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Equity in the distribution of health resources and services in the West Bank, Palestine: a focus on hospitals and primary healthcare centers

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Abstract

Background Inequalities in the provision, distribution and utilization of healthcare services are the most commonly used variables to measure health system equity. Health inequalities in the Palestinian health system are evidenced due to geopolitical and socioeconomic challenges. This study evaluates the equity of healthcare resource distribution and utilization in the West Bank, focusing on primary healthcare centers and hospital services managed by the Palestinian Ministry of Health over a six-year period (2017–2022).

Methods The data was extracted from the Annual Health Reports for the investigated six years, covering the eleven governorates of the West Bank. The distribution of primary healthcare centers, hospital beds, and health workforce was assessed using standardized measures per population and geographic area, service utilization trends were analyzed across governorates. The Gini coefficient was calculated to evaluate equity in resource allocation.

Results Disparities in resources allocation and services expansion and utilization are noticed among the different governorates. Hospital services expanded at a higher rate (18.5% increase in beds, and 5.8% increase in standardized beds ratio to population) compared to PHC centers (6.8% increase in centers, and −4.63% for the standardized ratio of PHC centers to population). The rates varied widely among different governorates in both areas. Human resources growth rates lagged behind infrastructure expansion. Despite these inequities, the Gini coefficient values suggested relatively balanced resource allocation at the population level ranging between 0.078 and 0.164, though higher values for Gini coefficients and inequalities are found for resources distribution by geographic area.

Conclusion The findings emphasize the urgent need for a strategic equity-oriented approach that integrates community needs, geographic accessibility and workforce development. Comprehensive plans for strengthening healthcare services at different levels; focusing on PHC services and aligning workforce growth with infrastructure expansion are essential for achieving universal health coverage in Palestine.

Keywords Health equity, Health resources allocation, Health services utilization, Health disparities, Palestine

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Background

Health equity means that everyone can attain full health potential without any discrimination [1]; this definition of health equity implies reducing and ultimately eliminating disparities in health that affect marginalized groups [2]. Equitable access to healthcare is associated with healthcare availability, accommodation and appropriateness [3–5], as well as the physical existence and appropriate distribution of health resources and health workers with sufficient capacity that can be reached in a timely manner are essential to eliminate health access disparities [4, 6], it is also important to consider the actual and diverse community health needs [3], as well as contextual settings of different groups within the same community.

The way resources are allocated and distributed within the health system is considered a main issue to ensure meeting all needs of different community groups and thus achieve better health equity [7, 8]. Resource allocation and prioritization are challenging issues for decision-makers; they are considered main variables for analysing healthcare access inequalities [9–11]. Inequalities in the provision, distribution and utilization of healthcare services are the commonly used major variables to measure health equity [8, 12, 13].

Little attention has been given to assessing the equity aspects of the Palestinian health system. However, debates about disparities in healthcare provision and access have been highly raised [14], and mostly linked to health access barriers caused by the complex Palestinian geopolitical and socioeconomic context [15, 16].

In the Palestinian health system, the Palestinian Ministry of Health (PMOH) is the main service provider, it provides about 65% of primary health care (PHC) services in Palestine through a wide net of PHC centers distributed all over the Palestinian governorates. Governmental PHC centers constitutes for 73% of total PHC centers in the West Bank. PMOH also manages about 60% of hospital beds in Palestine [17].

Table 1 Percentage of total population and total geographical area of the West bank

Governorate	% of total Population	% of total area
Hebron	27.9%	17.7%
Nablus	14.7%	10.6%
Ramallah & Al-Bireh	12.6%	15.1%
Jenin	12%	10.3%
Bethlehem	8.3%	11.6%
Tulkarm	7%	4.4%
Jerusalem (Al-Quds)	6%	6.2%
Qalqilya	4.3%	2.9%
Salfit	2.9%	3.6%
Tubas	2.3%	7.2%
Jericho	1.9%	10.5%
Total	**100%**	**100%**

The PMOH, affected by the complex geopolitical context of the Palestinian Authority in the West Bank, is facing major challenges of inadequate resources and poor jurisdiction, inhibiting free movement between Palestinian urban and rural localities and imposing large restrictions on the movement of patients or health workers. The Palestinian national health policies have prioritized the expansion of local healthcare services as the major health priority towards achieving universal health coverage and minimizing health referrals outside Palestine, which would also contribute to improved health equity [18]. The success of these efforts would involve adequate and equal resource allocation at different healthcare levels in a way that is aligned with population growth and meeting the transition in the community health needs affected by demographic and epidemiological transition. This study aims to evaluate the equity of PMOH resource distribution and expansion among the different West Bank governorates during the last six years.

Study settings

Palestine consists of two geographically fragmented regions, the West Bank and Gaza Strip, with a total population of 5,483,450 Palestinians living in the State of Palestine at the mid of 2023. The estimated population of the West Bank was 3,256,906, representing 59.4% of the state of Palestine's population, of whom 1,657,974 were males and 1,598,932 were females [19]. More than one-third of the Palestinian population is less than 15 years old, constituting 35.2% of the West Bank's population, compared to 3.9% of those aged 65 years and above. The Palestinian population is characterized by high growth rates of 2.1% in the West Bank, due to high fertility rates (3.8 births per woman), and high percentage of women in the fertility age, constituting for 24.9% of the total population.

The West Bank includes eleven governorates that vary in terms of population and geography as shown in (Table 1) below. Hebron governorate, located in the south of the West Bank, is considered the largest one in terms of area and population. Nablus, located in the north is the second governorate in terms of population, while Ramallah & Al-Bireh in the middle is the third one. The total of the four governorates (Hebron, Nablus, Jenin, and Ramallah and Al-Bireh) constitutes for two-thirds of the total West Bank population (67.3%), and about 54% of the total area. Jericho and Qalqilya are considered the smallest. The table below shows the detailed percentage of population and geographical area for each governorate [17, 20].

Methods

Data sources

The data used in this study were extracted from the annual health reports produced and published annually by the Palestinian Ministry of Health. Reports for

the previous six years between 2017 and 2022 were used [21], covering the eleven governorates of the West Bank. A time-series data set (2017–2022) was used to analyze equity in the allocation of the PMoH resources across the different governorates.

Indicators and measuring tools

Given the requirements for representation, availability and consistency of similar studies [22–26], labor and capital indicators were considered important input variables in the delivery of health services. The number of health centers and beds represent the capital, and health workers represent the human resources.

The number of primary healthcare facilities and inpatient hospital beds represent the capital input measures; both variables give a solid indication of physical infrastructure and capacity of healthcare services provided by PMoH. Total employed staff represents the human resource measure, including clinical and nonclinical staff, including physicians, nurses, laboratory staff, administrative staff, and other nonclinical personnel.

The outputs analyzed in the study include metrics that reflect the utilization and efficiency of healthcare services. These output measures include the rate of primary healthcare visits to physicians and to nurses per capita, the number of hospital admissions, and the bed occupancy rate, as these variables are considered most suitable and representative variables for the volume of utilization and demand for healthcare services [27, 28]. The data were aggregated at the governorate level for each year.

Gini coefficients were calculated using R statistical software (version 4.4.2). The Gini coefficient has been identified as a superior tool for measuring inequity [29]. The Gini coefficient (G) examines the distribution of health resources and services against population size and geographic size. (G) ranges from 0 to 1; the closer the value to 0, the better the fairness; the closer the value to 1, the lesser the equity. Generally, $G < 0.2$ indicates absolute equality; 0.2–0.3, relative equality; 0.3–0.4, proper equality; 0.4–0.5, relative inequality; and above 0.5, severe inequality. The Gini coefficient is calculated using the following formula:

$$G = 1 - \sum_{i=1}^{n} (X_i + X_{i-1})(Y_i - Y_{i-1})$$

Xi: cumulative percentage of population or geography in the ith governorate.

Yi: cumulative percentage of the resource (PHC centers, beds and health workers) in the ith governorate.

Data analysis

The analysis focused on examining disparities in resource allocation and service utilization among the different governorates, as well as assessing the progress made over the six-year period using a combination of descriptive and equity-focused statistical techniques. Inputs and outputs were standardized per 10,000 population, per km^2 area, and in total numbers to facilitate the calculation of Gini coefficients.

The Gini coefficient was calculated based on the Lorenz curve, which is a graphical representation showing the cumulative proportion of resources or services across ordered institutions mapped onto the corresponding cumulative proportion of their size. Gini coefficient reflects the ratio of the area between the Lorenz curve and the diagonal line to the whole area below the 45° line. The Lorenz curve illustrates inequality in the distribution of healthcare resources. A larger area between the curve and the line of perfect equality indicates greater inequality. Gini coefficient is directly related to the Lorenz curve, as it represents the area between the Lorenz curve and the line of perfect equality.

Results

Standardized distribution of resources

Data standardization is used to compare the status of resource distribution among different governorates fairly, removing the influence of population size from analysis. Two main new variables were used here that are the number of primary health centers per 10,000 people and the number of hospital beds per 10,000 people.

We find that the largest four governorates (Hebron, Nablus, Ramallah, and Jenin) that represent about 67% of the total population, have constituted for only 32.25% of PHC centers /10,000 people, and for about 39% beds /10,000 people. We can see from (Table 2) that approximately 11.47% (1–0.8853) of the population, represented by Tubas, Qalqiliya, Salfit, and Jericho, have access to about 44.10% (1–0.5590) of the primary health centers/10,000 people. They also have access to (1–57.4%) 42.6% of the hospital beds per 10,000 people.

Growth in the distribution of health resources

Results show that growth rate in the number of hospital beds was much higher than growth rate in PHC centers. However, in both cases human resources growth rates were not aligned with the expansion of needs nor with the population growth. From another aspect, disparities in resources allocation among different governorates were noticed.

Distribution of resources at primary health care level

The total number of primary healthcare clinics in the West Bank has increased from 413 centers in the year

Table 2 Standardized distribution of PHC centers and hospital beds against population in 2022

Governorate	Population	Cumulative population	PHC centers	PHC Centers per10,00	Cumulative PHC centers per 10,000	Hospital Beds	Hospital Beds per 10,000	Cumulative beds per 10,000
Hebron	802,172	27.88%	128	1.596	8.73%	452	5.63	8.16%
Nablus	423,572	42.60%	47	1.110	14.8%	263	6.21	17.2%
Ramallah & Al Bireh	362,602	55.2%	57	1.572	23.4%	312	8.60	29.6%
Jenin	345,875	67.22%	56	1.619	32.25%	223	6.45	38.95%
Bethlehem	239,740	75.55%	28	1.168	38.63%	153	6.38	48.20%
Jerusalem*	171,020	81.49%	27	1.579	47.05%	0	0	0
Tulkarm	202,401	88.53%	32	1.581	55.90%	129	6.37	57.4%
Tubas	67,340	90.87%	12	1.782	65.64%	54	8.02	69.0%
Qalqiliya	124,332	95.19%	24	1.930	76.20%	68	5.47	77.0%
Salfit	84,000	98.11%	18	2.143	87.91%	50	5.95	85.6%
Jericho & Al Aghwar	54,289	100.00%	12	2.210	100.00%	54	9.95	100.0%

2017 to 441 centers in the year 2022. This configures about 6.8% increase rate. However, this increase was not aligned with the population growth for the same period that constituted for 11.97%. Ultimately the increase rate for the standardized ratio of PHC centers against population (PHC centers /10,000 population) was −4.63%, which indicates widening gap between population growth and the availability of primary healthcare infrastructure. As seen in (Table 3); the expansion of the standardized ratio in the PHC centers/10,000 population varied between the different governorates, ranging between 19.6% in Bethlehem governorate to -12.2% in Salfit. All governorates had negative growth rate in the number of PHC centers compared to population growth except two governorates that are Bethlehem and Jericho.

The overall growth rate in PHC centers in the West Bank compared to the constant geographical area during the investigated period reached 6.8%, but also varied widely between different governorates, ranging between zero in two governorates (Jerusalem and Salfit) to 33.3% in Bethlehem as seen in (Table 3).

Human Resources allocated for PHC (PHC- HR) have increased from 2778 personnel in the year 2017 to 2967 personnel in the year 2022, constituting for 6.8% growth rate in six-year period. When analyzing the change of the standardized ratio of human resources against population, negative rate is noticed in all governorates, but varied between different governorates ranging from −0.23 to about −9%, with an average rate of -4.61% for all West Bank (Table 3).

Distribution of resources at hospitals level

The total number of hospitals in the West Bank has also increased from 13 hospitals in the year 2017 to 17 hospitals in 2022, while the total number of inpatient beds has increased from 1483 beds to 1758 beds in 2022, corresponding to 18.5% growth rate in beds. The growth rate of hospital beds was aligned with the population growth that configured 12% as mentioned earlier. As a result, the average increase for the standardized ratio of beds to population (hospital beds/ 10,000 population) was positive this time and reached 5.8% indicating for improved coverage of beds and of hospitals beds compared to population growth.

At the same aspect, the growth rate in hospital beds/10,000 population varied widely between the different governorates (Table 4), while some governorates demonstrated excellent positive rates that are mainly; Hebron (26.5%), Ramallah (13.62%), Bethlehem (4.76%) and Tubas (9.7%), other governorates demonstrated negative growth rates especially in Salfit, Jericho and Nablus. The same applies for beds ratio to geographical area (Table 4), the overall growth rate in hospital beds/km² in the West Bank reached 18.5%, with the highest rates are in Hebron (43.5%), Ramallah (27.9%) and Tubas (22.7%).

Human Resources allocated for hospitals (Hosp-HR) have also increased from 4260 personnel in 2017 to 4645 personnel in the year 2022, constituting for 9% growth rate in six-year period (compared to 18.5% increase in beds and 11.97% population growth rate). When analyzing the growth of human resources to population ratio, negative rate is noticed in all governorates reaching −2.68% in the West Bank, (with the exception of Hebron governorate where it was 5.5%), indicating for inadequate employment rates during that period compared to population growth (Tables 5, 6, 7 and 8).

Gini coefficient for the resources' distribution variables

For each year and for each indicator used, the Lorenz Curve and corresponding Gini Coefficient were produced. In general, Gini coefficients against population size were lower than Gini coefficients against geographical area, indicating better equality in the distribution against population size compared to geographical area. Gini coefficient values against population size were less than 0.2 indicating absolute equality, where values against geographical area indicated proper equality.

Table 3 Growth rates in PHC resources standardized by population and geographical area for the years 2017–2022

Year	Standardized by population					Standardized by geographical area				
	2017		2022		Overall growth	2017		2022		Overall growth
Governorate	PHC centers /10,000	PHC_HR /10,000	PHC centers /10,000	PHC_HR /10,000	PHC centers /10,000	PHC_HR /10,000	PHC centers /km^2	PHC HR /km^2	PHC centers /km^2	PHC HR /km^2	PHC centers /km^2	PHC HR /km^2
Jenin	1.72	9.62	1.62	9.22	-5.7%	-4.2%	0.09	0.51	0.10	0.55	5.7%	7.4%
Tubas	1.83	23.26	1.78	21.83	-2.5%	-6.2%	0.03	0.34	0.03	0.36	9.1%	5.0%
Tulkarm	1.69	12.28	1.58	12.25	-6.6%	-0.23%	0.13	0.91	0.13	1.01	3.2%	10.2%
Nablus	1.14	7.93	1.11	7.74	-2.3%	-2.3%	0.07	0.51	0.08	0.55	6.8%	6.8%
Qalqiliya	2.03	14.04	1.93	12.79	-5.0%	-8.9%	0.13	0.92	0.15	0.96	9.1%	4.6%
Salfit	2.44	18.57	2.14	16.90	-12.2%	-9.0%	0.09	0.67	0.09	0.69	0.0%	3.6%
Ramallah & Al Bireh	1.74	10.65	1.57	9.65	-9.6%	-9.3%	0.07	0.40	0.07	0.41	1.8%	2.0%
Jericho & Al Aghwar	2.00	21.20	2.21	20.26	10.5%	-4.4%	0.02	0.18	0.02	0.19	20.0%	3.8%
Jerusalem	1.75	10.69	1.58	10.64	-9.8%	-0.47%	0.08	0.47	0.08	0.52	0.00%	10.3%
Bethlehem	0.98	9.16	1.17	8.80	19.6%	-3.9%	0.03	0.30	0.04	0.32	33.3%	7.1%
Hebron	1.70	10.03	1.60	9.61	-6.0%	-4.2%	0.12	0.71	0.13	0.77	6.7%	8.7%
West Bank	**1.61**	**10.81**	**1.53**	**10.31**	**-4.63%**	**-4.61%**	**0.07**	**0.49**	**0.08**	**0.52**	**6.8%**	**6.8%**

From 2017 to 2022, the distribution of primary healthcare centers and human resources working at PHC showed good equality as indicated in low Gini coefficient values, with minor fluctuations during the six-year period. Comparing the allocation of resources by population (per 10,000 population) to allocation by geographical area (per kilometer square), equality in allocation by population was higher as indicated by the Gini coefficients approaching more equitable levels. Lorenz curve graphs, as well as Genin coefficient values, clearly indicate that inequalities in human resources allocation were relatively the most evident, especially in hospitals sector.

In the last two years, 2021 and 2022, and with the increase in the number of PHC centers and hospital beds in some governorates, slight improvement in equality of the distribution of PHC centers and number of beds are noticed as indicated by the Gini coefficients approaching the more equitable levels (Figs. 1, 2 and 3).

Services utilization indicators

A declining trend in healthcare services utilization tend is noticed at both PHC and hospitals levels. The reduction in hospitals utilization was higher compared to PHC utilization indicators. This decline is mainly noticed during the years 2020 and 2021 that could be attributed to COVID-19 pandemic and associated social and health restrictions. Disparities in utilization rates between different governorates are highly noticeable at both PHC and hospitals levels.

Regarding the PHC visits for doctors and nurses, a noticeable decrease in the number of visits is seen during the investigated period. The total number of physicians' visits has decreased by 1.87%, while the nurse visits have decreased by 8.71%. The variation in the total number of visits during the mentioned years varied clearly. While Jerusalem and Jenin governorates witnessed clear increase in the numbers of physician visits with 12.6% and 7.2%, respectively, Jericho, Tulkarem and Ramallah witnessed a dramatic decrease of 17.6%, 14.5%, and 14.4%, respectively.

When analysing the variations of patients' visits per physician, a negative trend is also seen in almost all governorates. The rate of visits per physician has decreased by -12.9% in the West Bank, with the highest noticeable decrease rates in Ramallah, Jericho and Tulkarem governorates, while Jerusalem was the only one that witnesses slight increase of 1.6%. Disparities between governorates are also seen in the utilization of nurse visits, while Jerusalem and Bethlehem governorates witnessed noticeable increase in the number and rate of nurse visits during the investigated period, all other governorates witnessed a noticeable decreasing trend with variable rates.

Regarding the hospital utilization indicators, noticeable decrease in standardized population ratios of total

Table 4 Growth rates in hospital resources standardized by population and geographical area for the years 2017–2022

Year	Standardized by population						Standardized by geographical area					
	2017		2022		Overall change		2017		2022		Overall change	
Governorate	Beds/ 10,000	Hosp-HR/ 10,000	Beds/ 10,000	Hosp-HR/ 10,000	beds/ 10,000	Hosp-HR/ 10,000	Beds / km^2	Hosp-HR/ km^2	Beds/ km^2	Hosp-HR/ km^2	beds/ km^2	Hosp-HR/ km^2
Jenin	6.71	13.38	6.45	12.52	-3.87%	-6.45%	0.35	0.71	0.38	0.74	7.7%	4.84%
Tubas	7.31	25.42	8.02	25.10	9.69%	-1.28%	0.11	0.37	0.13	0.41	22.7%	10.46%
Tulkarm	6.60	18.67	6.37	18.38	-3.50%	-1.54%	0.49	1.39	0.52	1.51	6.6%	8.77%
Nablus	6.59	19.24	6.21	18.65	-5.71%	-3.06%	0.43	1.24	0.44	1.32	3.1%	6.04%
Qalqilya	5.73	20.70	5.47	18.02	-4.52%	-12.9%	0.38	1.36	0.41	1.36	9.7%	0.00%
Salfit	6.78	29.01	5.95	25.60	-12.2%	-11.8%	0.24	1.05	0.24	1.05	0.0%	0.47%
Ramallah & Al Bireh	7.57	21.82	8.60	21.76	13.62%	-0.27%	0.29	0.82	0.36	0.92	27.9%	12.23%
Jericho & Al Aghwar	10.80	40.60	9.95	38.31	-7.90%	-5.63%	0.09	0.34	0.09	0.35	0.0%	2.46%
Jerusalem	0	0	0	0	0	0	0	0	0	0	0	0
Bethlehem	6.09	18.37	6.38	16.94	4.76%	-7.80%	0.20	0.60	0.23	0.62	16.8%	2.78%
Hebron	4.46	12.28	5.63	12.95	26.47%	5.50%	0.32	0.87	0.45	1.04	43.5%	19.70%
West Bank	**5.77**	**16.58**	**6.11**	**16.14**	**5.87%**	**-2.62%**	**0.26**	**0.75**	**0.31**	**0.82**	**18.5%**	**9.04%**

Table 5 Gini coefficient for input variables for PHC and hospitals 2017–2022

Gini Coefficient	Year	Primary Health Care Sector		Hospitals Sector	
		PHC centers	Human Resources	No. of Beds	Human Resources
Population size	2017	0.099	0.126	0.111	0.158
	2018	0.098	0.124	0.096	0.162
	2019	0.098	0.124	0.100	0.159
	2020	0.098	0.124	0.109	0.154
	2021	0.085	0.124	0.078	0.164
	2022	0.084	0.119	0.081	0.144
Geographical size	2017	0.285	0.228	0.226	0.213
	2018	0.278	0.230	0.226	0.210
	2019	0.278	0.230	0.226	0.211
	2020	0.278	0.234	0.224	0.206
	2021	0.273	0.230	0.235	0.210
	2022	0.274	0.234	0.218	0.216

admissions and occupancy rates over the last six years is noticed with 11.8% and 9.2% respectively at the West Bank level. At the governorate level, disparities are still seen. The negative (or the decrease) trend is still prominent except in Bethlehem governorate where 61.4% increase was observed in the total admissions in 2022 compared to 2017, and in Tubas governorate that witnessed 22.7% increase and Jenin with 3.1% increase in admissions. When analysing admissions to population ratio (admissions/10,000 population), Tubas and Bethlehem also where the only governorates that showed large positive increase during the investigated period, while other governorates showed negative trend with various values ranging from 26.9% decrease in Nablus to 8.03% decrease in Jenin.

Also, disparities were noticed clearly in the bed occupancy rates trends, where some governorates recorded clear positive increase in occupancy rates like Tubas (19.4%), Jenin (15.8%) and Nablus (14.9%). While other governorates recorded clear negative trend (decrease) in occupancy rates like Hebron (-21.8%) and Ramallah (-18.6%).

Gini coefficient for service utilization indicators

In general, The Gini coefficients for service utilization indicators were very low, indicating for absolute equality (less than 0.2). The year 2020 had the highest relative value of Gini coefficient at both PHC and hospitals levels, that could be related to COVID-19 pandemic at that year.

Discussion

This study analyzes the governmental hospital and primary care sectors in the West Bank in terms of health resource distribution, services utilization and expansion. The results show that more efforts have been

Table 6 Growth rates in the utilization variables for PHC services during the years 2017–2022

Year	2017		2022		Six-years change for the rates of visits for physicians		2017		2022		Six-years change for the rates of visits for nurses	
Governorate	Visits for Physician	Rate of Visits for Physician	Visits for Physician	Rate of Visits for Physician	Visits for Physician	Rate of Visits for Physician	Visits for Nurse	Rate of Visits for Nurse	Visits for Nurse	Rate of Visits for Nurse/ person	Visits for Nurse	Rate of Visits for Nurse
Jenin	273,861	0.89	293,681	0.85	7.2%	-4.3%	277,255	0.90	240,880	0.70	-13.1%	-22.5%
Tubas	114,763	1.91	113,086	1.68	-1.5%	-11.9%	92,376	1.53	70,019	1.04	-24.2%	-32.3%
Tulkarm	201,318	1.10	172,189	0.85	-14.5%	-22.6%	238,445	1.30	206,989	1.02	-13.2%	-21.4%
Nablus	302,817	0.78	306,317	0.72	1.2%	-7.5%	318,503	0.82	246,570	0.58	-22.6%	-29.2%
Qalqiliya	147,616	1.36	141,978	1.14	-3.8%	-16.3%	172,832	1.60	150,593	1.21	-12.9%	-24.1%
Salfit	89,711	1.22	92,824	1.11	3.5%	-9.1%	91,360	1.24	90,374	1.08	-1.1%	-13.1%
Ramallah & Al Bireh	283,217	0.88	242,385	0.67	-14.4%	-24.0%	304,783	0.95	204,624	0.56	-32.9%	-40.3%
Jericho & Al Aghwar	47,140	0.94	38,829	0.72	-17.6%	-24.1%	34,742	0.69	32,987	0.61	-5.1%	-12.5%
Jerusalem	106,564	0.69	119,963	0.70	12.6%	1.581%	79,922	0.52	106,829	0.62	33.7%	20.6%
Bethlehem	145,825	0.68	147,832	0.62	1.4%	-9.1%	98,972	0.46	155,804	0.65	57.4%	41.2%
Hebron	670,829	0.95	669,982	0.84	-0.1%	-12.0%	662,008	0.94	659,029	0.82	-0.4%	-12.3%
West Bank	**2,383,661**	**0.93**	**2,339,066**	**0.81**	**-1.87%**	**-12.9%**	**2,371,198**	**0.92**	**2,164,698**	**0.75**	**-8.71%**	**-18.5%**

concentrated on improving hospital services and expanding hospital beds capacity compared to PHC centers. The growth rates in the hospital sector for beds and staffing exceeded those in PHC in both facility and staffing aspects. While the number of primary healthcare clinics has increased by 6.8%, the total number of hospital beds increased by 18.5%, nearly three times growth rate of PHC facilities. Four new hospitals have been established within the investigated period, raising the total number of governmental hospitals from 13 to 17 hospitals, which constitutes for about 30% increase rate. This trend might be attributed to the PMoH policies of investing in hospitals sector aiming to minimize services purchasing from the private sector and rationalize expenditure [18].

The literature suggests that strengthening primary health care system is the recommended approach, especially in low- and middle-income countries, for improving health access and achieving universal health coverage [30–32]. Strategies to implement equity-oriented PHC services include enhanced effectiveness of services, enhanced continuity of care at different levels, and improved 'fit' between people's needs and services [33, 34]. In the Palestinian context, more efforts are needed to promote primary healthcare services capacity and equity [35, 36]. Geographical expansion of PHC centers and strengthening primary care delivery approach will promote health equity and universal coverage through ensuring better access for vulnerable groups and meeting rapid population growth rates. It will also contribute to lowering incidence and morbidity rates of non-communicable diseases through strengthening preventive care, early detection, and healthier lifestyle as parts of primary healthcare services, and accordingly contribute to reducing need for specialized hospital care and referrals outside PMOH facilities and outside the country.

Regarding the human resources allocation, results have shown that growth rates in human resources employment were not aligned with facility expansion rates. Investment in health workforce is considered a key issue for promoting health equity through the consideration of size, distribution and competencies issues [37, 38].

From another perspective, both PHC and hospitals sector witnessed a clear decline in the utilization rates. This could be due attributed to several factors including COVID-19 pandemic in the years 2020–2021, shortages in medications in PMOH centers during the last two years due to governmental financial crisis, and the reduced workload in some hospitals associated with the opening of new ones. During COVID-19 pandemic, people were asked to minimize their movement and health care visits, elective surgeries were postponed and delayed for several months, PHC centers were working with minimum package of services whereby hundreds of health workers have been assigned to work in temporarily

Table 7 Growth rates in the utilization variables for hospitals during the years 2017–2022

Year	2017		2022		Six-years change for the hospital's admissions		2017	2022	Six-years change in occupancy rate
Governorate	Total hospitals admissions	Admissions /10,000	Total hospitals admissions	Admissions /10,000	Total hospital admissions	Admissions /10,000	Bed Occupancy Rate	Bed Occupancy Rate	Bed Occupancy Rate
Jenin	27,621	894.99	28,471	823.16	3.1%	-8.03%	76.67	88.77	15.78%
Tubas	5,777	959.86	7,091	1053.01	22.7%	9.71%	73.74	88.08	19.45%
Tulkarm	17,219	939.88	15,796	780.43	-8.3%	-16.96%	83.86	83.61	-0.30%
Nablus	44,016	1136.66	35,208	831.22	-20.0%	-26.87%	91.51	105.11	14.86%
Qalqiliya	12,154	1122.94	11,099	892.69	-8.7%	-20.50%	94.75	91.14	-3.81%
Salfit	8,622	1168.99	7,941	945.36	-7.9%	-19.13%	89.79	89.64	-0.17%
Ramallah & Al Bireh	36,453	1131.40	36,577	1008.74	0.3%	-10.84%	99.59	81.03	-18.63%
Jericho & Al Aghwar	8,316	1663.13	7,038	1296.40	-15.4%	-22.05%	76.83	80.11	4.27%
Jerusalem	0	0	0	0	0	0	0	0	0
Bethlehem	17,709	823.49	28,588	1192.46	61.4%	44.80%	94.02	82.20	-12.58%
Hebron	66,958	947.05	63,863	796.13	-4.6%	-15.94%	99.08	77.52	-21.76%
West Bank	**244,845**	**952.77**	**241,672**	**839.91**	**-1.3%**	**-11.85%**	**97.03**	**88.10**	**-9.20%**

Table 8 Gini coefficient for output variables for PHC and hospitals 2017–2022

Year	2017	2018	2019	2020	2021	2022
(G) for the rate of PHC visits for physician	0.11	0.105	0.104	0.136	0.105	0.100
(G) for the number of hospital admissions	0.070	0.064	0.066	0.078	0.079	0.075
(G) for the bed occupancy rate	0.049	0.036	0.043	0.091	0.020	0.056

opened COVID centers or in COVID vaccination campaigns [39, 40]. The drop in PHC services utilization during 2020 and 2021 is noticeable. Hebron governorate which is actually the largest one in terms of population and area, has also recorded the highest growth rates in hospital resources. This is mainly because two new hospitals have been operational in the end of 2021 that have greatly contributed to increased number of beds, and indirectly improved rates of occupancy rates in the year 2022 as workload is decreasing [17].

Disparities between different governorates are noticeable in terms of resources distribution, services growth rate and service utilization. At PHC level, some governorates didn't witness any change in the number of PHC centers (Salfit and Jerusalem), while others recorded very minor change that only one center was added (Ramallah, Tulkarm and Tubas), only two governorates recorded reasonable positive growth rates (Jericho and Bethlehem). The same applies for human resources growth which varied obviously between different governorates. While some governorates showed minimum or no change in PHC centers, they showed good increase in PHC staffing as in the case of Jerusalem governorate. This illustrates the incoherent distribution of different resources and inconsistent planning for service expansion. The same applies for hospital sector growth rates which varied widely between different governorates, the growth rate in the number of beds wasn't consistent with parallel increase rates in staffing.

The Gini coefficient (G) reflected high equality of the distribution of resources among different governorates. The (G) values reflected better equality by population compared to geographical area, corresponding to more disparities in the geographical distribution of resources among different governorates, such findings are aligned with similar studies carried out in China where geographical equality was much less than population equality [23, 25, 41], where most resources planning programs in China are used to consider population size rather than geographical dimension [26]. However, the situation is Palestine is different where most resources planning activities consider both population needs and geographical dimension due to the complicated geopolitical dimension and its impact on healthcare accessibility [14]. From another aspect, although the values of (G) indicated for absolute or proper equality of distribution of resources, it does not reflect the adequacy of these resources nor the efficiency.

The variations in the number of primary healthcare centers per square kilometer are obvious among different governorates ranging from 0.02 in Jericho and 0.03 in Tubas to 0.15 in Qalqilya and 0.13 in Hebron and Tulkarm. Also, the variations in the number of hospital beds among different geographical governorates were evident ranging from 0.09 in Jericho to 0.52 beds/km^2 in Tulkarm.

The findings suggest that high equality in health resource allocation is achieved from population-based

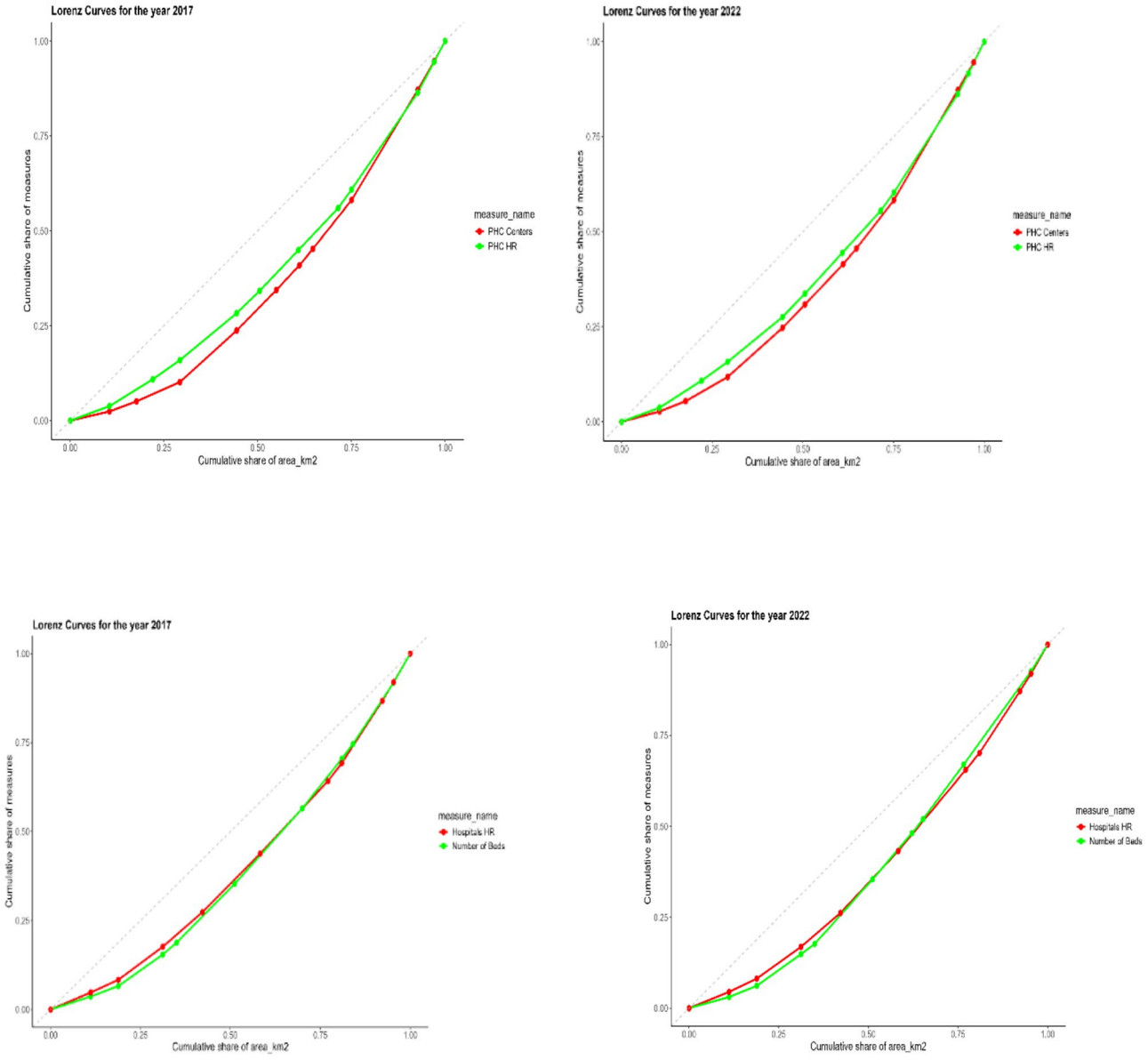

Fig. 1 Lorenz Curves for hospitals and PHC input variables by geographical area for the years 2017 and 2022

perspective. Population-based resource allocation has been considered an effective and efficient approach for health planning that is used to address differences in population needs to promote equity and efficiency in both health outcomes and the distribution of resources [42, 43]. The successful implementation of population-based or population needs-based model in resources allocation should be clearly adopted as a comprehensive health planning model, and should include detailed demographic analysis and projection, holistic assessment of needs, alignment with national policy goals and regional or local policies, and the implementation of strong governance and monitoring mechanisms [43]. Population-based resources allocation planning and funding approaches are regarded as an essential policy for successful decentralization process since they help to ensure that allocation of healthcare resources is responsive to variation in regional/local population profiles [43]. In the Palestinian case, where centralized financing and planning system is adopted, still population-based resource allocation is beneficial to enhance equity and efficiency but should be implemented in more technical and systematic manner. However, effective planning or reform efforts should consider all service provision levels in Palestine, primary healthcare and hospitals. Reform initiatives in Palestine should be based on holistic approach of health system strengthening and addressing socioeconomic determinants of health. Comprehensive

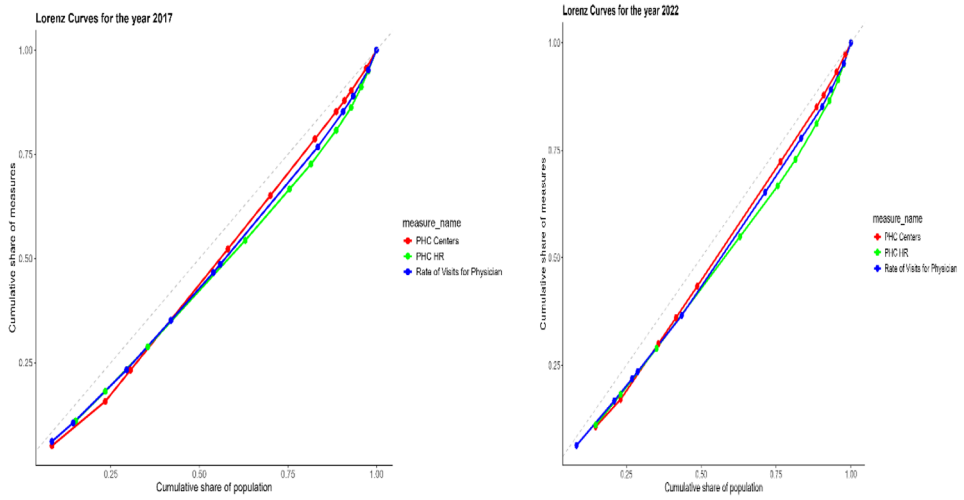

Fig. 2 Lorenz Curves for PHC variables by population size for the years 2017 and 2022

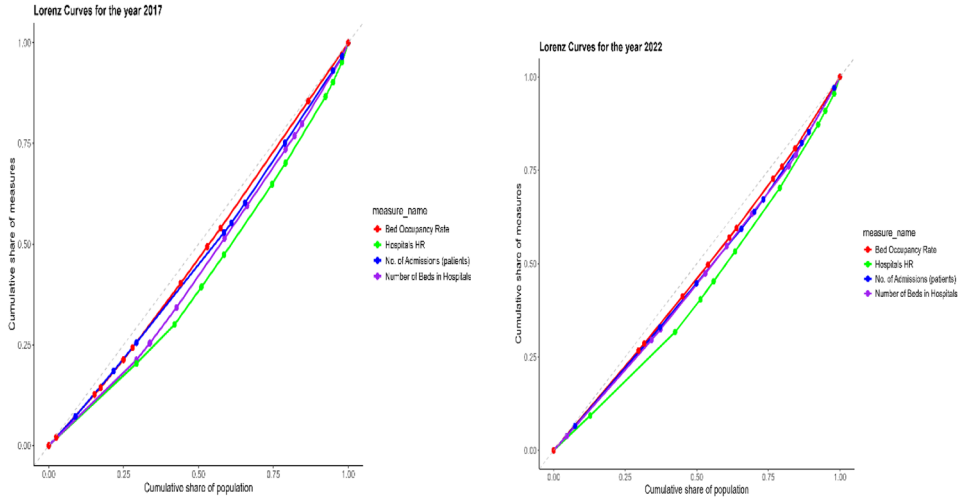

Fig. 3 Lorenz Curves for hospital variables by population size for the years 2017 and 2022

equity-oriented approach is more efficient and effective to promote equitable resources allocation and equitable health access [44, 45].

Although Gini coefficient values have reflected fair equality in healthcare distribution, it doesn't reflect any specifics about the adequacy of resources in each governorate or capture other health care access aspects like traveling time or socio-economic conditions that play a significant role in healthcare access aside from that. The issue of insufficient resources has been frequently raised in literature [46, 47], the number of hospital beds per population is considered low compared to nearby countries like 14.7 beds/10,000 population in Jordan, and 21.5 in Saudi Arabia [48], or compared to global rates like 29.9 in Turkey, 31.8 in Italy, 60 in France and 50 in China [49]. In the same aspect, the shortages in hospital beds and specialized healthcare in the governmental sector have contributed to the huge financial burden of the service purchasing system through referring patients for treatment outside MOH hospitals [14, 18]. The shortage in specialized health workforce in the governmental sector has also been stated [18, 50], health workers are facing several challenges including difficulties accessing their workplaces due to movement restrictions, high workload and shortages in resources, absence of any motivation system or professional development system [51–55].

Healthcare provision system in the West Bank is highly complicated by the challenging geopolitical context in the Palestinian territories, due to ongoing Israeli occupation and its imposed barriers for free movement between different geographical localities. These barriers include checkpoints; closure between cities and nearby villages, and other physical barriers that affects free patients' movement and free health access, in addition to the bureaucratic and administrative permits requirements for accessing East Jerusalem hospitals. Because of

different access barriers, MoH has been adopting several policies to overcome these barriers, including strengthening primary healthcare services, opening emergency centers in vulnerable areas, investment in local hospital services and expansion of MOH hospitals [14, 18]. However, the finding of this study indicate that MoH efforts were more concentrated on hospitals sector rather than PHC centers in terms of infrastructural expansion and staffing.

Limitations

This study analysed a 6-year trend in the change of equality of health resources and health services. The indicators selected in this study were restricted by the availability of data, financial resources were not considered due to the lack of data about financial allocations per each hospital or governorate.

Although indicators used are consistent with other studies, they may not be comprehensive enough to reflect the entire picture of inequality in health resources and health services. For example, neither inequalities in hospital inpatient care between different hospitals were considered in this study, nor inequalities in PHC services between different PHC centers' levels.

From another perspective, the study did not consider the impact of such disparities in service provision on health outcomes or clinical outcomes. Analysing the health impact of these disparities might be a significant issue to consider for future research.

Conclusion

By offering a data-driven perspective, this research offers valuable insights for policymakers and health planners seeking to build a more just and resilient healthcare system. This study provides empirical evidence on the equity of Palestinian healthcare services provision and distribution based on reliable data. The results confirm the existence of disparities in the distribution, expansion and utilization of governmental healthcare services across different governorates.

Reform initiatives in Palestine should be based on holistic approach to health system strengthening, addressing socioeconomic determinants of health, and incorporating strengthening and expansion of healthcare services delivery at different levels to ensure equitable geographical accessibility, and aligning workforce development with infrastructure expansion. A comprehensive equity-focused reform strategy is essential, one that ensures equitable resources allocation and access to healthcare at both the hospitals and primary healthcare levels. This should be based on an evidence-based gap analysis and community needs assessments.

Supplementary Information

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Supplementary Material 1

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Author contributions

O. A.: conceived the study, analyzed data, and prepared the manuscript. A. I.: supervised the study conception and design. Both authors contributed significantly to the data interpretation and agreed on the final revision of the manuscript.

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Data availability

The source of the data used within the manuscript are openly available at the Palestinian Ministry of Health website, https://site.moh.ps/index/Books/BookType/2/Language/ar.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Research Ethic Committee of Al-Quds University (REF number: 05/ 2023).

Competing interests

The authors declare no competing interests.

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