ORIGINAL RESEARCH

Comparative Analysis and Spatial Distribution of the Primary Health Care Centers and Health Manpower Across Saudi Arabia Using Shapiro–Wilk Test

Ashraf A'aqoulah [1,2], Samir Albalas[3], Mustafa Albalas[4], Raghad Abdullah Alherbish[5], Nisreen Innab [6]

[1]Department of Public Health, College of Public Health and Health Informatics, King Saud bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia; [2]King Abdullah International Medical Research Center, Riyadh, Saudi Arabia; [3]Department of Public Administration, Faculty of Business, Yarmouk University, Irbid, Jordan; [4]Surgery Department, Ministry of Health, Irbid, Jordan; [5]Department of Respiratory Care, College of Applied Sciences, AlMaarefa University, Riyadh, Saudi Arabia; [6]Department of Computer Science and Information Systems, College of Applied Sciences, AlMaarefa University, Riyadh, Saudi Arabia

Correspondence: Nisreen Innab; Ashraf A'aqoulah, Email ninnab@um.edu.sa; aqoulaha@ksau-hs.edu.sa

Background: Due to the growing demand for better health services by the population pressure, Saudi Arabia is facing challenges in providing the required coverage in primary health care over all regions.

Study Objectives: The study aims to do a comparative analysis of the spatial distribution of the primary healthcare centers and health manpower across Saudi Arabia.

Study methods: This study deals with the analysis of the spatial distribution of the PHCCs and health manpower in Saudi Arabia regions during the period 2017–2021 by applying the Shapiro–Wilk test. This study relied on a dataset issued by the Ministry of Health (MoH). The variance of the spatial distribution of the dataset was also analyzed using the T-student and Binomial tests.

Results: This study found that PHCCs of 2020; the dentists of 2021; and Allied Health Personnel of 2017, 2020, and 2021 were normally distributed. However, the distribution of the population and all datasets of the other health indicators is a non-normal distribution. In addition, the correlation between the number of PHCCs and regions based on population is significant in all the regions. Moreover, The number of dentists showed a significant correlation with the population in most regions, except Riyadh, Makkah, and Jazan. However, the number of physicians, allied health personnel, nurses, and family medicine practitioners generally did not correlate significantly with the population, with exceptions for nurses in Tabuk and family medicine in the Northern Borders. Finally, the spatial distribution of the population shows the concentration in three major regions which are Riyadh, Makkah, and Eastern Province.

Conclusion: Despite the expansion in the number of PHCCs and health workers and spread in all regions of Saudi Arabia, their spatial distribution still requires the establishment of more of them to provide the basic health services necessary to cover the actual needs of the population.

Keywords: primary health care centers, systems of care, public health, knowledge, statistical analysis, Saudi Arabia

Introduction

In line with the Alma Ata Declaration of 1978, Saudi Arabia has placed great importance on health care through primary health care centers (PHCCs). By 2021, the Ministry of Health regulates many PHCCs throughout the kingdom. These PHCCs provide primary services to all citizens of Saudi Arabia. With the growing demand for better healthcare services due to population pressure, Saudi Arabia faces the challenges of the required coverage in primary healthcare in all regions.[1] Over many decades, Saudi Arabia has implemented a number of development plans, centered on infrastructure development, as well as many ambitious development plans and initiatives, particularly in the field of health of.[2]

Infrastructure plays a vital role in enhancing the health sector.[3] These plans led to remarkable achievements in the field of health indicators, which reflect the progress in the health sector, and have a significant impact on the health and well-being of the population.

Regional disparities in Saudi Arabia involve the distribution of infrastructure, resources, and services across different regions. Major cities like Riyadh, Dammam, and Jeddah have advanced education, healthcare, and economic opportunities, while rural areas, particularly in the northern and southern regions, face challenges in accessing these services. These disparities are rooted in geographical, historical, and economic issues. The Saudi government's Vision 2030 seeks to create equitable and improved access to services in all regions.[4,5] Many studies have focused on the major cities to improve healthcare services.[5–9] Almujadidi et al mentioned that there is a shortage of labor especially in rural areas of Saudi Arabia.[9] Jamjoom, Gahtani, and Sharab found that medical personnel in Saudi Arabia are distributed differently.[5]

The strategic interest in developing primary health care has been one of the main pillars of successive development plans for Saudi Arabia. This stems from of the importance of providing healthcare components to support the development of the health levels and health capabilities of citizens across Saudi Arabia. Preventive, curative and rehabilitative healthcare services in Saudi Arabia are provided by a network of healthcare facilities headed by PHCCs. These centers are the main institution entrusted with providing integrated and comprehensive healthcare services to all regions of Saudi Arabia.[10]

The number of PHCCs reached 2121 centers in 2021.[11] These centers are spread across the regions of Saudi Arabia and linked to general and specialized hospitals. The services of PHCCs are integrated with hospitals through referrals and therapeutic care, starting from the first level to the specialized level.

The primary health care centers provide various integrated services such as maternal and child health care through follow-up during pregnancy, during and after delivery. They implement immunization programs for mothers and children against infectious diseases, in addition to the programs for prevention of communicable and endemic diseases. The primary health care centers also take care of people with non-communicable diseases, especially chronic diseases such as blood pressure and diabetes, to reduce their complications.[1]

It is expected that the population per center will improve in all regions once the implementation of the PHCCs is completed. Saudi Arabia's various development plans have prioritize, social development needs in order to provide basic services to the population, including PHCCs. The Ministry of Health made more efforts to provide PHCCs and their operations by constructing many centers and attempting to develop them and continuously improve their services.[12] Therefore, two main objectives are being pursued. The first objective is to determine the adequacy of PHCCs and health personnel (doctors, nurses, pharmacists, dentists, allied health professionals, and family medicine doctors). This selection is usually based on their role in patient care, their impact on healthcare outcomes and their fulfillment of the needs of the population in the different regions of Saudi Arabia. The second objective is to identify the differences in the spatial distribution of the services of PHCCs and health manpower.

The Shapiro–Wilk test is a useful test. Many disciplines, including the social sciences and healthcare, have adopted it. It assesses the kurtosis and skewness of a data set. For small- datasets, the Shapiro–Wilk test is a very useful tool for detecting deviations from normality. The disadvantage of the Shapiro–Wilk test is that it can lead to an unnecessary rejection of the normality assumption for large data sets and is limited to continuous data. This study relies on the Shapiro–Wilk test to assess the normality of spatial distribution of primary healthcare centers and health workers across Saudi Arabia.

Methods

Saudi Arabia is located in south-west Asia. The country is characterized by arid climatic conditions. Consequently, human life is severely affected by the dry and dusty climatic conditions. This study included some comparisons and focused on selected key indicators. The study is based on secondary data. The dataset is available in the statistical yearbooks published by the Ministry of Health for the period 2017–2021.[11] This study covers six of the most important health and demographic indicators in Saudi Arabia. These indicators were carefully selected from a set of health indicators available in the statistical yearbooks of the period 2017–2021.[11]

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The data were organized and tabulated using the SPSS package, version 23, and used to analyze the descriptive statistics of the selected indicators. These data were processed and tested using the Shapiro–Wilk test to determine the normality distribution of the data. In addition, a correlation coefficient was used between the regions in Saudi Arabia (independent factors) and the number of PHCC, doctors, nurses, allied health professionals, dentists, and family medicine doctors (dependent factors).

Results

Table 1 shows the population, area and density in the regions of Saudi Arabia in 2021.[13] The area of Saudi Arabia is administratively divided into 13 provinces. The population distribution is mainly concentrated in three provinces: Riyadh (capital city), Makkah Al Mukarramah and the Eastern Province. The population in these areas is 8,175,378; 7,692,188; and 4,879,962 respectively.

Table 2 shows the distribution of health workers in the Saudi Arabia region. The table shows that in most regions, the number of PHCCs, doctors, nurses, allied health professionals, dentists, and family medicine doctors increased between 2016 and 2018. However, between 2019 and 2021, there was a decrease or stability in the same variables in the regions of Saudi Arabia.

Table 3 shows the Shapiro–Wilk test of health indicators to determine the significance of the health indicators dataset. The results of the test show that the PHCCs of 2020, the dentists of 2021, and the Allied Health Personnel of 2017, 2020 and 2021 were normally distributed. However, the distribution of the population and all datasets of the other health indicators is a non-normal distribution with degree of freedom of 13 and a p-value of 0.05.

Table 4 shows the correlation between the health indicators and the regions based on population. The correlation (ratio) between the number of PHCCs and the region is significant in all regions, as shown by the "tr" values, which are greater than the critical value of 2.13 at degrees of freedom 4. Moreover, the correlation between = dentists and = region

Table 1 Population, Area, and Density in the Saudi Region in 2021

Region	Population (People)	Area (km^2)	Density (People/km^2)
Riyadh	8,175,378	382,027	21.4
Makkah	7,692,188	139,351	55.2
Eastern Province	4,879,962	536,259	9.1
Madinah	2,053,240	144,594	14.2
Aseer	1,943,532	78,685	24.7
Jazan	1,355,099	13,430	100.9
Qaseem	1,289,032	69,302	18.6
Tabuk	850,859	137,235	6.2
Ha'il	715,422	127,753	5.6
Al Jouf	574,894	85,805	6.7
Najran	567,533	128,984	4.4
North Borders	359,411	92,156	3.9
Al Bahah	327,833	11,227	29.2
Total	30,784,383	1,948,378	15.8

Note: Statistical Database, General Authority for Statistics.[13]

Table 2 Distribution of PHCCs and Health Manpower in PHCCs in the MoH in All Regions

Year	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Region	**PHCCs**					**Physicians**				
Riyadh	436	447	415	415	390	1931	2489	2568	2463	1416
Makkah	340	344	324	335	322	2050	1808	2007	2868	1485
Madinah	159	159	149	156	144	772	776	752	1023	701
Qaseem	181	183	156	155	155	691	717	760	989	466
Eastern Province	255	255	244	240	218	1372	1794	1673	1956	1035
Aseer	339	339	334	316	277	1122	1289	1476	1371	1268
Tabuk	87	96	96	94	90	249	263	381	580	297
Ha'il	110	111	109	110	109	371	350	371	459	255
Northern Borders	47	48	43	42	41	244	251	284	381	262
Jazan	170	170	168	168	155	688	732	769	842	532
Najran	69	68	69	69	68	270	269	307	395	206
Al-Bahah	108	108	94	94	94	363	302	357	464	316
Al-Jouf	60	62	60	63	58	289	281	316	403	238
Region	**Nursing**					**Allied Health Personnel**				
Riyadh	3595	2725	3484	3417	2894	2203	3059	3042	2417	1499
Makkah	3181	1854	3328	3287	2739	2009	2501	2376	2699	1814
Madinah	1657	1024	1611	1362	1675	966	1297	1091	1312	1080
Qaseem	1244	944	1454	1102	990	869	1181	1075	1036	798
Eastern Province	2595	2840	3166	2710	2474	1602	2467	2182	1962	1580
Aseer	1816	1484	2237	1737	2216	826	1345	1317	1118	1304
Tabuk	676	459	828	794	882	313	375	366	426	357
Ha'il	930	593	869	725	687	390	484	472	479	366
Northern Borders	423	283	477	444	408	118	260	194	202	122
Jazan	1184	1059	1434	1103	1184	894	1108	1080	1041	1135
Najran	529	273	557	477	497	677	561	578	648	525
Al-Bahah	639	359	585	317	546	331	407	368	379	355
Al-Jouf	788	426	796	358	783	366	463	423	360	268
Region	**Dentists**					**Family Medicine**				
Riyadh	253	274	268	534	218	875	1308	1451	1206	761
Makkah	285	298	349	579	413	832	725	799	1250	721
Madinah	150	138	146	197	246	253	258	244	432	306
Qaseem	140	148	169	209	181	229	259	268	450	195

(Continued)

Table 2 (Continued).

Year	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Eastern Province	248	334	343	462	385	452	578	573	801	484
Aseer	193	197	282	340	337	362	365	380	420	374
Tabuk	47	55	89	106	99	123	102	181	245	158
Ha'il	58	66	96	116	124	117	113	101	139	89
Northern Borders	30	32	42	58	44	52	60	57	94	98
Jazan	1000	97	127	175	194	313	315	317	344	284
Najran	38	38	71	72	69	103	95	88	136	77
Al-Bahah	43	43	94	109	112	94	85	87	103	101
Al-Jouf	36	50	83	86	106	87	82	82	120	100

Table 3 The Shapiro–Wilk Test of the Health Indicators

Health Indicators	Period (Year)	Statistic	D.F	P-value	Null Hypothesis (H$_0$)	Distribution
Population	2017	0.733	13	*0.023	Rejected	Non-Normal
	2018	0.789	13	*0.003	Rejected	Non-Normal
	2019	0.732	13	*0.021	Rejected	Non-Normal
	2020	0.754	13	*0.042	Rejected	Non-Normal
	2021	0.783	13	*0.002	Rejected	Non-Normal
PHCCs	2017	0.816	13	*0.012	Rejected	Non-Normal
	2018	0.805	13	*0.014	Rejected	Non-Normal
	2019	0.810	13	*0.032	Rejected	Non-Normal
	2020	0.892	13	0.104	Accepted	Normal
	2021	0.853	13	*0.016	Rejected	Non-Normal
Physicians	2017	0.821	13	*0.022	Rejected	Non-Normal
	2018	0.807	13	*0.045	Rejected	Non-Normal
	2019	0.809	13	*0.032	Rejected	Non-Normal
	2020	0.822	13	*0.002	Rejected	Non-Normal
	2021	0.844	13	*0.024	Rejected	Non-Normal
Nurses	2017	0.857	13	*0.001	Rejected	Non-Normal
	2018	0.802	13	*0.023	Rejected	Non-Normal
	2019	0.816	13	*0.005	Rejected	Non-Normal
	2020	0.817	13	*0.002	Rejected	Non-Normal
	2021	0.867	13	*0.048	Rejected	Non-Normal

(*Continued*)

Table 3 (Continued).

Health Indicators	Period (Year)	Statistic	D.F	P-value	Null Hypothesis (H$_0$)	Distribution
Dentists	2017	0.857	13	*0.014	Rejected	Non-Normal
	2018	0.822	13	*0.011	Rejected	Non-Normal
	2019	0.818	13	*0.002	Rejected	Non-Normal
	2020	0.877	13	*0.039	Rejected	Non-Normal
	2021	0.913	13	0.201	Accepted	Normal
Allied Health Personnel (AHP)	2017	0.062	13	0.875	Accepted	Normal
	2018	0.861	13	*0.025	Rejected	Non-Normal
	2019	0.865	13	*0.045	Rejected	Non-Normal
	2020	0.895	13	0.916	Accepted	Normal
	2021	0.890	13	0.885	Accepted	Normal
Family Medicine	2017	0.805	13	*0.032	Rejected	Non-Normal
	2018	0.741	13	*0.007	Rejected	Non-Normal
	2019	0.732	13	*0.011	Rejected	Non-Normal
	2020	0.824	13	*0.042	Rejected	Non-Normal
	2021	0.826	13	0.014	Rejected	Non-Normal

Notes: *P-value < 0.05 indicates that the health indicators are not normally distributed.

Table 4 Correlation Between Health Indicators and Regions Based on Population

Region	PHCC				Physicians				Nursing			
	R^2	t_r	Ho	df	R^2	t_r	Ho	df	R^2	t_r	Ho	df
Riyadh	0.86	4.95	*Reject	4	0.06	0.54	Accept	4	0.33	1.41	Accept	4
Makkah	0.87	5.29	*Reject	4	0.23	1.09	Accept	4	0.07	0.56	Accept	4
Madinah	0.91	6.52	*Reject	4	0.04	0.01	Accept	4	0.01	0.25	Accept	4
Qasim	0.87	5.25	*Reject	4	0.28	1.27	Accept	4	0.33	1.42	Accept	4
Eastern Province	0.53	2.18	*Reject	4	0.21	1.06	Accept	4	0.00	0.16	Accept	4
Aseer	0.80	4.12	*Reject	4	0.08	0.60	Accept	4	0.45	0.81	Accept	4
Tabuk	0.08	2.62	*Reject	4	0.38	1.58	Accept	4	0.56	2.26	*Reject	4
Ha'il	0.84	4.58	*Reject	4	0.25	1.18	Accept	4	0.20	1.02	Accept	4
Northern Borders	0.92	7.06	*Reject	4	0.26	1.20	Accept	4	0.36	1.51	Accept	4
Jazan	0.93	2.73	*Reject	4	0.25	1.18	Accept	4	0.26	1.19	Accept	4
Najran	0.96	8.21	*Reject	4	0.11	0.71	Accept	4	0.23	1.10	Accept	4
Al Bahah	0.87	5.41	*Reject	4	0.01	0.24	Accept	4	0.03	0.03	Accept	4
Al Jouf	0.78	3.83	*Reject	4	0.02	0.31	Accept	4	0.14	0.839	Accept	4

(*Continued*)

Table 4 (Continued).

Region	Dentists				Allied Health Personnel				Family Medicine			
	R^2	t_r	Ho	df	R^2	t_r	Ho	df	R^2	t_r	Ho	df
Riyadh	0.03	0.39	Accept	4	0.13	0.79	Accept	4	0.04	0.09	Accept	4
Makkah	0.29	1.29	Accept	4	0.22	1.06	Accept	4	0.07	0.57	Accept	4
Madinah	0.59	2.44	*Reject	4	0.25	1.17	Accept	4	0.36	1.52	Accept	4
Qasim	0.63	2.62	*Reject	4	0.08	0.61	Accept	4	0.03	0.03	Accept	4
Eastern Province	0.64	2.72	*Reject	4	0.02	0.34	Accept	4	0.01	0.07	Accept	4
Aseer	0.84	4.64	*Reject	4	0.41	1.70	Accept	4	0.11	0.70	Accept	4
Tabuk	0.89	5.84	*Reject	4	0.42	1.71	Accept	4	0.38	1.59	Accept	4
Ha'il	0.86	5.14	*Reject	4	0.03	0.40	Accept	4	0.29	1.29	Accept	4
Northern Borders	0.73	3.33	*Reject	4	0.02	0.31	Accept	4	0.83	4.46	*Reject	4
Jazan	0.05	0.49	Accept	4	0.17	0.69	Accept	4	0.30	1.31	Accept	4
Najran	0.60	2.47	*Reject	4	0.05	0.49	Accept	4	0.10	0.68	Accept	4
Al Bahah	0.81	4.16	*Reject	4	0.15	0.84	Accept	4	0.34	1.46	Accept	4
Al Jouf	0.64	2.69	*Reject	4	0.02	0.18	Accept	4	0.25	1.17	Accept	4

Notes: *There is a correlation between health indicators and regions based on population.

was significant in all = regions= except Riyadh, Makkah and Jazan. In contrast, the correlations between the number of doctors and allied health professionals and the region were not significant in the regions. The correlations between the number of nurses and the region were also not significant in all regions except Tabuk. The correlation between the number of family medicine doctors and the region was also not significant in all regions, with the exception of the northern borders at degree of freedom 4.

Table 5 shows the spatial distribution of the population, PHCCs and health personnel in 2021. The spatial distribution of the population shows a concentration in three major regions, namely Riyadh (26.5%), Makkah (25%) and the Eastern Province (15.8%). The spatial distribution of health indicators is related to the spatial distribution of the population.

Table 6 shows the distribution of health indicators in groups based on concentration. The spatial distribution of health indicators can be divided into 3 groups. The first group consists of 3 regions (Riyadh, Makkah and Eastern Province)

Table 5 Spatial Distribution of the Population and Health Indicators Among Regions During 2021

Region	Population %	PHCCs %	Physicians %	Nursing %	Dentists %	Allied Health Personnel %	Family Medicine %
Riyadh	26.5	19.3	16.7	16.2	8.6	13.4	20.3
Makkah	25	15.9	17.5	15.3	16.3	16.2	19.2
Eastern Province	15.8	5.9	12.2	13.8	15.2	14.1	12.9
Madinah	6.7	7.1	8.3	9.4	9.7	9.6	8.2
Aseer	6.3	13.7	15.0	12.4	13.3	11.6	10.0

(Continued)

Table 5 (Continued).

Region	Population %	PHCCs %	Physicians %	Nursing %	Dentists %	Allied Health Personnel %	Family Medicine %
Jazan	4.4	7.7	6.3	6.6	7.7	10.1	7.6
Qaseem	4.2	7.7	5.5	5.5	7.2	7.1	5.2
Tabuk	2.8	4.5	3.5	4.8	3.9	3.2	4.2
Ha'il	2.3	5.3	3.0	3.7	4.9	3.3	2.4
Al-Jouf	1.9	2.9	2.8	4.3	4.3	2.4	2.7
Najran	1.8	3.4	2.4	2.7	2.8	4.7	2.1
Northern Borders	1.2	2.0	3.1	2.3	1.7	1.1	2.6
Al-Bahah	1.1	4.6	3.7	3.0	4.4	3.2	2.6

Table 6 Spatial Distribution of Health Indicators into Groups Based on Concentration

Groups	Population %	PHCCs %	Physicians %	Nursing %	Dentists %	Allied Health Personnel %	Family Medicine %	Concentration
Group 1 (Riyadh, Makkah, and Eastern Province).	67.3	41.1	46.4	45.3	40.1	43.7	52.4	High
Group 2 (Madinah, Asser, Qaseem, Jazan).	21.6	36.2	35.1	33.9	37.9	38.4	31	Moderate
Group 3 (Tabuk, Ha'il, Al-Jouf, Najran, Northern Borders, Al-Bahah).	11.1	22.8	18.5	21.2	21.8	17.9	16.7	Low

with a total of 67.3% of the population served by 41.1% of PHCC, 46.4% of doctors, 45.3% of nursing, 40.1% of dentists, 43.7% of allied health professionals, and 52.4% of family medicine doctors. The second group consisted of 4 regions (Madinah, Asser, Qaseem and Jazan) with a total of 21.6% of the population served with 36.2% of PHCC, 35.1% of doctors, 33.9% of nursing, 37.9% of dentists, 38.4% of allied health professionals, and 31% of family medicine doctors. The third group was composed by 6 regions (Tabuk, Ha'il, Al-Jouf, Najran, Northern Borders, Al-Bahah) with a total of 11.1% of the population served with 22.7% of PHCC, 18.5% of doctors, 20.8% of nursing, 22.0 of dentists, 17.9% of allied health professionals, and 16.6% of family medicine doctors.

Discussion

This study found that the PHCCs of 2020, the dentists of 2021; and allied health professionals of 2017, 2020 and 2021 were normally distributed. However, the distribution of the population and all data sets of the other health indicators is a non-normal distribution with the degree of freedom 13 and p-value 0.05. In addition, the correlation (ratio) between the number of PHCCs and the regions based on population is significant in all regions. Moreover, the correlation between the dentists and population was significant in all regions except Riyadh, Makkah and Jazan. In contrast, the correlations

between the number of doctors and allied health professionals and the population were not significant in all regions. It The correlation between the number of nurses and the population was also not significant in all regions except Tabuk. The correlation between family medicine doctors and the population were also not significant in all regions, with the exception the northern borders. Finally, the spatial distribution of the population shows a concentration in three major regions, namely Riyadh (26.5%), Makkah (25%) and the Eastern Province (15.8%). The spatial distribution of health indicators is related to the spatial distribution of the population.

Primary health care is the cornerstone of any health care system as it provides vital services such as general medical care, early diagnosis, chronic disease management and preventative care.[14] The majority of PHC facilities in Saudi Arabia are under the Ministry of Health (MoH). Although significant progress has been made in improving access to healthcare services, there are still large disparities in the number and distribution of PHC centers across the country.[15]

Due to geographic differences, rural and remote areas are underserved as primary healthcare facilities are concentrated in urban areas. Due to longer traveling times to health facilities, people in rural areas have less equitable access to care. The lack of PHC facilities in the less populated regions of Saudi Arabia, where a large proportion of the population lives, exacerbates health inequities, especially for the elderly and people with chronic diseases.[16]

There is a shortage of healthcare workers in Saudi Arabia, particularly doctors, nurses, and allied health professionals. This shortage affects access to and quality of healthcare. The shortage of PHC facilities and medical staff affects access to and quality of healthcare both directly and indirectly by increasing the burden on hospitals, limiting access to healthcare, and jeopardizing health outcomes.[17,18] In addition, we need to retain qualified professors in universities to ensure that graduates in healthcare fields have sufficient skills to improve the healthcare sector.[19]

There are several levels of health assessment in the PHCCs. Experts agree that there are three main levels proposed by Donabedian, namely structure, process and outcome.[20] The evaluation's structure level components emphasize the significance of health staff, facilities, and equipment.[21,22] However, many research studies conducted in different countries have shown that there are significant differences between PHCCs in terms of in the health personnel and equipment. This fact can be seen as the primary hindrance to the successful delivery of healthcare services by PHCCs. The process evaluation depends on (a) the way resources can be utilized to improve the interaction between patients and health workers; (b) the care goals achieved by the scope of health services provided by PHCCs; (c) the specific technique and procedures used in responding to people's demand in primary care; and (d) the good coordination between health workers of PHCCs.[23] Quality of care with higher validity of process measures are the most important practices of outcome evaluation.

A study by Al Fraihi, Famco and Latif (2016) concluded that the quality of care gap model is valid and needs to be prioritized and addressed through targeted health management improvement efforts.[24] In addition, the results of the evaluation of PHCCs in Riyadh based on users' views show the patient satisfaction due to the good order in health care.[12]

Conclusion

Although the number of PHCCs and health workers has increased and is spread across all regions of Saudi Arabia, more PHCCs need to be established to meet the actual needs of the population for basic health services. In addition, there are differences in the spatial distribution of PHCCs services and health personnel across Saudi Arabia.

Healthcare decision-makers need to not only increase the number of healthcare providers and PHCCs, but also focus on a more equitable distribution. Strategic, data-driven resource allocation is essential to ensure that underserved regions receive adequate healthcare support. Eliminating these disparities will be critical to achieving equitable healthcare across the country and meeting healthcare goals.

Ethical Approval

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board (IRB) at King Abdullah International Medical Research Centre (KAIMRC). The study approval number is MJ/EJ/WS/056.

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Disclosure

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