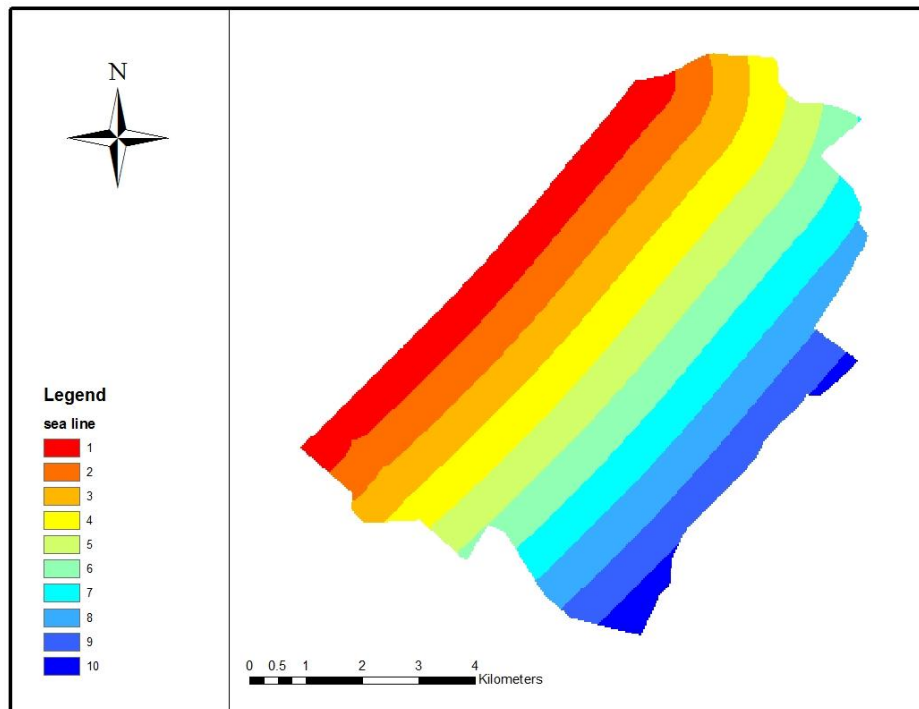
**Figure (5.28): Steps Fuzzy Analysis**

Dividing the Middle Governorate to ten equal sections and then the colors are arranged in terms of the advantage starting from No.1 to the worst and 10 the best



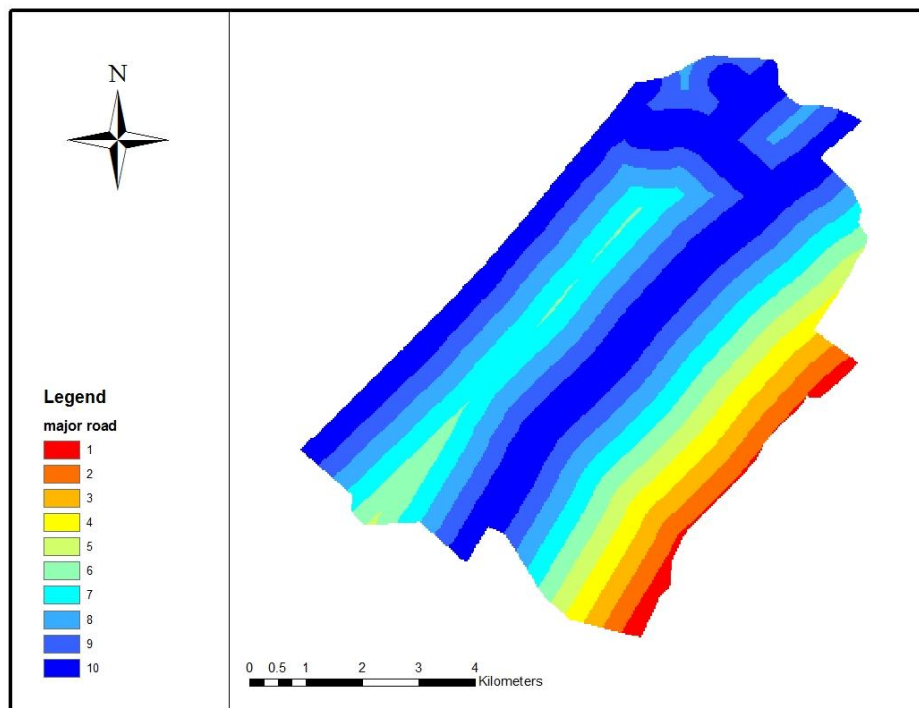
**Figure (5.29): Reclassify According to the degree of importance**

Dividing into ten sections of where the distance from the sea line. it starts with the red color and ends with the blue one as shown in the Figure (5.30).



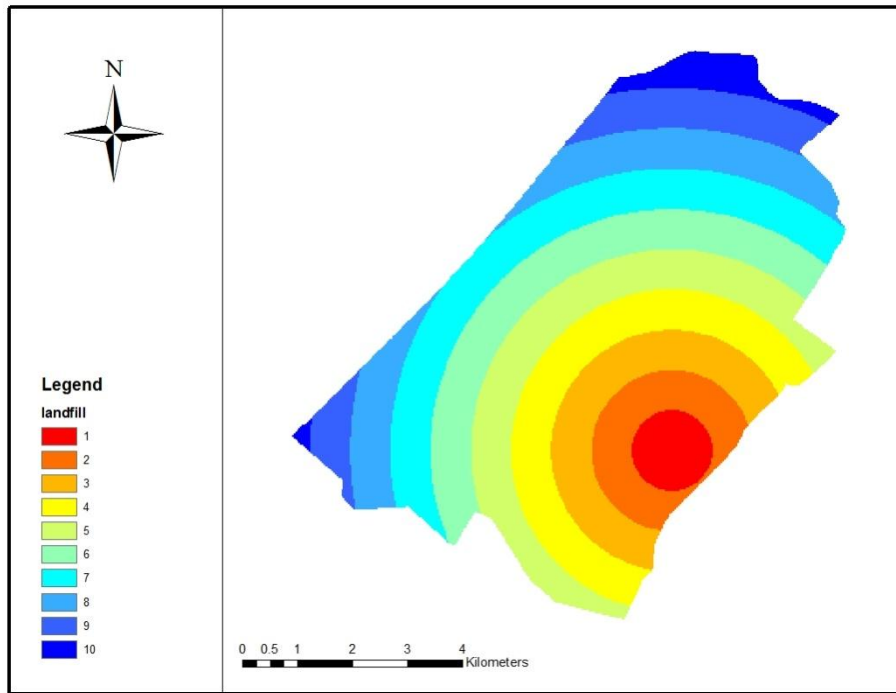
**Figure (5.30): Effect of sea line to choose the best place of hospital**

Dividing Governorate into ten sections of where the distance from the major road, it starts with the red color and ends with the blue one as shown in the Figure (5.31)



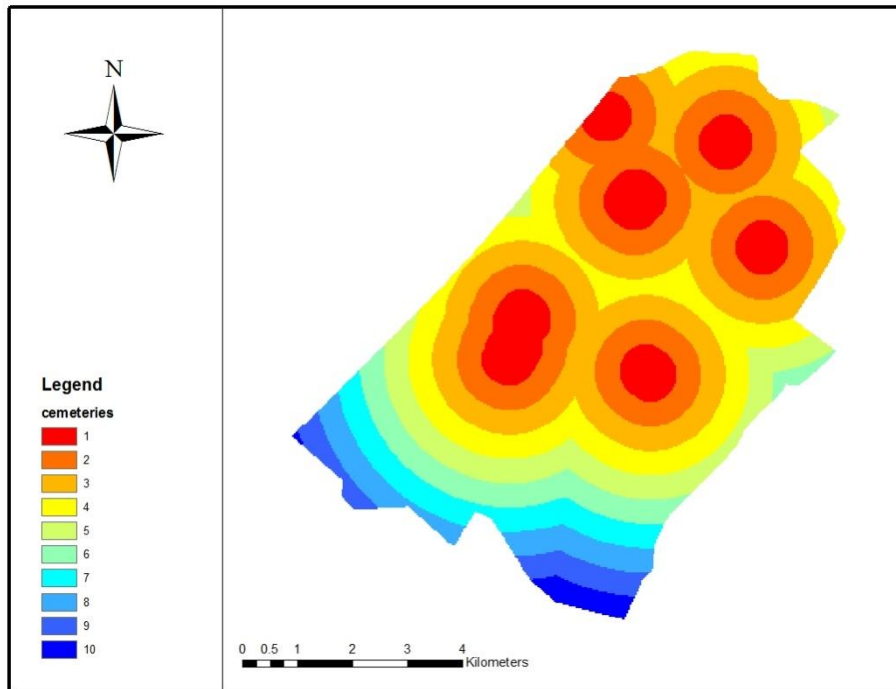
**Figure (5.31): Effect of major road to choose the best place of hospital**

Divided the Governorate into ten sections of where the distance from the landfill, it starts with the red color and ends with the blue one as shown in the Figure (5.32).



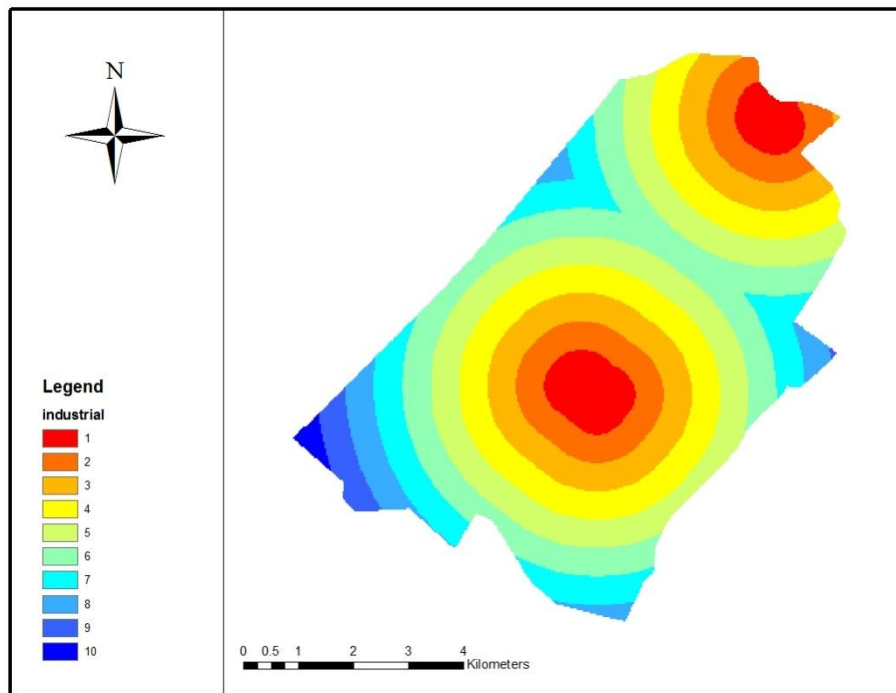
**Figure (5.32): Effect of landfill to choose the best place of hospital.**

Divided the Governorate into ten sections of where the distance from the cemeteries, it starts with the red color and ends with the blue one as shown in the Figure(5.33)



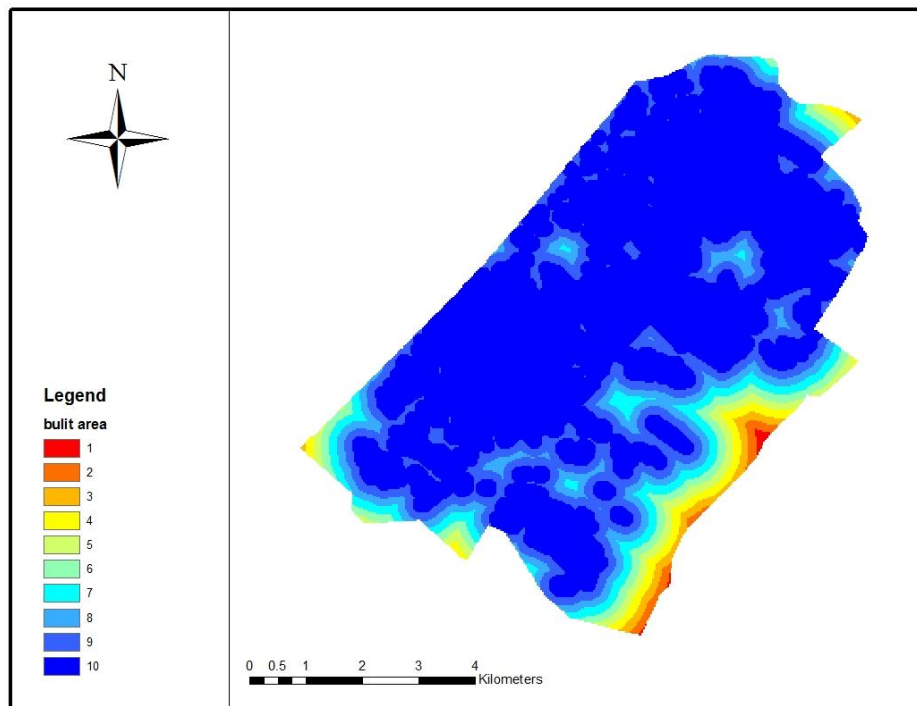
**Figure (5.33): Effect of cemeteries to choose the best place of hospital**

Divided Governorate into ten sections of where the distance from the industrial area it starts with the red color and ends with the blue one as shown in the Figure (5.34).



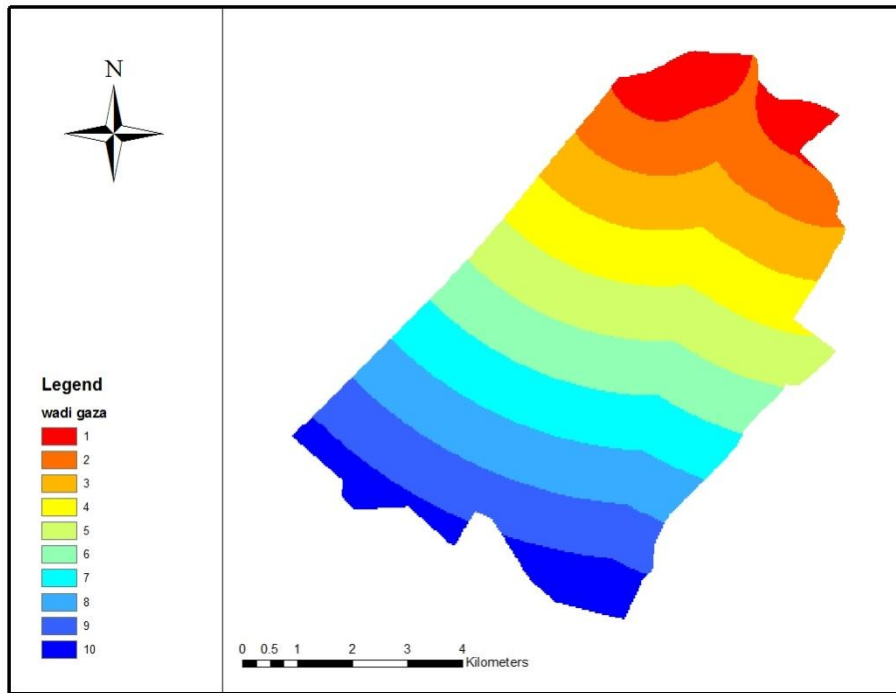
**Figure (5.34): Effect of industrial area to choose the best place of hospital**

Divided the Governorate into ten sections of where the distance from the built area, it starts with the red color and ends with the blue one as shown in the Figure (5.35).



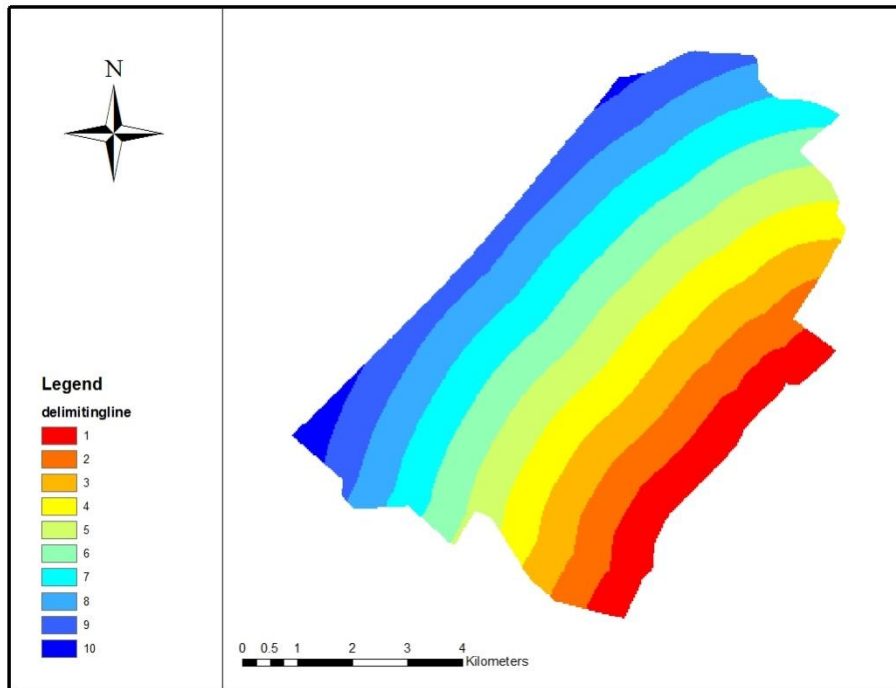
**Figure (5.35): Effect of built to choose the best place of hospital.**

Divided the Governorate into ten sections of where the distance from Wadi Gazait starts with the red color and ends with the blue one as shown in the Figure (5.36).



**Figure (5.36): Effect of Wadi Gaza to choose the best place of hospital**

Divided into ten sections of where the distance from the Delimiting line it starts with the red color and ends with the blue one as shown in the Figure (5.37)



**Figure (5.37): Effect of Delimiting line to choose the best place of hospital**

**Table (5.9):The Criteria, Weight to choose the specialized hospital.**

No.	Criteria	Weight (%)
1	Built-up areas	25
2	The main streets	20
3	Sea line	10
4	Landfill	10
5	Industrial Area	10
6	Delimiting line	10
7	Wadi Gaza	5
8	Cemeteries	5
9	Market	5
<b>Total</b>		<b>100</b>

From spatial analyst in GIS software, the composition suitability score of all previous raster data can be calculated to obtain one map which conclude all criteria data as shown in Figure (5.38). This can be calculated by multiplying each criteria rank by its weight according to Equation (5.1).

$$S = \sum_{i=1}^n C_i * W_i \quad (5.1)$$

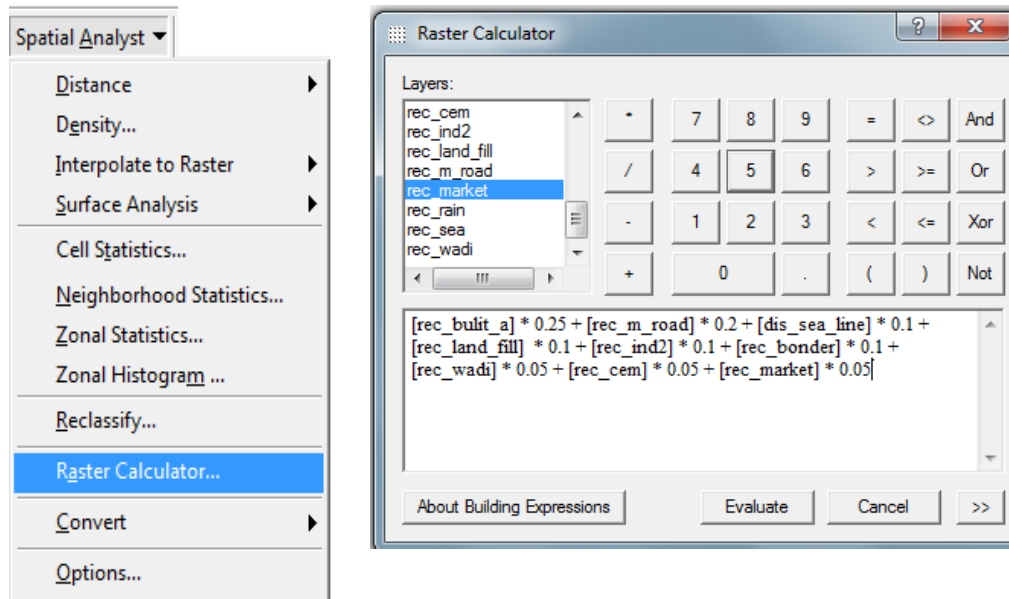
Where:

S: the composite suitability score,

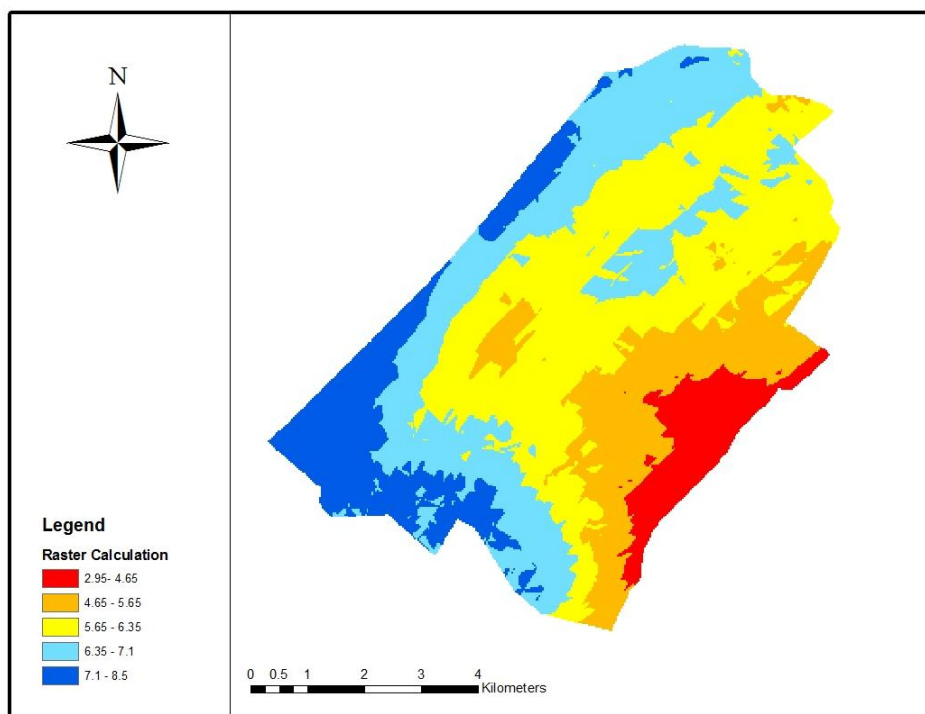
$C_i$ : criterion scores (cells), and

$W_i$ : weights assigned to each criteria



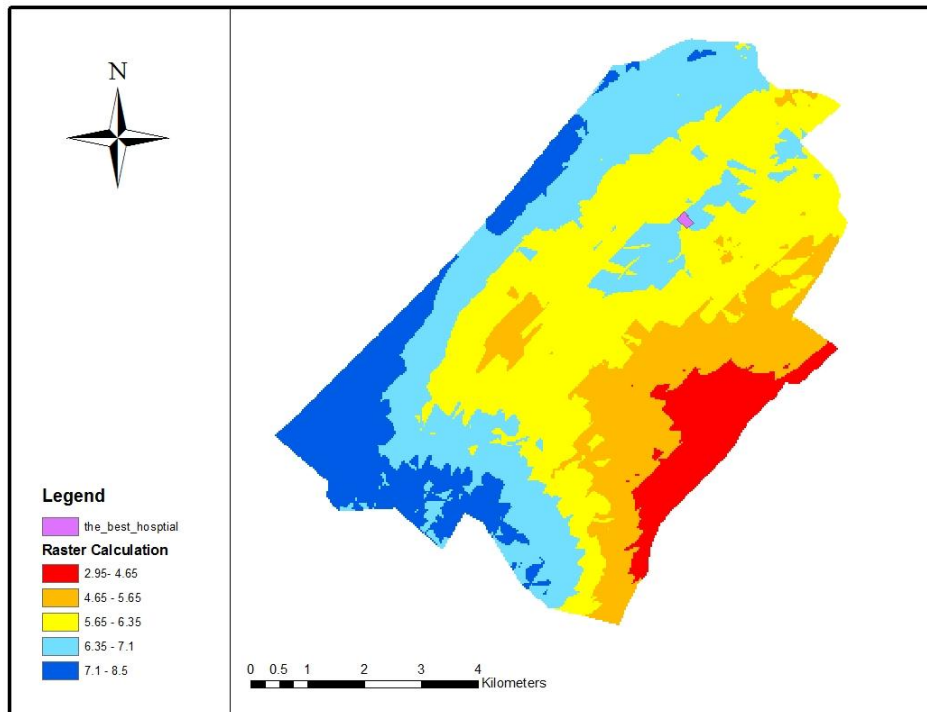


**Figure (5.38): Composite suitability score**



**Figure (5.39): The Raster Calculation of the Middle Governorate**

In this Figure, there is a comparison between two methods, the SMCDA method and the fuzzy method. It shows that the hospital location in erase method is closed to be similar to the fuzzy logic method, as shown in figure (5.40).



**Figure (5.40): Comparison the result between the SMCDA method and the fuzzy logic method**

## 5.8 Summary

- SMCDA method and fuzzy logic are the methods were used to determine the best locations for establishing clinics and specialized hospitals.
- Using various measures to apply these analysis, Built up area, The main streets, landfill, Delimiting line, cemeteries, market, Sea line, Wadi Gaza and Industrial area.
- The best location were found for clinics; they are two clinics in Nusairat, two clinics in Deir Al Balah, one in Buriij and the other one in Maghazi.
- The best location for the hospital was found near Nusairat towers.

## **CHAPTER 6: CONCLUSION AND RECOMMENDATIONS**

### **6.1 Conclusion**

Based on collected data and analysis, the following conclusions can be drawn:

#### **6.1.1 Conclusion of Questionnaire**

1. The researcher assessed the fields' internal and structural validity by calculating the correlation coefficients between each paragraph in one field and the whole field. The p-values (Sig.) are less than 0.05, so the correlation coefficients of all fields are significant at  $\alpha = 0.05$ , so it can be said that the paragraphs and the fields are valid to be measured what it was set for to achieve the main aim of the study.
2. The researcher used Alpha Cronbach's test, which indicates an excellent reliability.
3. One sample t test was used to determine if the mean of a paragraph is significantly different from a hypothesized value 3 (Middle value of Likert scale). So all fields of the questionnaire is significantly significant at 0.05 level in about the health services in the Middle Governorate.
4. One way ANOVA test presented that is no statistically significant difference at  $\alpha = 0.05$ , about the health services in the Middle Governorate due to age, level of education, and job.
5. Independent Samples Test presented that is no statistically significant difference at,  $\alpha = 0.05$  about the health services in the Middle Governorate.

### 6.1.2 Conclusion of GIS Work (Case Study)

1. Two methods are used for analyzing the health services in the Middle governorate using GIS; the MCDM and the fuzzy logic methods.
2. The suitable locations of the clinics are chosen by multiply each criteria by its weight and internal weight which is estimated by the decision makers. The station is chosen as a locations of clinics.
3. Using multiple criteria has been used several criteria were then choose the weight of each standard as well as an internal standard for each weight in terms of importance.
4. Six categories of data was collected such as, the Middle governorate population, health places in the Middle Governorate, the Middle Governorate streets, the Middle Governorate land use, the school in the Middle Governorate, and some planning standards related to research.
5. It shows the study that the only hospital in the Middle Governorate enough as a general hospital in the middle governorate, but the middle governorate lacks to a specialist hospital.
6. It shows the study that the Middle Governorate suffer from poor distribution and inadequate in relation to the health care centers initial, that needed to six clinics two in Deir al-Balah, two in Nuseirat, one in Bureij and one in Maghazi.
7. Results of the analysis showed that the pharmacies in the study area, suffer from poor distribution where accumulate pharmacies in city centers and on the main streets and lacks in the rest of the areas for the existence pharmacies.

## 6.2 Recommendations

As a result of this study, the following recommendations are depicted:

1. The study recommends to raise the efficiency and effectiveness of the existing health centers.
2. The study also recommends to work to create a specialized hospital in the middle governorate to put an end to the suffering of the population, which is particularly evident during the wars and disasters.
3. The study also recommends the rationalization of licensing of new pharmacies in densely pharmacies, so as to promote the opening of pharmacies in areas of need for the service and to achieve the spatial distribution more efficient.
4. The study recommends increasing the effectiveness of emergency centers and private ambulance where he appeared through the questionnaire that there is a clear deficit
5. The study also recommends action to introduce GIS technology in spatial planning and management of health services operations.
6. The study also recommends the government officials and researchers to develop specific standards for health planning, particularly spatial planning commensurate with the possibilities and needs of the Palestinian society, where most researchers depends on the Arab standards.
7. The study recommends to put clear plan to develop the health services in the middle governorate by depending on standard planning and taking into account of population distribution in the governorate.
8. Finally, the study recommends the Ministry of Health to work to establish a computerized database for the management of spatial information for health services of all kinds private and civil.

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## Annex 1

### English Version of Questionnaire

The Islamic University Gaza  
Higher Education Deanship  
Faculty of Engineering  
Civil Engineering Dept.  
Infrastructure Engineering



#### Questionnaire

Topic / fill in a questionnaire for the Master

The researcher studied about "**the use of GIS to evaluate and analyze the health services in The central governorate in Gaza Strip**", An Empirical Study about The central governorate in Gaza City to complement the requirements for obtaining a master's degree in infrastructure in the Islamic University of Gaza.

To our deep belief that you will knowledge the most health situation in the governorate and you are the best source to gain access to the required information, the researcher is pleased that puts between your hands to fill this questionnaire and the whole hope to find the absolute cooperation by you. Please read the paragraphs of the questionnaire attached and choose the answer that reflects actual fact, note that the information that will be mobilized by you will be treated confidentially, and will only be used for the purposes of scientific research.

Yours sincerely,,,

Researcher:  
Khaled A Alassar

### The first group : Demographic data

1. Name:.....
2. Age:  less than 20       20- less than 30       30 – less than 40       40 – less than 50       50- less than 60       more than 60
3. Education level       primary       secondary       academy       high education
4. gender       male  female
5. Job       governmental employee       privet employee       worker       unemployed       student       other than
6. The name of City that you live:.....      Name of zone :.....

### The second group: Questioner Paragraphs

The questions from 1-5 are general questions regarding of The overall satisfaction for the health service, complete the following Table according to the degree of approval.

No.	Items	The degree of approval				
		Very little	Little	Moderately	Much	Very much
		1	2	3	4	5
1.	The health center near your home has a high level service.					
2.	Available suitable ambulatory services, where you live.					
3.	Waiting time for doctors is short and appropriate.					
4.	Number of doctors is enough for the number of patients whom received of the health center.					
5.	The administration is concerned to the health center cleaning.					

\*The questions from 6-13 Relating to the availability of the required service and technical staff and appropriate equipment, complete the following Table according to the degree of approval.

No.	Items	The degree of approval				
		Very little	Little	Moderately	Much	Very much
		1	2	3	4	5
6.	Health facility has modern sophisticated equipment.					
7.	Enjoy frameworks operating in this facility with the required efficiency.					
8.	There are facilities fit with the nature of the service provided					
9.	The center includes all the required disciplines.					
10.	The Center Pharmacy has all medicines prescribed by a doctor.					
11.	There are places for a break time and waiting.					
12.	The health center design fits the required service.					
13.	Systems of public relations and effective communication.					

\*The questions from 14-20 Relating to Distribution services appropriately, complete the following Table according to the degree of approval

No.	Items	The degree of approval				
		Very little	Little	Moderately	Much	Very much
		1	2	3	4	5
14	Health Centre has an appropriate accessible location.					
15	Easy access to the emergency department					
16	The distance to the health center is short.					
17	There is a fair distribution for pharmacies in your area					
18	The arrival of emergency teams to the area you live in is fast.					
19	The number of hospitals is enough to the population in The Middle Governorate					
20	Health laboratory service is available in your city					

21. What are some places in the Central Province, which sees in it an urgent need for the establishment of a health center and from your point of

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## Arabic Version of Questionnaire



الجامعة الإسلامية - غزة  
عمادة الدراسات العليا  
كلية الهندسة - إدارة البنية التحتية

### الإستبانة

الأخ/الأخت ..... المحترم / ة

السلام عليكم ورحمة الله وبركاته ،،،

الموضوع / تعبئة استبانة لرسالة ماجستير

يقوم الباحث بدراسة حول " استخدام نظم المعلومات الجغرافية GIS لتقييم وتحليل الخدمات الصحية في المحافظة الوسطى بقطاع غزة "، دراسة تطبيقية عن الخدمات الصحية في المحافظة الوسطى وذلك استكمالاً لمتطلبات الحصول على درجة الماجستير في البنية التحتية في الجامعة الإسلامية بغزة. ولإيماننا العميق بأنكم الأكثر معرفة بالوضع الصحي في المحافظة ، وأنكم خير مصدر للوصول إلى المعلومات المطلوبة ، يسر الباحث ان يضع بين أيديكم هذه الاستبانة لتعبئتها وكله أمل ان يجد التعاون المطلق من قبلكم. يرجى قراءة فقرات الاستبانة المرفقة واختيار الإجابة التي تعكس الواقع الفعلي ، علماً بأن المعلومات التي ستعبأ من قبلكم ستعامل بسرية تامة ، ولن تستخدم إلا لأغراض البحث العلمي. وتقبلوا فائق الاحترام والتقدير ،،،

الباحث

خالد عبد الفتاح العصار

## المجموعة الأولى : البيانات الديموغرافية

- ١- الاسم (اختياري) : .....
- ٢- العمر  أقل من ٢٠  ٢٠- أقل من ٣٠  ٣٠- أقل من ٤٠  ٤٠- أقل من ٥٠  ٥٠- أقل من ٦٠  أكثر من ٦٠
- ٣- المستوى التعليمي  أساسي  ثانوي  جامعي  دراسات عليا
- ٤- الجنس  ذكر  انثى
- ٥- الوظيفة أو المهنة  موظف حكومي  موظف في قطاع خاص  عامل  لا يعمل  طالب جامعي  غير ذلك
- ٦- اسم المدينة التي تسكن : ..... اسم الحي : .....

## المجموعة الثانية : فقرات الاستبانة

\*الأسئلة من ١-٥ هي أسئلة تتعلق بمدى الرضا العام عن الخدمة الصحية ، أكمل الجدول الآتي حسب درجة الموافقة.

درجة الموافقة					الفقرة
درجة قليلة جداً	درجة قليلة	درجة متوسطة	درجة كبيرة	درجة كبيرة جداً	
١	٢	٣	٤	٥	
					١. يعتبر المركز الصحي القريب من سكنك ذو مستوى خدمة مرتفع.
					2. تتوفر خدمة إسعافيه مناسبة حيث تسكن .
					٣. تعتبر المدة الزمنية التي انتظر بها الطبيب قصيرة.
					٤ . عدد الأطباء كافي لعدد المرضى الذين يقبلون علي المركز الصحي.
					٥. تهتم الإدارة بنظافة المركز الصحي

\*الأسئلة من ٦-١٣ هي أسئلة تتعلق بتوفر الخدمة المطلوبة والطاقم الفني والتجهيزات الملائمة

درجة الموافقة					الفقرة
درجة كبيرة جداً	درجة كبيرة	درجة متوسطة	درجة قليلة	درجة قليلة جداً	
٥	٤	٣	٢	١	
					6. يمتلك المرفق الصحي أجهزة متطورة حديثة
					7. تتمتع الأطر العاملة في هذا المرفق الصحي بالكفاءة المطلوبة
					8. توجد مرافق تتلائم مع طبيعة الخدمة المقدمة
					9. توجد في المركز جميع التخصصات المطلوبة
					10. هناك توفر في الادوية التي يصفها الطبيب في صيدلية المركز الصحي.
					11. يوجد اماكن استراحة وانتظار في المركز الصحي.
					12. تصميم المركز الصحي يتلائم مع الخدمة المطلوبة.
					13. يوجد في المركز الصحي نظم علاقات عامة واتصالات فعالة.



\*الأسئلة من ١٤-٢٠ هي أسئلة تتعلق بتوزيع الخدمات بشكل مناسب

درجة الموافقة					الفقرة
درجة كبيرة جداً	درجة كبيرة	درجة متوسطة	درجة قليلة	درجة قليلة جداً	
٥	٤	٣	٢	١	
					14. يتمتع المركز الصحي بموقع ملائم وبسهل الوصول اليه.
					15. يمكن الوصول بسهولة الي قسم الطوارئ.
					16. تعتبر المسافة التي تقطعها للوصول الي المركز الصحي قريبة.
					17. هناك توزيع عادل للصيديات في منطقتك.
					18. هناك سرعة في وصول فرق الطوارئ الي المنطقة التي تسكن لإسعاف احدى الحالات.
					19. يعتبر عدد المستشفيات كافي لسكان المحافظة التي تسكن.
					20. تتوفر في مدينتك خدمة المختبرات الصحية.

١. اذكر بعض الأماكن في المحافظة الوسطي (اسم المدينة - اسم الحي) التي تري إنها بحاجة ماسة لإنشاء

مركز صحي جديد من وجهة نظرك

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## Annex 2



الجامعة الإسلامية - غزة  
عمادة الدراسات العليا  
كلية الهندسة - إدارة البنية التحتية

### الإستبانة

السلام عليكم ورحمة الله وبركاته ،،،

الموضوع / تعبئة استبانة لرسالة ماجستير

يقوم الباحث بدراسة حول " استخدام نظم المعلومات الجغرافية GIS لتقييم وتحليل الخدمات الصحية في المحافظة الوسطي بقطاع غزة "، دراسة تطبيقية عن المحافظة الوسطي وذلك استكمالا لمتطلبات الحصول على درجة الماجستير في البنية التحتية في الجامعة الإسلامية بغزة. وخلال دراستنا للوضع الحالي للمحافظة الوسطي تبين ان هناك نقص واضح في العيادات الصحية وكذلك لا يوجد مستشفى تخصصي في المحافظة وعند البحث عن معايير خاصة بالخدمات الصحية عند الوزارات المعنية لم نجد التعاون المطلوب، يسر الباحث إن يضع بين أيديكم هذه المعايير المقترحة وكله أمل إن يجد التعاون المطلق من قبلكم.

وتقبلوا فائق الاحترام والتقدير ،،،

الباحث

خالد عبد الفتاح العصار

Comment		Internal weight	Weight	Determinant
Internal weight	Weight			
		%60=100m %30= m200 %10=m200<	% 10	الشوارع الرئيسية
		%15= m200 %30= m300 55=m300<	% 10	الأسواق
		%20= m1000 %30= m1200 %50=m1200<	% 10	الحدود
		%20= m200 %30= m300 %50=m300<	% 10	خط البحر
		%15= m250 %30= m400 %45=m400<	% 10	المقابر
		%20= m300 %30= m400 %50=m400<	% 10	وادي غزة
		%20= m200 %30= m400 %50=m400<	% 10	المناطق الصناعية
		%60= m100 %30= m200 %10=m200<	% 10	التجمعات السكانية
		%25= m250 %30= m400 %45=m400<	% 20	مكبات النفايات

جدول(1.1): المعايير المقترحة لإنشاء المستشفى التخصصي بالمحافظة الوسطي

ملاحظة في حالة وجود معايير أخرى يجب الاهتمام بها الرجاء ذكرها

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Comment		Internal weight	Weight	Critical
Internal weight	Weight			
		%60= m200 %30= m300 %10=m300<	%20	الشوارع الرئيسية
		%15= m800 %25= m1200 %60=m1200<	%20	العيادات الموجودة
		%15= m800 %30= m1000 %45=m1000<	%15	الحدود
		%20= m200 %30= m300 %50=m300<	%15	المقابر
		%20= m250 %35= m350 %45=m350<	%15	الأسواق
		%10= m250 %30= m350 %60=m350<	%15	المدارس

جدول(1.2):المعايير المقترحة لإنشاء للعيادات الصحية في المحافظة الوسطي

ملاحظة في حالة وجود معايير أخرى يجب الاهتمام بها الرجاء ذكرها

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### Annex 3

- Government clinics Coordinate

NO	Government clinic	City	E_WGS48_Deg,Min,sec	N_WGS48_Deg,Min,sec
1	Deir al-Balah Clinic	Deir al-Balah	34°20' 54.822" E	31° 24' 58.625" N
2	Baraka Clinic	Deir al-Balah	34°19' 40.603" E	31° 23' 54.697" N
3	Hakr Clinic	Deir al-Balah	34° 20'41.063" E	31° 24' 37.421" N
4	Nuseirat old clinic	Nusseirat	34°23' 37.336" E	31° 26' 45.706" N
5	New camp clinic	Nusseirat	34°23' 20.932" E	31° 27' 38.099" N
6	Alsoarhh Clinic	Nusseirat	34°22'4.341" E	31° 25' 59.166" N
7	Shohadaa Nuseirat	Nusseirat	34°23'7.042" E	31° 26' 21.337" N
8	Bureij Clinic	Bureij	34° 24' 13.438" E	31° 26' 29.147" N
9	New Bureij Clinic	Bureij	34° 23' 58.853" E	31° 26' 20.183" N
10	Altamen Clinic	Almaghazi	34° 23' 14.806"E	31° 25' 27.12" N
11	Zawaida Clinic	Zawaida	34° 22' 4.771" E	31° 25' 43.347" N
12	Almsader Clinic	Almsader	34° 22' 20.305" E	31° 24' 56.45" N
13	Wada al-salqa Clinic	Wada al-salqa	34° 21' 45.402" E	31° 23' 26.248" N

- UNRWA Clinics Coordinate.

NO	UNRWA Clinic	City	E_WGS48_Deg,Min,sec	N_WGS48_Deg,Min,sec
1	Deir al-Balah clinic	Deir al-Balah	34° 20'14.696" E	31° 25' 25.054" N
2	Nusseirat clinic	Nusseirat	34°23' 18.225" E	31° 26' 51" N
3	New camp clinic	Nusseirat	34° 23' 20.69" E	31° 27' 35.58" N
4	Bureij clinic	Bureij	34° 24' 17.271" E	31° 26' 18.852" N
5	Almaghazi clinic	Almaghazi	34° 23' 16.576" E	31° 25' 12.456" N

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- Private Clinic Coordinate

NO	Private Clinic	City	E_WGS48_Deg,Min,s	N_WGS48_Deg,Min,sec
1	Al Baraka	Deir al-Balah	34°19" 54.849' E	31° 24' 21.489" N
2	Fathi Arafat Center	Deir al-Balah	34°20" 35.558' E	31° 25' 21.063" N
3	Mohja Jerusalemr	Nusseirat	34°22" 28.348' E	31° 27' 9.885" N
4	Charity Medical	Nusseirat	34°23" 19.672' E	31° 27' 9.261" N
5	Palestinian medical	Nusseirat	34°23" 30.995' E	31° 26' 50.206" N
6	Panorama Center	Nusseirat	34°23" 25.334' E	31° 26' 59.734" N
7	Nuseirat specialist	Nusseirat	34°23" 23.144' E	31° 26' 54.938" N
8	Complex Razi	Nusseirat	34°23" 6.563' E	31° 26' 37.616" N
9	Complex Bisan	Bureij	34°24" 12.58' E	31° 26' 14.128" N
10	Complex Salah	Almaghazi	34°23" 6.203' E	31° 25' 11.539" N

## Annex 4

- Pharmacies Coordinate.

NO	The Name	City	E_WGS48_Deg,Min,s	N_WGS48_Deg,Min,sec
1	Farah Pharmacy	Deir al-Balah	34°20' 21.396" E	31° 25' 25.985" N
2	Al raad Pharmacy	Deir al-Balah	34°20' 25.022" E	31° 25' 24.779" N
3	alhlal Pharmacy	Deir al-Balah	34°20' 34.378" E	31° 25' 18.494" N
4	alkhalal Pharmacy	Deir al-Balah	34°20' 57.645" E	31° 25' 34.596" N
5	moaead Pharmacy	Deir al-Balah	34°20' 55.679" E	31° 25' 23.657" N
6	muslim Pharmacy	Deir al-Balah	34°20' 34.178" E	31° 25' 11.956" N
7	Yarmouk Pharmacy	Deir al-Balah	34°20' 51.009" E	31° 25' 7.238" N
8	Taher Pharmacy	Deir al-Balah	34°20' 51.052" E	31° 25' 2.514" N
9	Raghda 2000	Deir al-Balah	34°20' 51.773" E	31° 24' 58.975" N
10	albarai Pharmacy	Deir al-Balah	34°20' 47.119" E	31° 24' 59.682" N
11	Khalid bin Waleed	Deir al-Balah	34°20' 45.412" E	31° 24' 58.047" N
12	deana Pharmacy	Deir al-Balah	34°21' 3.617" E	31° 25' 4.242" N
13	Basher Pharmacy	Deir al-Balah	34°20' 47.35" E	31° 24' 34.437" N
14	D -B central	Deir al-Balah	34°20' 56.492" E	31° 25' 3.229" N
15	eman Pharmacy	Deir al-Balah	34°20' 57.26" E	31° 25' 3.808" N
16	Banias Pharmacy	Deir al-Balah	34°21' 0.6" E	31° 25' 4.759" N
17	balsam Pharmacy	Deir al-Balah	34°21' 0.027" E	31° 25' 2.079" N
18	alnor Pharmacy	Deir al-Balah	34°21' 5.171" E	31° 25' 0.314" N
19	alslam Pharmacy	Deir al-Balah	34°21' 2.326" E	31° 24' 59.196" N
20	alasma Pharmacy	Deir al-Balah	34°20' 59.84" E	31° 24' 57.031" N
21	Tal alrba Pharmacy	Deir al-Balah	34°20' 58.584" E	31° 24' 54.224" N
22	Freedom Pharmacy	Deir al-Balah	34°20' 58.319" E	31° 24' 51.324" N
23	Majid Pharmacy	Deir al-Balah	34°20' 58.339" E	31° 24' 49.225" N
24	Um Al-Qura Pharmacy	Zawaida	34°21' 34.193" E	31° 25' 22.02" N
25	Hamarneh Pharmacy	Zawaida	34°22' 34.302" E	31° 26' 7.17" N
26	Petra Pharmacy	Zawaida	34°22' 44.832" E	31° 26' 19.015" N
27	Eman new Pharmacy	Zawaida	34°22' 47.702" E	31° 26' 22.35" N
28	alshamal Pharmacy	Zawaida	34°22' 50.389" E	31° 26' 24.688" N
29	Yarmouk Pharmacy	Zawaida	34°22' 5.315" E	31° 25' 44.535" N

30	Zeina Pharmacy	Almaghazi	34°22' 49.229" E	31° 25' 24.878" N
31	mofed Pharmacy	Almaghazi	34°22' 52.617" E	31° 25' 20.736" N
32	Hassan Pharmacy	Almaghazi	34°22' 52.65" E	31° 25' 16.924" N
33	Jerusalem Pharmacy	Almaghazi	34°22' 56.74" E	31° 25' 18.41" N
34	aldode Pharmacy	Almaghazi	34°23' 3.639" E	31° 25' 19.341" N
35	Shaheen Pharmacy	Almaghazi	34°23' 0.331" E	31° 25' 14.451" N
36	Tilbani Pharmacy	Almaghazi	34°23' 2.465" E	31° 25' 12.824" N
37	Abdullah new	Almaghazi	34°23' 6.016" E	31° 25' 13.434" N
38	Ikhlas Pharmacy	Almaghazi	34°23' 11.548" E	31° 25' 14.29" N
39	Maher Phrmacy	Bureij	24' 12.425" E	31° 26' 7.105" N
40	Bisan Pharmacy	Bureij	34°24' 12.95" E	31° 26' 15.767" N
41	Mahmoud Pharmacy	Bureij	34°24' 11.304" E	31° 26' 18.592" N
42	Ameer Pharmacy	Bureij	34° 24' 7.379" E	31° 26' 20.577" N
43	Saftawi Pharmacy	Bureij	34° 24' 4.653" E	31° 26' 23.034" N
45	my pharmacy	Bureij	34° 24' 3.628" E	31° 26' 30.347" N
46	Maxi Care Pharmacy	Bureij	34° 24' 9.258" E	31° 26' 32.857" N
47	Alslama Central	Bureij	34° 24' 13.009" E	31° 26' 30.097" N
48	Ailia Pharmacy	Bureij	34° 24' 19.102" E	31° 26' 27.61" N
49	Yasmine Pharmacy	Bureij	34° 24' 12.262" E	31° 26' 26.02" N
50	alnda Pharmacy	Bureij	34° 24' 10.901" E	31° 26' 23.538" N
51	Yafa Pharmacy	Bureij	34° 24' 16.62" E	31° 26' 22.594" N
52	Flora Pharmacy	Bureij	34° 24' 23.937" E	31° 26' 17.435" N
53	Rafidah Pharmacy	Bureij	34° 24' 18.088" E	31° 26' 19.686" N
54	Balsam Pharmacy	Bureij	34°24'9.248" E	31° 26' 31.666" N
55	Samer Pharm	Nusseirat	34° 22' 31.814" E	31° 27' 12.434" N
56	Abu Srar Pharmacy	Nusseirat	34° 23' 8.839" E	31° 27' 6.953" N
57	Dr.Safe Pharmacy	Nusseirat	34° 23' 21.007" E	31° 27' 33.997" N
58	Mecca Pharmacy	Nusseirat	34° 23' 24.517" E	31° 27' 30.261" N
59	Aqsa Pharmacy	Nusseirat	34° 23' 28.879" E	31° 27' 33.011" N
60	Zaytoonah Pharmacy	Nusseirat	34° 23' 28.195" E	31° 27' 24.711" N
61	Osama new Pharmacy	Nusseirat	34° 23' 13.108" E	31° 27' 3.485" N
62	Majd Pharmacy	Nusseirat	34° 23' 18.728" E	31° 27' 0.669" N
63	Nuseirat new	Nusseirat	34° 23' 26.255" E	31° 27' 4.477" N



64	Carmel Pharmacy	Nusseirat	34° 23' 28.695" E	31° 27' 2.029" N
65	Central Pharmacy	Nusseirat	34° 23' 22.385" E	31° 26' 57.452" N
66	Farouk Pharmacy	Nusseirat	34° 23' 24.438" E	31° 26' 56.929" N
67	Nuseira Centrally	Nusseirat	34° 23' 25.432" E	31° 26' 54.776" N
68	Faisal Pharmacy	Nusseirat	34° 23' 28.425" E	31° 26' 51.66" N
69	Zohour Pharmacy	Nusseirat	34° 23' 31.575" E	31° 26' 49.207" N
70	Freedom Pharmacy	Nusseirat	34° 23' 26.856" E	31° 26' 55.029" N
71	SADA Pharmacy	Nusseirat	34° 23' 37.319" E	31° 26' 45.937" N
72	D safa new Ph	Nusseirat	34° 23' 38.966" E	31° 26' 43.122" N
73	Akka Pharmacy	Nusseirat	34° 23' 42.25" E	31° 26' 41.495" N
74	SHAFa Pharmacy	Nusseirat	34° 23' 21.308" E	31° 26' 53.979" N
75	Shohola Pharmacy	Nusseirat	34° 23' 20.21" E	31° 26' 51.635" N
76	Hamdan Pharmacy	Nusseirat	34° 23' 24.405" E	31° 26' 51.542" N
77	Jerusalem Pharmacy	Nusseirat	34° 23' 10.86" E	31° 26' 40.07" N
78	Al Wafa New Pha	Nusseirat	34° 23' 5.904" E	31° 26' 33.207" N
79	Razi Pharmacy	Nusseirat	34° 22' 57.419" E	31° 26' 28.419" N
80	Buraq Pharmacy	Nusseirat	34° 23' 36.044" E	31° 26' 54.433" N
81	Abeer Pharmacy	Nusseirat	34° 23' 3.401" E	31° 26' 31.57" N
82	Almsader Pharmacy	Almsader	34° 22' 20.02" E	31° 24' 57.08" N
83	Wada al-salqa Pharmacy	Wada al-salqa	34° 21' 39.982" E	31° 23' 21.264" N

## Annex 5

- Emergency Centers Coordinate.

NO	The Name	City	E_WGS48_Deg,Min,s	N_WGS48_Deg,Min,sec
1	Deir al-Balah	Deir al-Balah	20' 54.567" E34°	31° 24' 58.504" N
2	Bureij Emergency	Bureij	24' 13.364" E34°	31° 26' 28.965" N
3	Nusseirat Emergencyer	Nusseirat	23' 38.131" E34°	31° 26' 45.091" N
4	Central Emergencyr	Nusseirat	23' 16.9" E34°	31° 26' 8.863" N
5	Red	Deir al-Balah	20' 34.313" E34°	31° 25' 20.11" N

- Laboratories Coordinate.

NO	The Name	City	E_WGS48_Deg,Min,s	N_WGS48_Deg,Min,sec
1	Deir al-Balah Lab	Deir al-Balah	20' 54.822" E34°	31° 24' 58.625" N
2	new camp Lab	Nusseirat	23' 20.932" E34°	31° 27' 38.099" N
3	Alsoarhh Lab	Nusseirat	22' 4.341" E34°	31° 25' 59.166" N
4	Shhdaa Nuseirat Lab	Nusseirat	23' 7.042" E34°	31° 26' 21.337" N
5	Bureij Central Lab	Bureij	24' 13.438" E34°	31° 26' 29.147" N
7	Zawaida Laboratory	Zawaida	22' 4.771" E34°	31° 25' 43.347" N
8	Almsader Laboratory	Almsader	22' 20.305" E34°	31° 24' 56.45" N
9	Wada al salqa Lab	Wada al-salqa	21' 45.402" E34°	31° 23' 26.248" N
10	Hamad Medical Lab	Nusseirat	23' 23.738" E34°	31° 26' 56.576" N
11	Family Medical Lab	Nusseirat	23' 22.684" E34°	31° 26' 57.589" N
12	Balsam Laboratory	Nusseirat	23' 20.953" E34°	31° 26' 53.92" N
13	Ibn Sina Laboratory	Nusseirat	23' 21.187" E34°	31° 26' 53.093" N
14	Heimd advanced llab	Nusseirat	23' 21.422" E34°	31° 26' 52.934" N
15	Basma Laboratory	Nusseirat	23'25.516" E34°	31° 26' 52.535" N
16	Basam medical Lab	Nusseirat	23' 30.257" E34°	31° 26' 50.273" N
17	Nuseirat Central Lab	Nusseirat	23'36.433" E34°	31° 26' 46.588" N
18	Deir al-Balah cent lab	Deir al-Balah	20'53.663" E34°	31° 25' 3.224" N
19	Holyland medical Lab	Deir al-Balah	21'31.825" E34°	31° 25'12.524" N
20	Firas Medical Lab	Deir al-Balah	20'48.663" E34°	31° 24' 59.319" N
21	Aqsa Laboratory	Deir al-Balah	21'31.825" E34°	31° 25'12.524" N

22	Kandil Laboratory	Bureij	24'15.637" E34°	31° 26' 18.348" N
23	Diagnostic tests Lab	Bureij	24'9.559" E34°	31° 26'25.082" N