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Assessment of Jeddah City Public Health Facilities Readiness to Combat Epidemics

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Abstract: The research aims to review the spatial analysis of health services and their readiness to combat and confront epidemics. It also aims to analyze the relationship between population density and the efficiency of the spread of government health services in the city. In the study, data and statistics issued by the Health Affairs in Makkah Al-Mukarramah region were used, relying on digital maps from the Municipality of the region and reports of the Statistics Authority. Then the data was processed in the ArcGIS map creation and analysis program. The research consists of an introduction, a problem presentation, and a review of the study data on maps.

The results showed that the distribution of services extends north and south, and there is a dispersion in the distribution of health care centers and hospitals, most of which are located in the center. It became clear that more than 64% of the city is devoid of government health services at all levels, and it cannot meet the population's needs for health services. It must develop and find new locations for health centers and hospitals to compensate for the shortfall.

Keywords: Assessment - Epidemic Control - Health Facilities - Jeddah - Saudi Arabia.

تقييم جاهزية منشآت الصحة العامة بمدينة جدة لمكافحة الأوبئة

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المستخلص: يهدف البحث إلى مراجعة التحليل المكاني للخدمات الصحية ومدى استعدادها في مواجهتها ومكافحة الأوبئة. كما يهدف إلى تحليل العلاقة بين الكثافة السكانية وكفاءة انتشار الخدمات الصحية الحكومية في المدينة. تم في الدراسة استخدام البيانات والإحصاءات الصادرة عن الشؤون الصحية بمنطقة مكة المكرمة وبالاعتماد على الخرائط الرقمية من أمانة المنطقة وتقارير هيئة الإحصاء. حيث تمت معالجة البيانات وإنشاء الخرائط وتحليلها في برنامج ArcGIS

يتكون البحث من مقدمة وعرض للمشكلة ومراجعة لبيانات الدراسة على الخرائط.

وأظهرت النتائج أن توزيع الخدمات يمتد شمالا وجنوبا، وهناك تشتت في توزيع مراكز الرعاية الصحية والمستشفيات التي يتواجد معظمها في الوسط. أصبح من الواضح أن أكثر من 64٪ من المدينة خالية من الخدمات الصحية الحكومية على جميع المستويات، ولا يمكنها تلبية احتياجات السكان من الخدمات الصحية. وعليها تطوير وإيجاد مواقع جديدة للمراكز الصحية والمستشفيات لتعويض النقص.

الكلمات المفتاحية: تقييم – مكافحة الأوبئة – منشآت الصحة – مدينة جدة – السعودية.

1.0 Introduction

To combat a pandemic, cities mostly employ most of their capabilities trying to harness the number of infected cases. As seen in Saudi Arabia, officials dedicated whole hospitals and centers to treat Corona cases and control their numbers.

Health care system is provided and managed by the Ministry of Health (MOH) and is translated into a planned number of facilities distributed throughout each city. These facilities include Primary Health Care centers (PHC), Hospitals, and Tertiary Hospitals. Each facility is equipped and staffed to face the demand and provide sufficient services in compliance with MOH goals. These facilities provide health care to residents without cost.

Despite the existence of other health care providers besides the government such as private sector, this study will focus on MOH facilities as these facilities are within direct reach to the MOH and mostly don't require additional cost as they are already established and prepared.

Jeddah city is well established in terms of health services; however, it is not known precisely how prepared the city is to combat a pandemic such as COVID-19. This study investigates the geographical distribution of health services provided by MOH in the city of Jeddah and how it is coping with the increase in population based on MOH standards and its ability to respond to any epidemic disaster.

The use of GIS can help address all types of planning issues, but one of the essential methods for this type of assessment depends on defining the accessibility to health services, which will allow us to understand the ratio of population growth to the number of health centers provided.

It's very important to conduct such studies and diagnose the gap in healthcare for the confrontation of any future challenge; achieving universal health coverage will constitute progress in achieving other sustainable development goals, and it's a pillar of long-term economic development. No study has focused on assessing the readiness of Jeddah city to combat pandemics. Available studies mainly focused on assessing certain parts of health services, such as hospitals or PHCs, separately, like Murad (2004) and Almaliki et al. (2011). Furthermore, these studies did not account for the total health services situation. On the other hand, study like Jamalallail et al. (2012) was more comprehensive. However, it was conducted a decade prior to this study.

Conducting a comprehensive assessment study for health services is necessary to determine whether the city is ready to face pandemics. Many governmental hospitals may benefit from such a study when planning for future health facilities and allocating temporary hospitals to provide emergency health services when needed in cases of pandemics.

1.1 Research problem

Epidemics can put the most prominent health systems under stress as most of the population becomes at high risk, thus, requiring health care to be provided in an urgent manner. The COVID-19 pandemic has proven that people who live in overcrowded conditions without adequate prevention and

control measures are susceptible to disease, even in the world's wealthiest countries. The rapid and effective response to any pandemic is the practical key for any community and patients must be met instantly, as a rapid response can significantly impact the number of people who become sick and die of the disease. In December 2019, the whole world was abrupt by the COVID-19 pandemic;

Jeddah being the second largest city in Saudi Arabia is well- prepared and staffed in terms of healthcare. many publics in private facilities provide health services to the population throughout the year. But is the city prepared to combat pandemic and provide the required health service to its population or does it need additional resources.

The main concern in this research is the ability of MOH to provide complete health care services by following the applicable local and international standards considering the human aspect of all patients equally at any time and in any case, especially in times like crisis and emergency, regardless of the number of patients in need of service. In most emergency cases, the most significant burden and responsibility fall on hospitals, whether specialized or general, because they are concerned with providing universal health care and the presence of special equipment for the care of patients with particular circumstances. The design of hospitals is based on international standards applicable worldwide in terms of the locations of the buildings and the number of different departments such as outpatient clinics, radiology departments, laboratories, pharmacies... etc. There is indeed a difference in terms of capacity and equipment for each country according to the strength of its economy and the number of its population. However, some fundamentals cannot be dispensed in order to call it a hospital.

1.2 Objectives

As Jeddah is the second largest city in KSA and area of study,

We are going:

- To assess and examine comprehensively the geographical distribution of health resources such as (Primary Health Centers, General Hospitals, and specialist Hospitals) provided in Jeddah and focus on their capacity to serve the population during pandemics.
- As per findings, propose temporary field hospitals that can serve covid19 cases on-site before they can be safely transported to more permanent facilities.

1.3 Study area

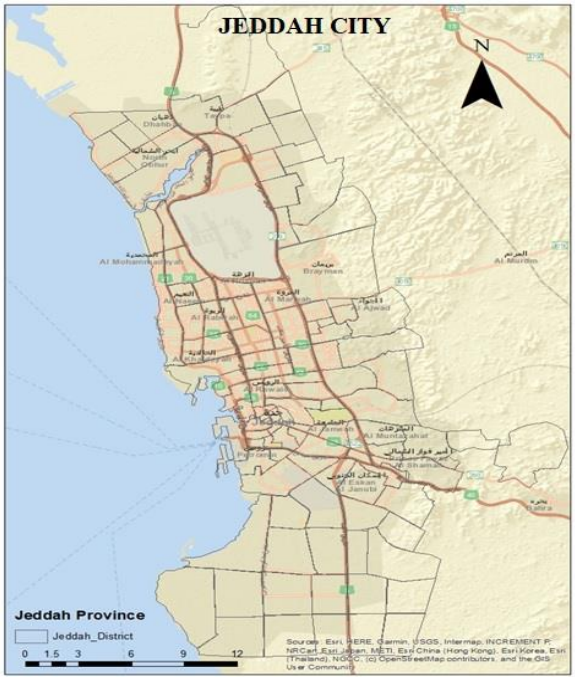
Jeddah is a Saudi city, located in the Makkah region in the west of the Kingdom of Saudi Arabia. it is the largest city overlooking the red Sea and second largest city in the country, it is distinguished by its geographical location as it is the gateway to the two holly mosques. It is the first station where pilgrims from all over the world land on their way to Makkah city, through its international airport and seaport.

Jeddah with its strategic location on the Red Sea coast has made it of great importance to the Kingdom's international trade movement with foreign markets. Jeddah is a major commercial center

characterized by constant movement, as it has developed greatly in all commercial and service fields, and had a major industrial renaissance, which made it one of the most attractive cities in the world for business, and it has become an important center for business and finance. Jeddah is an

economic and one of the most attractive tourist cities, with its distinguished popular and modern high-end shopping malls and markets destinations, and its tourist and recreational facilities and facilities spread in all areas of the city, which are frequented by coast, and a total area of 74,762 square kilometers, while the urban area is more than 63,847 square kilometers.

With a population of 4,697,000 people as of 2021, Jeddah is the second-largest city in the Kingdom of Saudi Arabia after the capital, Riyadh, and it is the largest city in the Makkah region with a total area of 748 square kilometers, holds the largest seaport on the Red Sea. visitors from all cities of the Kingdom and from abroad. Jeddah extends to the north and south with a length of 58 kilometers over the western



Figure, 1 Jeddah city over view

2.0 Methodology

This research was based on the study of public health facilities from march 2019 to march 2020, a whole year from the appearance of COVID 19.

The plan is based on three main phases and follows the method of the analytical approach, the most important of these phases:

- Data will be collected from Jeddah Health Affairs about; the current number of public health facilities including Hospitals and Primary Clinics (PHCs) that can serve the population and during pandemics.
- Using geographic information systems, maps will be designed that includes health facilities locations and identify their distribution.

- Questions of the study will be addressed using GIS capabilities. First, the distribution of the health services will be explored. Second, will be the sufficiency of the health services in extreme cases, like pandemics, be adequate.

2.2 Spatial statistics methods:

All the previous steps will be conducted using the following spatial statistics methods:

- Nearest Neighbor Method: this method was used to determine the closest facility for each district.
- Mean Center: this method was used to determine how far the mean center of the city to the mean center of both hospitals and PHCs.
- Standard distance: this method was used to determine if the Hospitals and PHCs are focused or spread.
- Directional distribution: this method was used to determine the trend of the distribution of both Hospitals and PHCs.
- Euclidean Density: this method was used to determine the distance to the closest health facility from any point in the city.
- Buffer model: this method was used to determine the actual catchment areas of each facility.
- Average Nearest Neighbor: this method was used to assess the distribution of both hospitals and PHCs.

2.3 Data Elements and Description:

The data used in this study is divided into three categories.

1- population data: include each district's population and the census data for Jeddah City. This data section has been collected from the Central Department of Statistics and Information.

2- health resources data: Health resources data consist of health facilities (including public hospitals and primary clinics) and health professionals (number of doctors and nurses' number per patient) provided to the populations of Jeddah city. (data has been Statistics Department and Information Center in the Ministry of Health at MOH)

3- geographical data. Geographical data of Jeddah city boundaries overall and for each district specific also the census tracts obtained from Jeddah Municipality as base maps. The census tract boundaries will be used to analyze the resources on a detailed geographical level. As explained earlier, this section of the data has been obtained from the GIS center at Jeddah Municipality.

According to Jeddah Municipality data, the city is subdivided into 119 districts; the population density varies from one district to another. Looking at Figure [3], the most significant number of resident's population is in the middle part of the city. For historical and economic reasons, we will not discuss them due to they are beyond the scope of this study, but the idea is that the highest proportion of people is concentrated in the middle.

4.0 Analysis and Discussion

4.1 Health staff:

We need to evaluate to the current health services provided in Jeddah. It is not sufficient to say that we have 11 MOH hospitals and five Other Government Sectors to serve people it has become necessary to add the spatial dimension to all these entities in the Geodatabase to evaluate the current situation and identify future needs. In distributing services, governments depend on many criteria that help determine the need for these services. Organizations are usually eager to implement them for the highest quality. We will not address them here in this study, but It is a fact that the service provided by the ministry of health depends on its human resources. Murad (2014), with the few data that we were able to obtain, which represented the total number of doctors and nurses serving in Jeddah, the number of health staff working under the Ministry of Health has significant limitations as we mentioned previously.

The shortage in the workforce is noted by extrapolating service rates and comparing them with other countries. (Saudi Health Council, 2017). The rate of doctors serving in hospitals to population is 1.06 per thousand, while the average rate for the countries under comparison is 2.3, and the rate of nursing services to the population is 1.84 per thousand, while the average rate stander is 6.5

The criterion of a doctor to population is one of the criteria adopted in evaluating health services and their workers. The World Health Organization has set a standard of one doctor for every (500) people (WHO 2020). In a report issued by the Jeddah Chamber of Commerce targeting health care sector in the Kingdom published in 2015, it was stated that manpower shortage: If the current trend continues as it is, there will be a manpower shortage of up to 109,000 doctors and 48,000 nurses by 2020. (JCCI) These figures are for the total combined of all public hospitals; it's clear there is a discrepancy in the number, which constitutes a precise pressure on the number of doctors and nurses. This rate puts pressure on them in a normal situation; let's imagine if an epidemic swept the city, the situation might have been worse, and the public health system might collapse.

With total of 52 hospitals in Jeddah, the share of government hospitals affiliated with the Ministry of Health and other government sectors is only 13, with an average of 25%. This percentage is considered low compared to a city of 74,762 square kilometers, and urban area is more than 63,847 square kilometers with a population of over 3.9. It is the second largest city in Saudi Arabia after the capital, Riyadh, and the largest city in the Makkah region, these number 13 hospitals need to be reevaluated, taking into consideration the increase in population density.

4.2 Hospitals and beds current situation:

In 2020, PhuaJ found in research that the bed capacity across Asia varies widely depending on the country's income. PhuaJ, et al. (2020) Critical Care Medicine:

Saudi Arabia MOH standard, that every hospital should have a service area of 4 to 8 km depending on its bed size. Small hospitals with a 50-bed size serve a 4 km area. Medium (100 bed) and large (400+ bed) hospitals serve 6 and 8 km area respectively. (MOH)

There are 13 hospitals with total of 3091 beds, some of these hospitals falls outside Jeddah city for instance Rabigh and Al-Leith general hospital, but is considered as one of MOH hospitals that fall under Jeddah city because it's a major city. in fact, only 5 hospitals related to MOH where CBAHI (Saudi central board for accreditation of healthcare institutions) certified. this organization evaluation the upgrade professional and administrative systems, nursing and doctor's quality services, operation, ER, sterilization and x-rays rooms.... etc. and plenty of other quality standards.

In all 287 hospitals in the Kingdom that are affiliated with the Ministry of Health, the total number of beds is 45180; Jeddah has a share of this number is 3091, which is an average of 6.8%, even though Jeddah is the second largest city in the Kingdom.

An annual report issued by the Ministry of Health, mentioned that the number of beds currently available is less than the rate standard, represent the current situation in the regen of Makkah, since Jeddah we want to give a simplified picture to clarify the depth of the problem and to make it clear that the problem is not related to the city of Jeddah but that the region, in general, needs to evaluate and reconsider the distribution of health facilities. The table shows the hospitals and beds per 100,000 population by sector and region. We will focus on the total. We note that the number of beds equals 181.61 beds per 100,000 patients. This issue is due to the acceleration of the high population growth rate, which reached 1.7%, the increase in the average life expectancy, and the high rate of internal migration, where the population growth reached 4.5%

Number of beds Measuring carrying capacity.

Measuring a hospital's clinical capacity is an essential criterion that measures the city's ability to respond to any pandemic or epidemic. It is considered the ideal environment for care through continuous follow-up and care for the necessary medical devices.

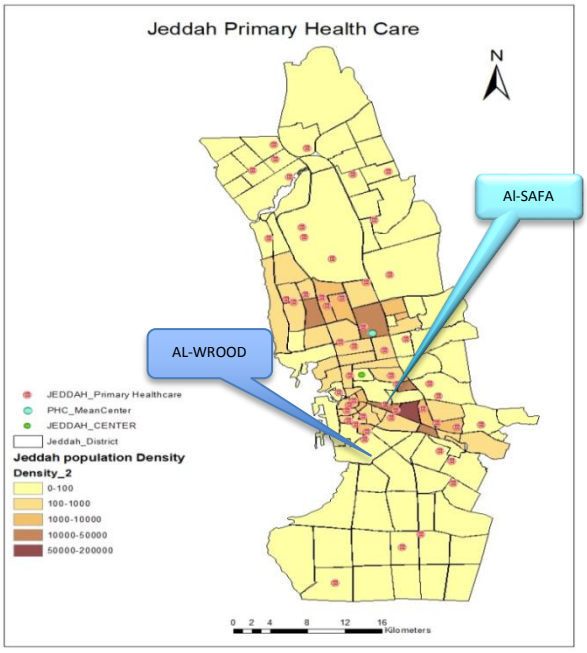
5.0 GIS for examining and analyzing current health states:

5.1 The mean center

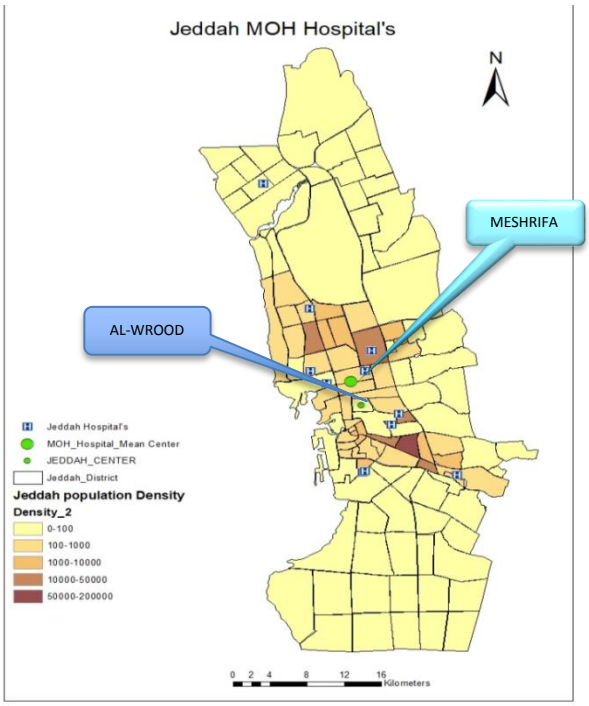
The Mean Center is the location that represents the central position between the points so that the sum of the points around it

is less than any other location on the map that appears in Figure [6&7]. In other words, it represents the mean center (location) of all hospitals and PHCs. Figure [6], depicts the mean center for both the districts and the PHCs. As appears on the map, the mean center for districts is located in Al-Wrood district, while the mean center for PHCs is located in AL-Safa district. This means they are 7.6 Km apart. This means that the distribution of the PHCs is not optimal. Most primary health care centers fall within the middle of Jeddah city. it appears that 56% of the city districts are considered deprived and not covered

by PHC services. Also, we can see from the map that almost all PHCs do not fall in the center of the community, meaning that residents in that neighborhood need more time to reach those dispensaries. Figure [7] depicts the mean center for the districts and Hospitals. The map shows that the mean center for districts is located in the Al-Wrood district, while the mean center for hospitals is in the Meshrifa district; they are 2.5Km apart, which means that the distribution of hospitals could be more optimal. Looking at the mean center of hospital distribution, we notice that 45% of the hospitals are located in the middle of the city. Figure [6&7], Determining the actual centering point of Jeddah, it is located in the middle, approximately in (the AL-Wrood district).



Figure, 6 PHC with mean center of Jeddah

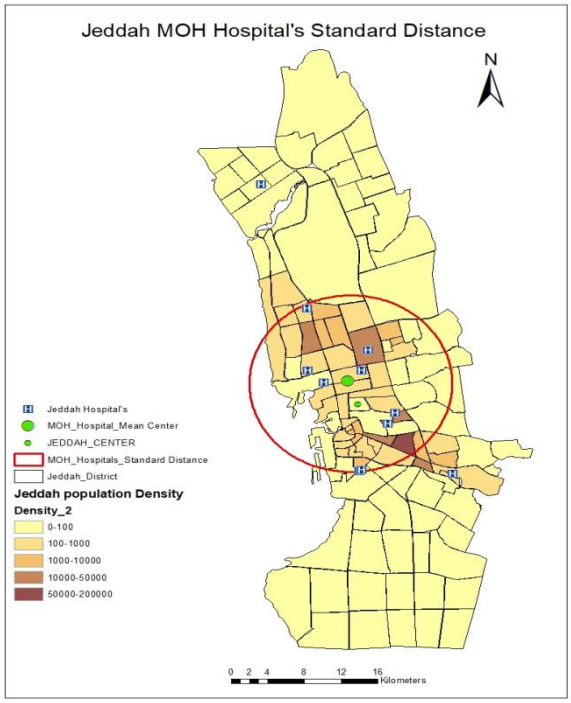


Figure, 7 hospitals with mean center of Jeddah

5.1 Standard Distance

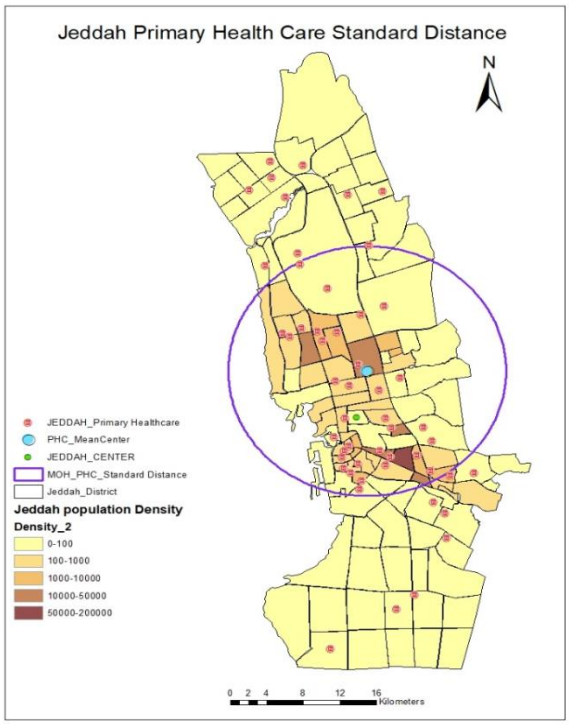
The standard distance is a useful statistic as it provides a single summary measure of feature distribution around their center (Esri). Standard distance values are used to draw a circle called the standard circle. It shows the extent of focus or spread of the spatial dimension of the phenomenon. The center of this circle is the location of the middle center Figure [8&9], A larger circle indicates an increase in phenomena' spatial distribution and dispersion and vice versa. As it appears on maps [5] and [6], the middle center of this measure is located in the Al-Worood district. Hospitals are located within a circle diameter of 22 km, and health care centers are within 30.5 km. We can observe that 67% of the city districts are under-served by MOH. Moreover, most of the primary healthcare centers and hospitals are concentrated in the middle. This might be due to the high density in that area. Looking at Figures [8&9], we find a difference in the size between hospitals and health centers in the Standard Distance. The radius for healthcare centers is 15 km, while for the hospitals is 11 km. This is because the number of health centers in Jeddah is 52, while the number of hospitals is only 10, and most hospitals are located in the middle area of the city. The area of study contains 119 districts; if we consider the standard of MOH of any PHC center, that it needs to cover from 2~4 km (Majdi et al. 2014.), then we need to have a PHC in each district because the average distance in a straight line between a district center and another in all districts.

is 2.5km, not considering the blocks restriction for people to walk and roads congestion and other restricts. Each neighborhood is supposed to have a health care center serving it.



Figure, 8 Standard Distance Hospitals in Jeddah

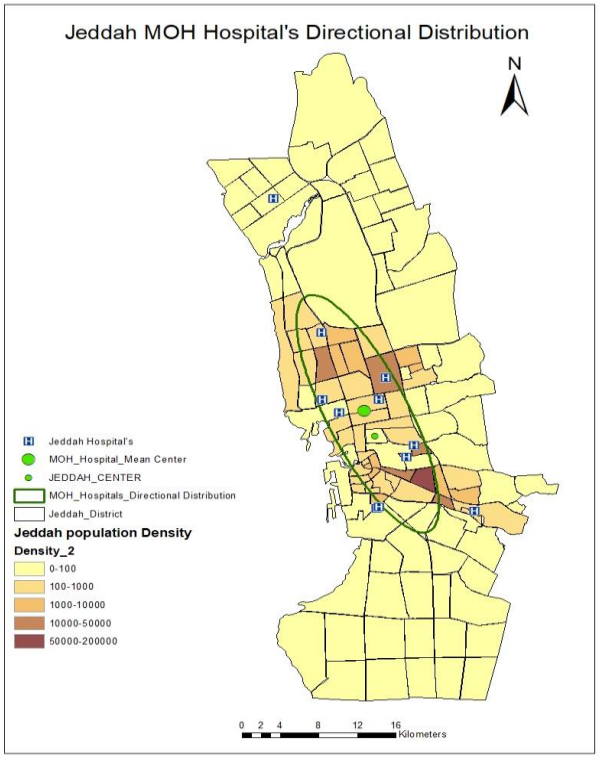
Jeddah



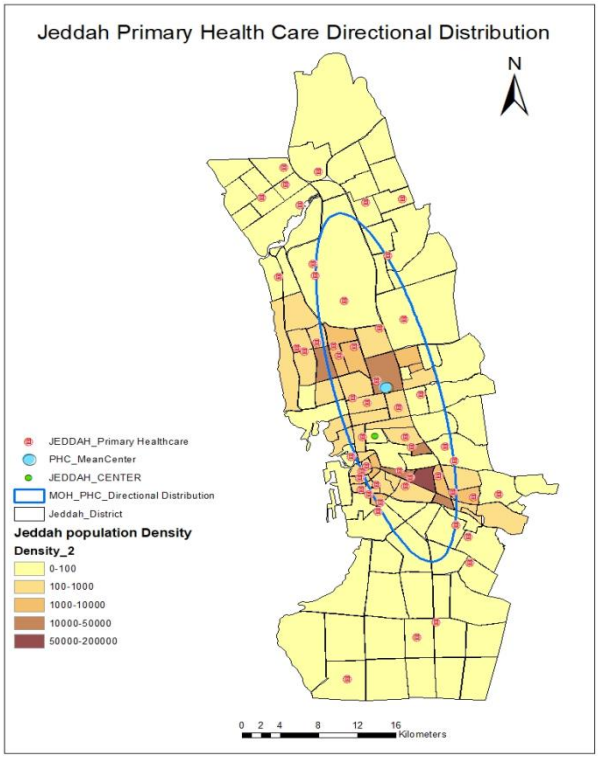
Figure, 9 Standard Distance of PHC Jeddah

5.2 Directional Distribution

A directional distribution is a common way of measuring direction for a group of points or areas; it Calculates the standard distance separately, plots a center-centered elliptical polygon for all features. that expresses the characteristics of a directional distribution, and the more extensive axis measures the value of the direction taken by the phenomenon., we can see the direction of the distribution takes the north-to-south direction. This is compliant with the high population density. The facilities of hospital's that are most in high demand in their spatial relationship are located within the circle of the standard ellipse sector, Figure [10], which are characterized by close average distances between them and are ideal in their distribution, and their percentage is 63%. For the rest of the facilities located outside the circle, they are far from the centrality of the distribution, and they do not achieve their function perfectly; Which requires redistribution in a way that ensures a balanced spatial distribution that considers the density of the population and the area of the city. As for the PHC, which are located within the circle, Figure [11], they are ideal for the people living in that space where 55% percent of the PHC distribution falls. For the rest, we can say that the distribution is random and does not achieve the principle of equality in distribution, as it is noted that many neighborhoods do not have a health center that meets their needs.



Figure,10 the Directional Distribution of Hospitals Jeddah Jeddah

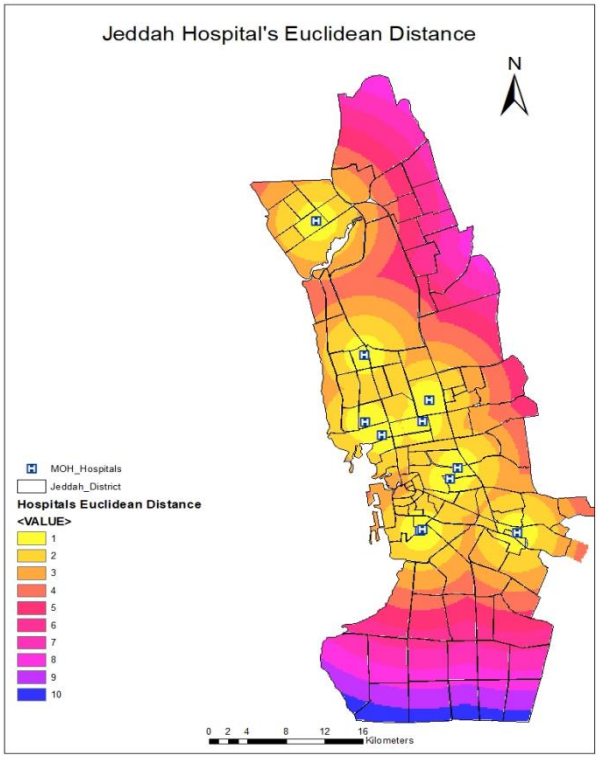


Figure,11 the Directional Distribution PHC Jeddah

5.3 Health coverage by the Euclidean Distance

Euclidean Density contains the measured distance from every cell to the nearest source. (Esri). The health coverage domain estimates the density within the range coverage areas. To determine the coverage

area, we used the Euclidean Density model as in Figures [12], this analysis tool can indicate the distances from a specific point and spread to cover the whole target area or whole study area creating color space waves. The closer the number is to one, the better opportunity hospital can provide its service and vice versa; every time the number gets more significant lease people are capable of reaching that hospital. Most of the MOH hospital falls in the center of Jeddah. There is great pressure on King Abdullah hospital since it's the only hospital in the north, more than 11 districts are served by this hospital, most of them are with reachable range but with an area of more than 147 thousand persons living in these neighborhoods, there is an only one hospital with a capacity of 500 beds. This will load the hospital in cases such as Epidemics, where there are supposed to be 1.6 beds to 1,000 patients as a stander. building at least one more hospital must be considered. As for the south side, we can say it's a deprived area and people need more time to reach the nearest hospital. The same thing goes for OGH, its coverage area is limited, and most of the beneficiaries go to the residents located in the middle of the city. It appears that the neighborhoods such as; ALSalhiyah, ALFalah, ALBashaer...etc.



Figure, 12 Euclidean Density model for MOH and OGH hospitals in Jeddah

In fact, all districts falling east, residents in this area lack a hospital that can meet the population's needs. Add to the distance they need to cut to the nearest service provider; traffic has become their biggest obstacle. Even the 10min nearby hospital will not be able to reach within this standard traveling time; they need an hour or more, especially at peak. South of Jeddah suffers from deprivation, considering the massive number of people living in the area as there is no hospital. The southern region is not much different from eastern Jeddah, as it also lacks the presence of a hospital serving the people of the region.

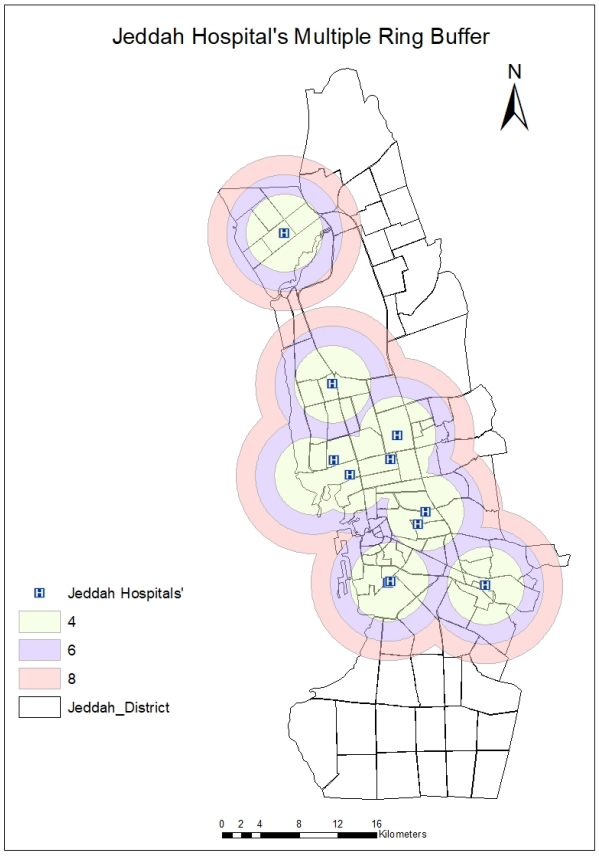
However, a glimmer of hope can play a semi-positive role, which is the poor traffic there, as the population density in the south is less than in the east.

5.4 Service Ranges

The Saudi Arabia MOH standards for the hospital service area are from 4 to 8 km (Murad, 2004) depending on the number of beds of each hospital. since hospitals in Jeddah are randomized, we used the Multi Buffer tool, by creating a buffer of three layers with 4, 6, and 8 kilometers to define the number of people that are covered within that buffers.

Multi Buffers is one of ArcGIS Successful analysis tools; it can describe the area clearly by creating a multi buffer around the object Figures [13], show the number of people within the buffer zone that can be served depending on the criteria we put in. A total of 1,390,219 residents was contained within the zone, most of them live in middle of the city in district such as Al-Ruwais, Al-Sharafiya, Al-Naseem, Al-Wrood. In the other hand, most of the south districts such as, Al-Ajaweed, Al-Sanabil, Al-Hada, Al-Wadi this district and all the nearby districts might be considered deprived; no hospital serves them, neither MOH nor the privet sector.

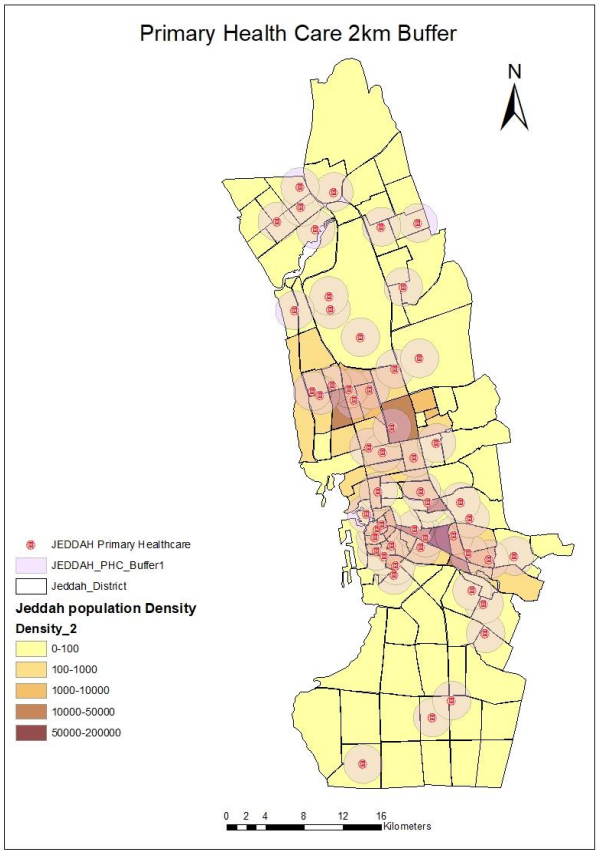
Only 40% of the total population in Jeddah can reach hospitals within its buffer, the rest of the residents need more time to travel to the nearest hospital.



Figure, 13 Service Ranges model for MOH and OGH hospitals in Jedda Jeddah

5.5 Single Buffer Model

Primary health care centers are considered the first gateway to provide health care. The patient is diagnosed and given the necessary treatment or directed to the nearest hospital if it requires more consultation. One of the essential pieces of information for this study was to review the delineation of healthcare centers' boundaries distributed in several parts of Jeddah city. It took the form of points inside each district. To show the spatial extent of its health facility, we created a 2km buffer around each PHC according to the MOH standard, each PHC center must cover 2km range and must be reached with in 5min. By examining Figure [14], we can see an imbalanced spatial distribution of healthcare centers in the city. Clear that healthcare centers are concentrated in high population areas, which is most are in the center of Jeddah; while some places like in the east and south are less covered. It is expected that the MOH targeting to serve most district with high number of populations, but people living in district with low population or unserved by MOH will suffer from deprivation of primary healthcare services. they will be forced to use one of the nearby neighborhood's available services, and this requires more traveling time and long distances and perhaps incur extra financial expenses, this will definitely affect the service provided in those areas due to the high number of patients, because each health center is designed in a way to accommodate a certain number of patients.



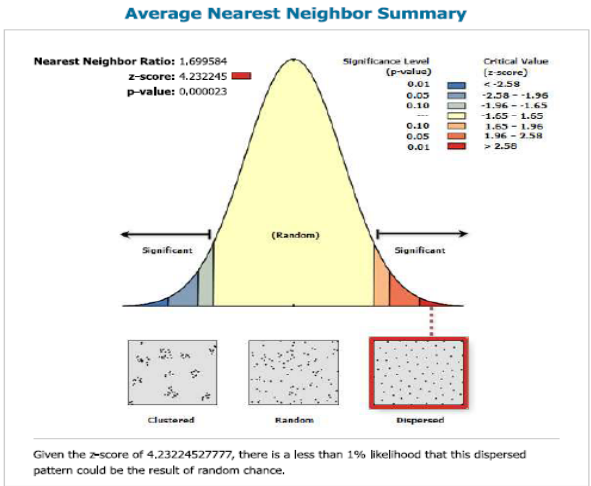
Figure, 14 a 2km buffer around the PHC in Jedda

5.6 Average Nearest Neighbor

Another useful analysis method is the Average Nearest Neighbor, this tool can measure the distances from one point to another of any distributed numbers and gives a hypothetical random distribution figure.

If it's less than the given average, then the distribution of the features is considered clustered, and If the standard is more excellent, then the distance features are dispersed. Actual, observed average distance divided based on a hypothetical random distribution with the same number of features covering the same total area. By revealing the spatial distribution pattern for the Ministry Health Hospitals, it was found that the distribution pattern of the hospitals is a dispersed pattern. Figure [15], Where the value of the actual average distance (Observed Mean Distance) was (5470m), which is higher than the value of the expected mean distance (3218m), which resulted in the registration of the nearest neighbor to a value of (1.69), and this pattern indicates a dispersion of hospitals in the study area.

Were the hypothesis of a normal distribution (z-score), as the value reached (4.2) and that this value confirms that the distribution pattern is abnormal. The same goes for PHC, it was found that the distribution pattern is random. Figure [16], Where the value of the (Observed Mean Distance) was (2221m), which is lower than the value of the expected mean distance (2331m), which resulted in the registration of the nearest neighbor to a value of (0.95), and this pattern indicates the dispersion of PHC In the study area, and the hypothesis of a normal distribution (z-score), as the value of z reached (-0.65) the pattern is not significantly different than random. to load these dispensaries or will have to go for the private sector.



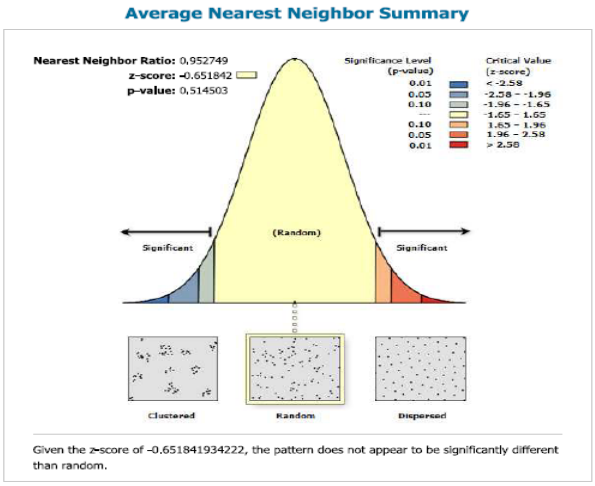
Average Nearest Neighbor Summary

Observed Mean Distance:	5470.0374 Meters
Expected Mean Distance:	3218.4564 Meters
Nearest Neighbor Ratio:	1.699584
z-score:	4.232245
p-value:	0.000023

Dataset Information

Input Feature Class:	Jeddah_Hospitals_Project
Distance Method:	EUCLIDEAN
Study Area:	414338464.402909
Selection Set:	False

Figure, 15 Average Nearest Neighbor distribution of MOH Hospitals



Average Nearest Neighbor Summary

Observed Mean Distance:	2221.3963 Meters
Expected Mean Distance:	2331.5647 Meters
Nearest Neighbor Ratio:	0.952749
z-score:	-0.651842
p-value:	0.514503

Dataset Information

Input Feature Class:	JEDDAH_PHC_Project
Distance Method:	EUCLIDEAN
Study Area:	1130728386.625187
Selection Set:	False

Figure, 16 Average Nearest Neighbor distribution of PHC distribution for PHC

6.0 Conclusion and Recommendation

6.1 Analysis and discussion:

The primary purpose of addressing the research is not limited to Saudi Arabia; it is a worldwide concern. We referred to the city of Jeddah as one of the largest cities in the Kingdom. We considered the importance of its geographical location because it is the main gateway for the influx of many pilgrims and one of the cities of tourist attractions. Access to health services and facilitating for all populations and social groups in a manner that satisfies them often collides with obstacles arising from how services are distributed or the order of priorities. (MOH 2017).

The health sector in Jeddah needs to be reassessed and developed; the reality is that Health services in Jeddah do not meet the population density and the high demand for healthcare. This research was conducted to assess the current status of health services provided based on the available data. The presence of data in such studies is essential. When distributing a particular geographical phenomenon, the distribution should be ideal, tending to be as regular and identical as possible and proportional to reality. If we, for example, divide the number of healthcare centers by the number of districts, the result should be approximately zero or equal to one standard deviation. According to the available data of PHC, an imbalance in the distribution of 43% of the city's neighborhoods can be considered as lacking a health service. Sixty-seven areas lack a healthcare center served by the Ministry of Health. Districts in east Jeddah, such as Al-Falah and Al-Kawthar, and in the north, such as Lulu and Al-Amwaje.

Moreover, in the south, districts such as Al-Hada, Al-Sanabel, and Al-Kharma do not have health centers; these are only examples from 67 districts. Residents in these districts suffer from long drive distances to reach the nearest PHC, negatively affecting these centers with many patients and visitors, leading to pressure on this sector. In the end, the service provided may be outside the standards applied by the Ministry of Health. The number of beds is a measurement method to define preparedness to encounter a pandemic. In the research, it was clear that there is a shortage of hospital beds in terms of number and that it needs to meet the city's demand by following the international standard or the standard set by the Ministry of Health. At the same point, the Ministry of Health mentioned in its annual report that the number of beds currently available is less than the rate approved by the Ministry, and this is due to the acceleration of the high population growth rate, which reached 1.7%, and the increase in the average life expectancy, and the high rate of internal migration, where the population growth reached 4, 5%

Moreover, the workforce is also considered an essential measuring element. In a report issued by the Jeddah Chamber of Commerce published in 2015 targeting the healthcare sector in the Kingdom clearly stated that; the number of health workers is less than the standard, and if the current trend continues as it is, there will be a shortage in cadre employees by 109,000' doctors and 48,000 nurses by 2020. (JCCI. 2015) Waiting for crises to deal with them is no longer acceptable. Instead, it is imperative to renew in various fields and work to formulate and implement a coherent, integrated, and long-term strategy to advance health care and put comprehensive "health security" right at the heart of our national priorities. The poor quality of care contributes to the burden of disease and health needs.

This has a significant impact, with high costs to systems and unsatisfied societies; It also has an economic impact on health worldwide. Referring to a problem does not necessarily mean that we are deficient; it might be an indicator to clarify the standard of our progress. High-income countries use about 15% of their hospital expenditures in addressing preventable complications. (WHO). The Kingdom of Saudi Arabia is one of the first countries that sought to maintain the sustainability of health care to enrich the lives of the population. Many plans implemented during the pandemic prove the Kingdom's keenness on this. According to the famous saying, we need many tools to work together in parallel to develop any system globally.

Forming a specialized public health team and enrolling the help of all health staff from medical, nursing, and pharmacy students to assess and follow up on confirmed and relevant cases in different regions, determine the causes of infection, link cases to each other, and monitor laboratory results daily. Moreover, to inform the concerned authorities to ensure comprehensive and integrated health care for the entire population. Finally, the health system in the Kingdom is still under development, and this was recognized by the Ministry of Health officially recognizes it in its annual report issued in 2020. The world has become one village. With urbanization and population increase, diseases have spread, and with the progress in science and technology, many diseases have appeared to us. I advise that government

institutions cooperate with their universities in financial, economic, and social aspects. All aspects must work together and pay attention to one aspect. Indeed, building hospitals and health centers are impossible just to be prepared in the event of any pandemic. However, it is necessary to have the basics on which health care is based and to develop plans and scenarios for how to recover in the event of an epidemic.

6.2 Conclusions:

Through this study, the reality of the current health services in Jeddah city draws the following conclusions:

- The study confirmed that there is no match between the actual distribution of health centers in the city and its expected theoretical distribution, where the number of PHCs in Jeddah reached 53, compared to 119 residential neighborhoods.
- The study showed tremendous pressure on the services provided by the hospital that falls in the city center because of the high population density, which negatively affects the efficiency of the service provided.
- The study indicates a discrepancy in the spatial distribution pattern of PHC in the Jeddah district, where most of the convergence is held in the older district at the center. The same applies to hospitals in these districts. And its affinity less in suburban.
- The study concluded that PHC did not serve districts north and south of the city.
- In terms of per capita, the study showed a negative relationship between population density and the number of health workers at a rate1.06

6.3 Recommendations:

Redistribution of PHC within the city equally to available in each district.

- Increasing the number of hospitals by no less than five, distributed over the north and south of the city.
- Studying urban development trends and population growth rates in order to choose Best for new hospitals places.
- The study recommends building a comprehensive details database of PHC and Hospitals.
- Using modern technologies represented in geographic information systems and remote sensing in determining the appropriate locations for primary health care centers in the city of Jeddah
- Establishing at least one new hospital is necessary to specialize in servicing maternity and pediatrics since the population is high and there is only one. Also, to have a specialized hospital in emergencies such as catastrophes, fire, and chemical treatment.

6.4 Limitations:

- The difficulty in obtaining detailed data was due to the complex routine processes, which could have produced the work more interactively and accurately.
- This study's census data (populations) was published in 2010. Unfortunately, the following detailed census for Jeddah was unavailable during the study due to COVID-19. The continuing population growth is considered a limitation of our study.

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