Spatial Analysis of Health Centers in the Governorate of Amman, Jordan

Mahmoud Abdullah Al-Habees*[1]

Abstract

Objective: This study aimed at shedding light on the health centers in the Health Directorate of Amman, Jordan. That is, it explained the spatial analysis of the primary health centers in order to show the quantitative and qualitative spatial distribution of the existing health centers in the study area, analyze the spatial variation of the characteristics of the health centers, and introduce some recommendations allowing decision makers to make the optimal use of these health centers.

Methods: This study adopted the inductive approach for the special and statistical properties of health services. The community consisted of all official health centers in the Health Directorate of Amman. There are 58 health centers that are comprehensive, primary, or secondary. The study used the appropriate statistical equations and methods appropriate to answer its specific questions.

Results: The study concluded that there is a lack of medically qualified and specialized staff in the majority of health centers, and there is a considerable variation in the pattern of distribution of health centers in general. That is, the spatial distribution is concentrated to some urban areas. Besides that, the concentration ratio of health services indicates that the concentration ratio of the recipients of health services is not balanced with the concentration ratio of doctors.

Keywords: Spatial analysis of health centers, the capital city.

Introduction

Investigating health services is of importance in civilized societies and developed countries since it assesses the government programs to achieve the social and economic goals. It is significant and of particular interest in the policies of developing countries since it is a developing and planning tool for the advancement of both individuals and communities. Thus, the process of providing developed health services for those in need becomes a primary responsibility of governments, which should provide them to their citizens.[1]

Some attempts have been carried out to define public health, including, within its recent framework, Winslow's definition which states that public health practice is the

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science of disease prevention and health promotion through the organized efforts of the community to ensure a healthy environment, the prevention of disease, the organization of medical and nursing services, and the development of social conditions.[2] Another definition can be set for the public health, in which it includes the protection and sanitation of the environment in addition to the treatment of water and pollutants that threaten human life.[3] Therefore, certain measures should be developed for disease prevention and the risk of injury to improve public health. As defined by some,[4,5] public health is the need for health, being deprived of disorder in human health and life, which requires medical attention. The World Health Organization defines health as a state of physical, mental, and social adequacy, not merely the inability or absence of disease. From a different perspective, public health provides health insurance to the community to ensure reducing the rates of disease and death tolls, sustaining the community, improving efficiency, and providing people with the best quantity and quality of the service through health institutions. In addition, it is also a basic demand for human needs that must properly be met in a way which is consistent with health planning due to specific planning standards to ensure the health of a community.[6]

Investigating health services is considered an important study in the geography of services because it touches an important side in the research concerning spatial and urban areas and because it is related to the health of the individual and society and represents one of the criteria of measuring the progress of the state in providing health care services.[7] Health services are provided in three ways: (1) the treatment services which are provided to the patient in health institutions in which patients' diseases are diagnosed and which provide extra laboratory testing needed

because of unclear symptoms of the disease to determine the appropriate treatment, (2) the preventive services presented by taking necessary precautions to fight diseases, and (3) the rehabilitation services associated with natural or rehabilitative treatment.[8]

The Problem

The study problem is summarized in answering the following questions:

1. Do the health centers cover all the communities in the study area?
2. What is the nature of the spatial variation of the health centers?
3. What is the pattern of the spatial distribution of health centers in the study area?

The Significance

The study is significant since it highlights the importance of the Amman Governorate, which is the largest governorate in terms of population in addition to the existence of the spatial diversity, where the urban and rural areas of the city of Amman are. Certainly, such a spatial diversity is accompanied by a variation in the level of services performed by health facilities in hospitals and health centers. In addition, this study is of importance because of the paucity of the planning studies of the health services in Amman.

Methods

The study was based on the inductive or deductive approach to the spatial and statistical properties of health services, along with the application of some equations and statistical methods to highlight different correlations.

Study Community

The study community consisted of all of the official health centers in the Amman Governorate, which exceeded 58 health centers and in which the number of doctors was 439 in 2009.[9,10]

Statistical Methods

The study used the analytical descriptive statistical method and used the following equations:

Equation 1: Pearson's correlation coefficient was calculated to measure the relationship between population size and the number of health staff in the study area by applying the following equation:

N mg X Y _ (mg X) (mg Y)
R= [(N mgX2) + (mg X2)] *[(N mgY2) + (mg Y2)]

where R = Pearson's correlation coefficient
N= number of health centers in Amman Governorate
X= number of recipients of health services in each health center
Y= the number of medical staff in each health center.

Equation 2: This is the equation of change percentage which is: $G = \dfrac{p1 - p0}{p0} *100$
where G = the change percentage during the period for which the spatial variation will be measured
P0 = the number in the previous year (1999)
P1= the number in the following statistical year (2009)

Equation 3: This is the concentration percentage (for more details, look at Ahmed Al-Jarallah, 1997, p. 13, quoted by Abed-AlMohsen Zinni, 1974) [11]

The concentration percentage = $\dfrac{\text{The number of variable elements in the region}}{\text{The number of variable elements in all regions}} \times 100$

Equation 4: This is for the method of nearest-neighbor (for more details, look at Khair Safouh, 1990, p. 341) [12], which refers to the distribution pattern based on the following equation:

$$S = 2P \sqrt{N / ST}$$

where S = the pattern of distribution
      P = the average of the distance between each health center and the nearest residential area
      N = number of health centers
      St = size of the area of Amman Governorate

The Limitations

The study is limited by the review of related literature. The spatial studies related to the health services at the international level are varied and can be classified according to several categories as follows:

1. Certain studies were interested in investigating the geographical distribution of health services based on statistical methods. What distinguishes this group of studies was the attempt to promote health services through site planning, investigate their recipient's properties, and analyze barriers that affected the efficiency and effectiveness of health services. Of these important studies are: Schneider (1967), [13] Bashhur and Scott (1970), [14] Abernathy and Hershey (1970), [15] Calvo and Marks (1973), [16] Hetzel (1978), [17] and Brvida and Wan (1981). [18]

2. Other studies focused on the spatial distribution of health services, based on the rates of population growth, the increase of health services, and the size of the workforce. Of these important studies are the study by Taylor (1980), [19] which focused on the variation problem in the distribution of public services and accessibility, especially in rural areas, and

it emphasized the importance of investigating the spatial distribution of health centers. This agreed with what was concluded by Shannon and Dever (1974) [20], which stated that the quantitative and qualitative spatial distribution for the sources of health services was regarded as one of the fundamentals of an effective delivery of health services.

3. The developing countries were interested in studies related to health services, particularly those evaluating the status of the services and compared them with those in developed countries. Then obstacles were determined and certain solutions were developed. Of these important studies are: Annis (1981), [21] Okfor (1982), [22] Gesler (1984), [23] and David (2001), [24] which highlighted the characteristics of health services in developing countries.

4. The Arabic studies addressed the health sector topics. Of these important studies are: El- Bushra (1980), [25] Al-Zahrani (1989), [26] AL-Ribdi(1990), [27] and Al-Qahtani (1994) [28] which dealt with the patterns of spatial distribution of health services.

5. The Jordanian studies addressed the health sector, by focusing on the relationship between the population and the spatial distribution of different health care centers or the optimal distribution of health services or regional planning and its role in improving the overall performance of public facilities and services through analytical study of the health facilities or demand for health care. Of these important studies are: Al-Momani (1994), [29] Arabyat (1995), [30] Al-Hunaiti (1996), [31] AL-Dabbas (2002)[32] Abukhurma (2004), [33] and Hamidat (2002). [34]

This study addresses the reality of health services in one region of the largest population of Jordan.

The Study Area

The Amman Governorate is considered the largest governorate of Jordan in terms of population which is nearly 2,315,600 people (38.7% of the total population) of whom 2,177,100 live in urban regions, compared to the total population of Jordan which is 5,980,000. The total area of the Amman Governorate is 7,579 km² which is 8.54 % of the total area of the state.[35] The Amman Governorate witnessed a rapid population growth during the second half of the twentieth century. In 1950, the population was only 100,000 people according to the estimates then. The population growth has been increasing quickly because of the natural increase and forced migrations which occurred because of the migration of Palestinians in addition to the internal migrations represented by the rural migration and depopulation of other areas to the city motivated by the availability of services, transportation, and opportunities for the population. According to the Statistical Yearbook of the Department of Statistics (2010), it has observed the increase in the population in the capital since the first census conducted in Jordan in 1952 to 2009, which indicated that the capital (Amman) has witnessed a very rapid population increase during the mentioned period, as the population jumped from 190,499 people, according to the 1952 census to 2,315,600 people in 2009.[36]

Analysis of Relationships

- #### Analysis of the relationship between population and health services
An analysis of the relationship between the population and health services shows that the data delivered by the Ministry of Health (2009), Directorate of Studies, Amman has the potential to indicate the distribution of health centers and basic information about

them in the study area for the year 2009. The first question ("Do the health centers serve all communities in the capital city?) is answered by analyzing the relationship between the population and health services.

These data indicate that the study area includes 58 health centers (comprehensive, primary, and secondary) divided as follows: 9 comprehensive health centers, 37 primary health centers and 12 secondary health centers, distributed in all the residential areas in the study area. Consequently, this health service covers all the residential areas in the central and western parts of Amman. It is evident from the names of the health centers that there is a difference in service quality, that is, comprehensive, primary and secondary centers, and there is a clear difference in the distance between the

primary and secondary centers for the service of comprehensive centers or the nearest hospital and the number of recipients of health services in the two years (1999 and 2009) in these centers.

- *Analysis of the spatial variation of the health centers*

To measure the size of the spatial variation of the health centers from one region to another, it is statistically reliable to depend on the data of the two separated periods and then to calculate the percentage of change during the period that separates the statistics. The percentage of change can be applied on different quantitative variables, including the number of doctors, employees, and so on. By using equation 2 mentioned in the statistical methods before, the percentage of change is revealed in table (1) to calculate the percentage of change between 1999 and 2009.

Table (1): Percentage of change in the number of doctors, employees and recipients of health services in 1999 and 2009.

Health center	Doctors numbers			Employees number			The number of recipients of health services (in thousands)		
	1999	2009	Change %	1999	2009	Change %	1999	2009	Change %
Training compressive center of Iskan Abu Nseer	21	29	38.10	54	72	33.33	89,464	127,056	-29.59
Al-Weibedh Al-Sharqi	16	24	50.00	36	28	-22.22	75,035	76,939	-2.47
Wadi Al-Seer	17	23	35.29	36	49	36.11	109,222	127,957	-14.64
Al-Naser	5	14	180.00	19	46	142.11	77,593	90,361	-14.13
Naour	10	18	80.00	38	42	10.53	20,009	32,200	-37.86
Al-Hashmi Al-Shamali	18	21	16.67	51	55	7.84	69,410	81,634	-14.97
Sweileh	12	20	66.67	28	37	32.14	53,820	99,525	-45.92
Rass Al-Een (HRH Princess Basma)	16	18	12.50	48	60	25.00	841,140	145,024	480.00
Amman Comprehensive (Shmasani)	22	29	31.82	48	60	25.00	89,742	963,417	-90.69
Marj Al-Hamam	3	8	166.67	19	21	10.53	75,790	88,884	-14.73
Jufah	4	7	75.00	11	28	154.55	14,573	36,908	-60.52
Abu-Ayoub Al-Ansari	5	11	120.00	6	12	100.00	22,351	49,250	-54.62
The Urban Development of Marka	6	9	50.00	20	16	-20.00	34,069	60,514	-43.70
Manarah	9	14	55.56	20	22	10.00	44,363	53,932	-17.74
Tajj	4	9	125.00	26	18	-30.77	87,764	67,174	30.65
Thiraa	2	10	400.00	23	21	-8.70	37,799	50,464	-25.10
Oudeh Abu Taaih	1	7	600.00	22	21	-4.55	12,827	20,435	-37.23
Umm Al-Basateen	2	5	150.00	21	15	-28.57	56,510	41,290	36.86
Al-Rawdah	1	6	500.00	5	6	20.00	29,312	29,124	0.65
Al-Royah Hamlan	5	8	60.00	9	12	33.33	6,830	5,725	19.30
Jabal Amman	6	9	50.00	8	6	-25.00	17,261	87,854	-80.35
Nuzhah	5	5	0.00	22	16	-27.27	56,871	71,734	-20.72

Health center	Doctors numbers			Employees number			The number of recipients of health services (in thousands)		
Al-Nadeef	1	7	600.00	16	19	18.75	46,993	47,673	-1.43
Shafa Badran	3	8	166.67	6	14	133.33	5,500	58,334	-90.57
Al-Basmah	5	11	120.00	13	16	23.08	15,633	22,901	-31.74
Dhahiyat Al-Hussein	3	6	100.00	12	16	33.33	11,477	12,943	-11.33
Tabarbour-Tarq	3	6	100.00	18	23	27.78	31,787	38,672	-17.80
Al-Qusour	1	9	800.00	11	9	-18.18	32,424	62,670	-48.26
Al-Adaseyah	3	6	100.00	6	5	-16.67	36,870	33,306	10.70
Al-Hashmeyah	3	3	0.00	12	11	-8.33	28,950	35,762	-19.05
Badr	2	6	200.00	12	19	58.33	23,926	29,164	-17.96
Al-Zuhour	2	4	100.00	13	13	0.00	10,076	13,980	-27.93
Al-Maraf	2	4	100.00	2	8	300.00	19,724	25,540	-22.77
Husban	3	3	0.00	11	10	-9.09	3,869	7,690	-49.69
Hamzah	2	3	50.00	3	3	0.00	110,060	123,040	-10.55
Al-Mahtah	1	6	500.00	4	3	-25.00	15,160	2,430	523.87
Al-Aal	1	2	100.00	17	62	264.71	37,390	11,308	230.65
Umm Abahwarah	1	2	100.00	14	19	35.71	129,888	124,257	4.53
Iraq Al-Ameer	0	2	0.00	19	16	-15.79	23,173	30,021	-22.81
Seil Husban	3	1	0.00	1	5	400.00	34,208	55,320	-38.16
Al-Samik	5	1	-50.00	9	12	33.33	89,464	127,056	-29.59
Umm Al-Usoud	2	2	0.00	11	16	45.45	75,035	76,939	-2.47
Koom Yajouz	4	6	50.00	10	15	50.00	109,222	127,957	-14.64
Manshyeat Husban	2	5	150.00	51	62	21.57	77,593	90,361	-14.13
Al-Mishgar	3	1	-66.67	21	20	-4.76	20,009	32,200	-37.86
Salhyat Al-Abed	1	2	100.00	12	40	233.33	69,410	81,634	-14.97
Istiqlal	2	4	300.00	15	21	40.00	53,820	99,525	-45.92
Umm Al-Qutein	6	5	-16.67	10	15	50.00	841,140	145,024	480.00
Zboud Al-Oula	2	1	-50.00	34	40	17.65	89,742	963,417	-90.69
Marka Civil Airport	3	0	-100.00	11	13	18.18	75,790	88,884	-14.73
Qasur Al-Adel	3	1	-66.67	12	14	16.67	14,573	36,908	-60.52
Umm Al-Hussein	4	1	-75.00	11	25	127.27	22,351	49,250	-54.62
Comprehensive Sweileh	2	1	-50.00	10	9	-10.00	34,069	60,514	-43.70
Al-Nadeef Al-Shamaali	3	0	-100.00	4	6	50.00	44,363	53,932	-17.74
Parliament	5	4	100.00	8	5	-37.50	87,764	67,174	30.65
Al-Sweiseh	1	4	300.00	3	4	33.33	37,799	50,464	-25.10
Husban Al-Qadeemeh	5	2	-60.00	1	2	100.00	12,827	20,435	-37.23
Al-Ibneyat	1	6	500.00	0	2	50.00	56,510	41,290	36.86

The Source: The researcher's work based on data of the Ministry of Health

It is noted from table (1) that the highest change percentages of the number of doctors were in the health centers Al-Qusour, Oudeh Abu Taayeh and Al-Nadeef followed by Al-Rawdah, Al-Mahtah, and Al-Ibneyat where the percentage of change was the highest with 500% and the health center of Seil Husban was the highest center regarding the percentage of change in the number of health staff with 400%, followed by the health center of Al-Marqab with 300% and the health centers of Al-Aal and Salheyat Al-Abed with 264% and 233%, respectively.

The center of Al-Mahtah had the highest percentage of change in the number of recipients of health services with 523.87%, followed by the health center of HRH Princess Basma and Umm Al-Qutein with 480% each, and the health center of Al-Aal with 260.65%. It can be observed that the percentage of change in some health centers is very low and weak such as the health centers of Umm Al-Basateen and Al-Ibneyat with 36.66% each, Al-Tajj and the Parliament with 30.65% each, Al-Royah Hamlan with 19.30%, Al-Adaseyah with 10.70%, Umm Ahbaarah with 4.53%, and Al-Rawdah with 0.65%.

- ***The existence of medical staff and health services recipients of health services***

The question, which states: "Is there a shortage of medical staff in health centers?" is answered by determining the concentration percentages of health services based on equation 3. Table (2) shows the concentration percentages of doctors, staff and health services recipients for the year 2009.

Table (2): The concentration percentages of doctors, staff, and recipients of health services for the year 2009.

Health centers	Doctors numbers		Concentration %	Employees		Concentration %	Number of recipients of health services		Concentration %
	1999	2009	2009	1999	2009	2009	1999	2009	2009
Training comprehensive center of Iskan Abu Nseer	21	29	6.6	54	72	5.7	89,464	127,056	2.4
Al-Weibedh Al-Sharqi	16	24	2.8	36	28	1.1	75,035	76,939	0.7
Wadi Al-Seer	17	23	2.8	36	49	2.0	109,222	127,957	1.2
Al-Naser	5	14	1.7	19	46	1.9	77,593	90,361	0.9
Naour	10	18	2.3	38	42	1.8	20,009	32,200	0.3
Al-Hashmi Al-Shamali	18	21	2.7	51	55	2.4	69,410	81,634	0.8
Sweileh	12	20	2.7	28	37	1.7	53,820	99,525	1.0
Rass Al-Een (HRH Princess Basma)	16	18	2.5	48	60	2.8	841,140	145,024	1.4
Amman Comprehensive (Shmasani)	22	29	4.1	48	60	2.8	89,742	963,417	9.7
Marj Al-Hamam	3	8	1.2	19	21	1.0	75,790	88,884	1.0
Jufah	4	7	1.0	11	28	1.4	14,573	36,908	0.4
Abu Ayoub Al-Ansari	5	11	1.6	6	12	0.6	22,351	49,250	0.6
The Urban Development of Marka	6	9	1.4	20	16	0.8	34,069	60,514	0.7
Manarah	9	14	2.2	20	22	1.1	44,363	53,932	0.6
Tajj	4	9	1.4	26	18	0.9	87,764	67,174	0.8
Thiraa	2	10	1.6	23	21	1.1	37,799	50,464	0.6
Oudeh Abu Taaih	1	7	1.1	22	21	1.1	12,827	20,435	0.2
Umm Al-Basateen	2	5	0.8	21	15	0.8	56,510	41,290	0.5
Al-Rawdah	1	6	1.0	5	6	0.3	29,312	29,124	0.3
Al-Royah Hamlan	5	8	1.3	9	12	0.6	6,830	5,725	0.1
Jabal Amman	6	9	1.5	8	6	0.3	17,261	87,854	1.0
Nuzhah	5	5	0.9	22	16	0.9	56,871	71,734	0.9
Al-Nadeef	1	7	1.2	16	19	1.0	46,993	47,673	0.6
Shafa Badran	3	8	1.4	6	14	0.8	5,500	58,334	0.7
Al-Basmah	5	11	2.0	13	16	0.9	15,633	22,901	0.3
Dhahiyat AlHussein	3	6	1.1	12	16	0.9	11,477	12,943	0.2
Tabarbour-Tarq	3	6	1.1	18	23	1.3	31,787	38,672	0.5
Al-Qusour	1	9	1.7	11	9	0.5	32,424	62,670	0.8
Al-Adaseyah	3	6	1.1	6	5	0.3	36,870	33,306	0.4

Al-Hashmeyah	3	3	0.6	12	11	0.6	28,950	35,762	0.4
Badr	2	6	1.2	12	19	1.1	23,926	29,164	0.4
Al-Zuhour	2	4	0.8	13	13	0.8	10,076	13,980	0.2
Al-Maraf	2	4	0.8	2	8	0.5	19,724	25,540	0.3
Husban	3	3	0.6	11	10	0.6	3,869	7,690	0.1
Hamzah	2	3	0.6	3	3	0.2	110,060	123,040	1.6
Al-Mahtah	1	6	1.2	4	3	0.2	15,160	2,430	0.0
Al-Aal	1	2	0.4	17	62	3.7	37,390	11,308	0.1
Umm Abahwarah	1	2	0.4	14	19	1.2	129,888	124,257	1.6
Iraq Al-Ameer	0	2	0.4	19	16	1.0	23,173	30,021	0.4
Seil Husban	0	1	0.2	1	5	0.3	34,208	55,320	0.7
Al-Samik	0	1	0.2	9	12	0.8	89,464	127,056	1.7
Umm Al-Usoud	2	2	0.4	11	16	1.0	75,035	76,939	1.0
Koom Yajouz	4	6	1.2	10	15	1.0	109,222	127,957	1.7
Manshyeat Husban	2	5	1.1	51	62	4.0	77,593	90,361	1.2
Al-Mishgar	3	1	0.2	21	20	1.4	20,009	32,200	0.5
Salhyat Al-Abed	1	2	0.4	12	40	2.8	69,410	81,634	1.1
Istiqlal	0	4	0.9	15	21	1.5	53,820	99,525	1.4
Umm Al-Qutein	6	5	1.1	10	15	1.1	841,140	145,024	2.1
Zboud Al-Oula	2	1	0.2	34	40	2.9	89,742	963,417	14.2
Marka Civil Airport	3	0	0.0	11	13	1.0	75,790	88,884	1.5
Qasur Al-Adel	3	1	0.2	12	14	1.1	14,573	36,908	0.6
Umm Al-Hussein	4	1	0.2	11	25	1.9	22,351	49,250	0.9
Comprehensive	2	1							
Sweileh			0.2	10	9	0.7	34,069	60,514	1.1
Al-Nadeef Al-Shamaali	3	0	0.0	4	6	0.5	44,363	53,932	1.0
Parliament	2	4	0.9	8	5	0.4	87,764	67,174	1.2
Al-Sweiseh	1	4	0.9	3	4	0.3	37,799	50,464	0.9
Husban Al-Qadeemeh	5	2	0.4	1	2	0.2	12,827	20,435	0.4
Al-Ibneyat	0	6	1.3	0	2	0.2	56,510	41,290	0.8

By applying the equation mentioned, the concentration percentages of the recipients of health services were calculated and named by the percentage of overcrowding which highlights the extent of the overcrowding of the recipients of health services and its variance from one region to another. Then compared with the doctors and health staff, it can be found that the health centers of which the percentage is more than 2% of doctors are those of Abu-Nasir, Amman Al-Shamali, Al-Weibdeh, Wadi Seer, Al-Hashmi Al-Shamali, Sweileh, and Princess Basma.

It is noted that this percentage of staff has been found in the centers of Abu-Nnasir, Manshiet Husbaan, Al-Aal, Zbod A-Ulaa , Princess Basma, Amman Comprehensive, Salheyat Al-Abed, Al-Hashmi Al-Shamali and Wadi Al-Seir. Besides that, this percentage regarding the concentration of the recipients of health services were in the centers of Zbod Al-Ulaa, Amman Comprehensive, Abu-Nasir, and Umm Al-Qutein.

- ### *The pattern of spatial distribution*

In order to answer the fifth question, which states: "What is the pattern of spatial distribution of health centers in the study area?", the geographic researcher tried when investigating the distribution pattern of a certain geographic phenomenon to determine whether the distribution is a regular pattern, which means that there are certain forces and factors behind it, but if the pattern is random, then it refers to a factor of luck or coincidence.[12]

To study the pattern of spatial distribution of health centers in the study area, we can rely on the way of the closest neighbor automatically in geographic information systems, which are a known analytical spatial function in this technology, which relies on the same principle, based on this method.

This method is to measure the distance between each health center and its nearest neighbor center in order to reach evidence, which can determine the pattern of distribution. This method, which refers to the pattern of distribution, is measured by applying equation 4 mentioned before. Safouh Khair [12] determined the spatial distribution as mentioned in figure (1), and table 6 illustrates the variance between the pattern of distribution at the governorate level by comparing it with the level of the three spatial environments studied, and then the distribution pattern of the phenomena can be determined.
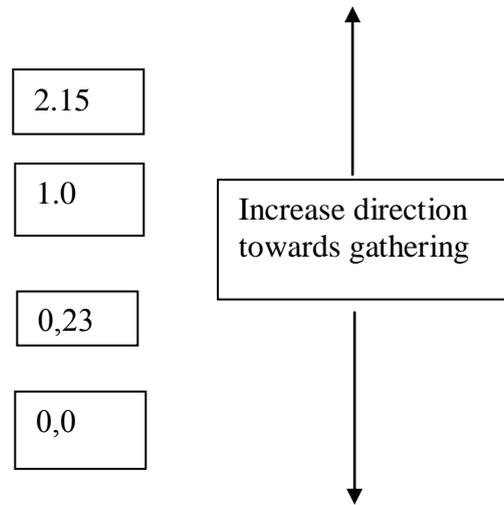
| 2.15 |

| 1.0 |

| Increase direction towards gathering |

| 0,23 |

| 0,0 |

Figure (1): The quantitative linear scale to determine the pattern of the spatial distribution of geographical phenomena.

Based on the linear scale as described in figure 1, the pattern of spatial distribution of these centers is towards a regular increase, and it is noted that these values are increased more than 2.15 as mentioned by Sifouh.

Table (2) and figure (2) show that the F-value is considerably varied in the case of applying the equation on the study area, as compared with other environments, which is indicated by the pattern of distribution, which tends to gather around the urban environment with population overcrowding, and it gets lower in rural environments, which means that there is no agreement between these environments within the study area.

Table (3): The pattern of the distribution of health centers in the study area

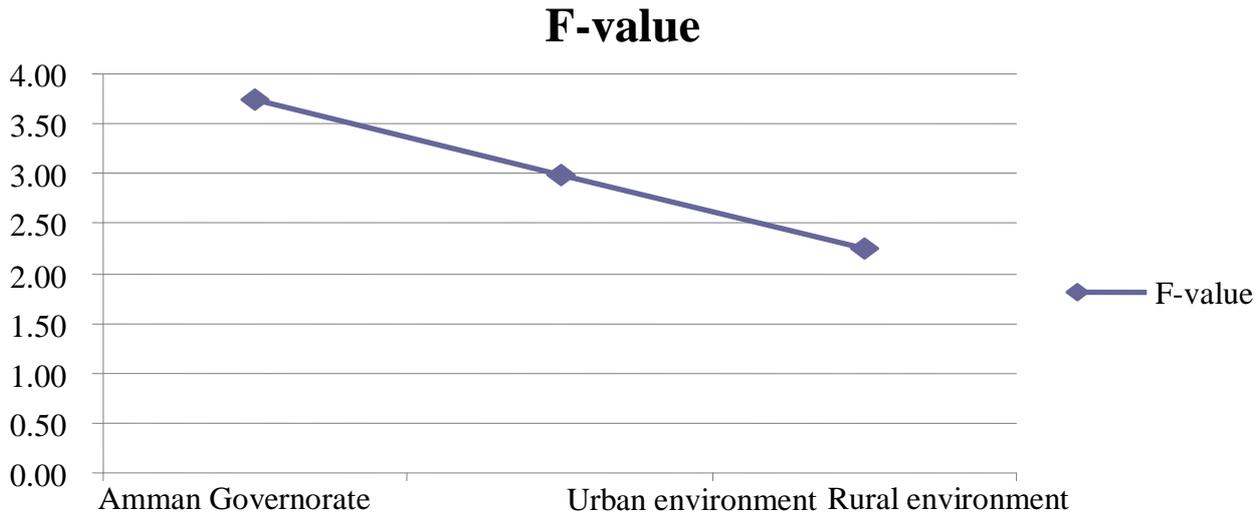| *The pattern of distribution of health centers*			
The studied area	*Health center numbers*	*F-value*	*The pattern of distribution of health centers in three regions*
Amman Governorate	*58*	*3.75*	*Gathering around the built regions*
The urban environment	*37*	*2.99*	*A tendency for regular distribution but not perfect*
The rural environment	*21*	*2.26*	*Gathering towards a direction regularly but not perfect*

F-value

Figure (2) shows the pattern of spatial distribution of these centers in the three spatial environments and on the grounds that the area of the region is defined by the Ministry of Health.
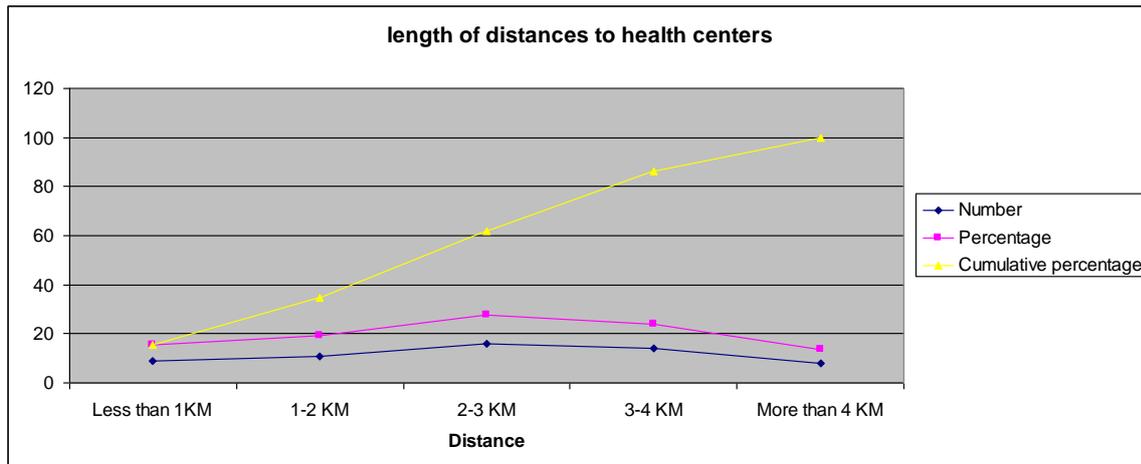

Figure (3): Distance lengths of health centers

- *Assessing the occupied distance*

Gester [23] shows that calculating the factor of the occupied distance to reach health centers can contribute to the understanding of one of the important factors that affect the benefits from the services of health centers. The standard of distance between population centers and health facilities represents a link in the system of health care delivery, whether comprehensive, primary, or subsidiary, and that means that the quality of health service varies depending on the quality of the center. That is, the shorter the distance, the better the access to integrated health services. This provides an opportunity for the planners in the health sector to adopt this method of providing health care based on an index of distance between the comprehensive, primary, and secondary health facilities and the closest hospital to that center. Table (4) and figure 3 show the lengths of distances.

Table (4): Lengths of distances to health centers

Categories of distances (KM)	Number	Percentage	Cumulative percentage
Less than 1 KM	9	15.5	15.5
1-2 KM	11	19.0	34.5
2-3 KM	16	27.6	62.1
3-4 KM	14	24.1	86.2
More than 4 KM	8	13.8	100.0
Sum	58	100	

It is clear that 86.2% of medical centers are accessible by a distance less than 4 km, pointing to the existence of these services near the population centers, and this is linked to the population size of the study area, which requires that these health services must be available.

Results

The present study finds that the health centers cover somehow all the population communities with variations in the quality of these centers, whether a comprehensive, primary or secondary, and there is a weak relationship in the correlation coefficient between the number of population, doctors and recipients of health services. The study shows that there is overcrowding in some centers due to those previous indicators and there is a lack of medical specialist staff qualified in the majority of health centers, and the pattern of distribution of these centers tends to be regular but not perfect. In addition, the study finds out that there is considerable variation in the pattern of distribution of health centers, in general, while the spatial distribution is concentrated to some urban areas, and that the concentration percentage of health services indicates that the percentage concentration of the recipients of health services is nearly the same in many centers, while the concentration percentage in the number of physicians is different in the same centers.

There is a weak but positive relationship between the population of the area and the number of staff in health centers, regardless of the type of the center, whether comprehensive or primary, which is disclosed by the correlation coefficient. Also, there is variation in the percentage of comprehensive or primary health center concentration between areas of the capital city of Amman and overcrowding of these centers in certain areas, which is explained by the pattern of the spatial distribution of health centers as well as the degree of variation of the health service.

Recommendations

Based on previous results, the study recommends establishing comprehensive health centers in Shmeisani and the Al-Bieder region which is free of such health centers and achieving balance in the distribution of health service variation in the centers of Amman to maintain and balance between the number of the recipients of health services, on the one hand, and the number of doctors and health staff such as nurses, on the other. Also, medical services to those centers need to be improved.

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التحليل المكاني لمراكز الرعاية الصحية في محافظة عمان بالأردن

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الملخص

تسعى الدراسة إلى تسليط الضوء على المراكز الصحية في مديرية صحة محافظة عمان بالأردن، فجاء هذا البحث موضحاً التحليل المكاني لمراكز الرعاية الصحية الأولية بهدف تبيان التوزيع المكاني النوعي والكمي للمراكز الصحية الحالية في منطقة الدراسة. وتحليل التباين المكاني لخصائص المراكز الصحية. ووضع توصيات تتيح لمتخذي القرار تحقيق الاستفادة المثلى من الرعاية الصحية. واعتمدت على المنهج الاستقرائي او الاستنباطي للخصائص المكانية والاحصائية للخدمات الصحية وتكون مجتمع الدراسة من جميع المراكز الصحية الرسمية في تلك المديرية والبالغ عددها 58 مركزا صحيا ما بين مراكز شاملة وأولية وفرعية. استخدمت الدراسة المعادلات والأساليب الإحصائية المناسبة للإجابة على تساؤلاتها المحددة

توصلت الدراسة الى عدة نتائج وأبرزها عدم وجود كوادر طبية مؤهلة متخصصة في غالبية المراكز الصحية ووجود تباين كبير في نمط التوزيع المراكز الصحية بصورة عامة بينما يكون التوزيع المكاني متركزا لبعض المناطق الحضرية، وان نسبة التركز للخدمات الصحية تشير الى ان نسبة التركز للمراجعين لا تتوازن مع التركز للأطباء ووجود تقارب مع عدد من المراكز بينما تتباعد نسبة التركز في إعداد الأطباء في المراكز نفسها.

الكلمات الدالة: التحليل المكاني للمراكز الصحية، محافظة العاصمة.