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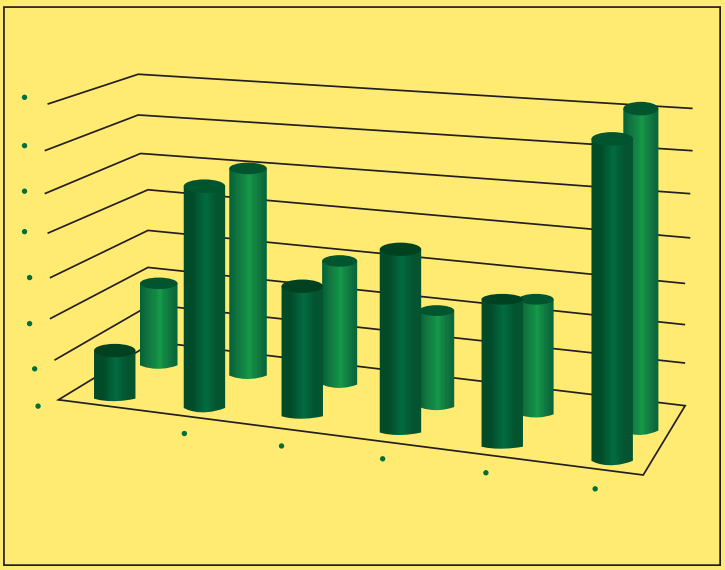

العدد رقم 27

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ISSN 2522-64X (Online), ISSN 2519-948X (Print)

مجلة العلوم الإحصائية

No. 27 Sep. 2025

مجلة العلوم الإحصائية

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شروط النشر في مجلة العلوم الإحصائية

1 – تنشر المجلة البحوث والدراسات العلمية في المجالات الإحصائية والمعلوماتية المكتوبة باللغة العربية والانكليزية والفرنسية على أن لا يكون البحث المقدم للنشر قد نشر او قدم للنشر في مجلات او دوريات أخرى او قدم ونشر في دوريات لمؤتمرات أو ندوات.

2 – ترسل البحوث والدراسات الى أمين التحرير على أن تتضمن اسم الباحث او الباحثين وألقابهم العلمية وأماكن عملهم مع ذكر عنوان المراسلة وأرقام الهواتف والبريد الالكتروني. وان يرسل البحث المراد نشره الكترونيا (على قرص او بالبريد الالكتروني) وفق المواصفات أدناه:

أ – أن يكون مطبوعاً على ورق حجم A4 وان يكون على شكل عمود واحد ويستخدم للغة العربية نوع حرف (Simplified Arabic) و(Times New Roman) للإنجليزية والفرنسية وبحجم خط (12). وباستخدام Microsoft Word وعلى وجه واحد للورقة.

ب – الهامش مسافة 2.5 سم لجميع جوانب الورقة.

ج – يرفق الباحث ملخصاً عن بحثه باللغتين العربية والانجليزية والفرنسية بما لا يزيد عن صفحة واحدة.

د - يتم الإشارة الى المصادر العلمية في متن البحث وفي نهايته، مع مراعاة أن لا يتضمن البحث سوى المصادر التي تم الإشارة إليها في المتن ووفق الأصول المعتمدة في ذلك (اسم المؤلف، سنة النشر، عنوان المصدر، دار النشر، البلد).

هـ– ترقم الجداول والرسوم التوضيحية وغيرها حسب ورودها في البحث، كما توثق المستعارة منها بالمصادر الأصلية.

و– أن لا يزيد عدد صفحات البحث اوالدراسة عن (25) صفحة.

3 – يتم إشعار الباحث باستلام بحثه خلال مدة لا تتجاوز يومين عمل من تاريخ استلام البحث.

4 – تخضع كافة البحوث المرسلة الى المجلة للتقييم العلمي الموضوعي ويبلغ الباحث بالتقييم والتعديلات المقترحة إن وجدت خلال مدة لا تتجاوز اسبوعان من تاريخ استلام البحث.

5 – لهيئة تحرير المجلة الحق في قبول او رفض البحث ولها الحق في إجراء أي تعديل او إعادة صياغة جزئية للمواد المقدمة للنشر بما يتماشى والنسق المعتمد في النشر لديها بعد موافقة الباحث.

6 – يصبح البحث المنشور ملكاً للمجلة ولا يجوز إعادة نشره في أماكن أخرى.

7 – تعبر المواد المنشورة بالمجلة عن آراء أصحابها، ولا تعكس وجهة نظر المجلة او المعهد العربي للتدريب والبحوث الإحصائية.

8 – ترسل البحوث على العنوان الالكتروني للمجلة:

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Hospital Bed Distribution Inequalities Among Regions in Comparison to Population Size in Saudi Arabia

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تاريخ استلام البحث: 2025/07/18
تاريخ قبول البحوث: 2025/08/18
نشر البحث في العدد السابع والعشرين: سبتمبر / ايلول 2025

رمز التصنيف ديوي / النسخة الالكترونية (Online): 2522-64X/614.793
رمز التصنيف ديوي / النسخة الورقية (Print): 2519-948X/614.793

Hospital Bed Distribution Inequalities Among Regions in Comparison to Population Size in Saudi Arabia

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Abstract

Access to adequate healthcare significantly impacts the quality of life. Hospital bed indicators are crucial for assessing health service policies. This study evaluates hospital bed distribution inequalities among regions in Saudi Arabia in comparison to population size from 2015 to 2022.

Methods

Data from 2015-2022 were retrieved from the Health Statistical Yearbook published by the Ministry of Health (MOH). A cross-sectional study design was employed. The Lorenz curve and Gini index were used to measure bed distribution inequality. Pearson's correlation assessed the relationship between population changes and hospital bed numbers.

Results:

A strong positive correlation existed between population and private hospital beds in Riyadh, Ha'il, Al-Jouf, and Najran. Regions like Madinah, Qaseem, Al-Bahah, and the Eastern region showed a negative correlation. The mean Gini index was 0.3 for the public sector and 0.52 for the private sector. Saudi Arabia had an average bed rate of 2.5 per 1,000 population. Owing to its distinct position as a hub for religious tourism, the Makkah region stood out being the only region with a negative correlation in both public and private beds.

Conclusion:

Disparities in hospital bed allocations are more pronounced in the private sector. Policymakers should address these inequalities to align with Saudi Arabia's Vision 2030 goals.

Keywords: Hospital beds, Gini index, Healthcare inequality, Healthcare Access, Lorenz curve

الملخص

يُعد الوصول إلى الرعاية الصحية الكافية عاملاً مؤثراً بشكل كبير في جودة الحياة. وتُعد مؤشرات أسرّة المستشفيات أداة حيوية لتقييم سياسات الخدمات الصحية. تهدف هذه الدراسة إلى تقييم التفاوت في توزيع أسرّة المستشفيات بين مناطق المملكة العربية السعودية، مقارنة بعدد السكان، خلال الفترة من عام 2015 إلى 2022.

المنهجية
تم الحصول على البيانات للفترة من 2015 إلى 2022 من الكتاب الإحصائي السنوي الصادر عن وزارة الصحة. استخدمت الدراسة تصميمًا مقطعياً. تم قياس التفاوت في توزيع الأسرّة باستخدام منحنى لورنز ومعامل جيني، كما تم استخدام معامل ارتباط بيرسون لتقييم العلاقة بين التغير السكاني وعدد أسرّة المستشفيات.
النتائج
أظهرت منطقة الرياض، وحائل، والجوف، ونجران علاقة ارتباط إيجابية قوية بين عدد السكان وعدد أسرّة المستشفيات الخاصة. في المقابل، أظهرت مناطق مثل المدينة المنورة، والقصيم، والباحة، والمنطقة الشرقية علاقة ارتباط سلبية. بلغ متوسط معامل جيني 0.3 للقطاع العام، و0.52 للقطاع الخاص. وبلغ متوسط عدد الأسرّة في المملكة 2.5 لكل 1000 نسمة. وتميّزت منطقة مكة المكرمة، نظراً لمكانتها كمركز للسياحة الدينية، بكونها المنطقة الوحيدة التي سجلت ارتباطاً سلبياً في كل من القطاعين العام والخاص.
الاستنتاج
التفاوت في توزيع أسرّة المستشفيات أكثر وضوحاً في القطاع الخاص. ينبغي على صانعي السياسات معالجة هذه التفاوتات بما يتماشى مع أهداف رؤية المملكة 2030.

Hospital Bed Distribution Inequalities Among Regions in Comparison to Population Size in Saudi Arabia

Introduction

Access to adequate healthcare is a fundamental right and significantly impacts the quality of life.[1] One of the critical measures of a healthcare system's effectiveness is the availability of hospital beds per capita, which directly affects the system’s capacity to provide necessary care.[2] In Saudi Arabia, the healthcare system is a dual structure composed of public and private sectors. The public sector, primarily operated by the Ministry of Health (MOH) and includes governmental hospitals as well, provides free healthcare services to citizens, while the private sector although regulated by the MOH caters to both citizens and expatriates.[3] Despite the efforts to ensure comprehensive healthcare coverage, disparities in the allocation of resources can lead to unequal access to healthcare services across different regions.[4]

Over the past few decades, the Saudi healthcare system has experienced substantial transformations driven by government initiatives focused on improving citizen well-being and enhancing medical services.[5] One of the aspects of these initiatives has been the expansion and equitable distribution of healthcare services. Despite significant progress, regional disparities in hospital bed allocation remain a persistent issue, which

hinders equitable access to healthcare resources. The Vision 2030 program, launched in 2016, aims to position Saudi Arabia among the leading nations in healthcare provision by enhancing the quality and ease of access of healthcare services.[6] Expanding hospital bed capacity and ensuring its equitable distribution are central to achieving these ambitious targets. However, the growing demand for specialized medical services and existing regional disparities present substantial challenges to these goals.[7] In 2022, Saudi Arabia had a total of 78,440 hospital beds, with 77.3% allocated to the public sector and 22.7% to the private sector. Despite the overall increase in the number of hospital beds, their distribution across the country's 13 regions remains uneven.

The findings from this study have important implications for the future of healthcare provision in Saudi Arabia. The analysis of hospital bed distribution, coupled with population and geographical data, provides a nuanced understanding of how healthcare resources are allocated and highlights the persistent regional inequalities that need to be addressed.[8]

The primary aim of this study is to examine hospital bed distribution in Saudi Arabia from 2015 to 2022, identifying inequalities in public and private sectors. It uses the Gini Index and lorenz curve to assess inequality. The reported findings can guide policymakers in improving resource allocation and achieving Vision 2030 objectives. Addressing these inequalities can help the Kingdom of Saudi Arabia achieve healthcare goals and ensure equitable access to essential services for all citizens.

Methods

This quantitative research uses a cross-sectional study design to evaluate hospital bed distribution in Saudi Arabia from 2015 to 2022. Data on the number of hospital beds and population were retrieved from the annual Statistical Yearbooks published by General Authority for Statistics (GASTAT) and the MOH. The study period was chosen to capture trends over a significant period, providing a comprehensive view of changes in hospital bed distribution.

Statistical analyses were performed using IBM SPSS and. The hospital bed rate per 1,000 population was calculated for each region, this rate is a standard metric used to compare healthcare capacity relative to population size. Additionally, the theoretical optimal number of hospital

beds was calculated based on population. Pearson's correlation coefficient was used to assess the relationship between population changes and hospital bed numbers. To measure inequality in hospital bed distribution, the Lorenz curve and Gini index, which are typically used to measure income inequality, were employed. The Lorenz curve plots the cumulative percentage of beds against the cumulative percentage of the population, while the Gini index quantifies the degree of inequality. A Gini index of 0 represents perfect equality, whereas a Gini index of 1 indicates maximum inequality.

Results

Table 1 presents descriptive statistics of population, beds, and bed rates in Saudi Arabia from 2015 to 2022. The population steadily increased across all 13 regions. The number of beds and beds per 1,000 population also showed an upward trend. The rate of change in the population was 7.9%, while public bed numbers increased by 15% and private beds by 7% when comparing 2015 and 2022 data (Shown in Table 2). It is obvious that there is a higher increase rate in the number of hospital beds than the increase rate of population that helped to raise the number of beds per 1000 of population.

The distribution of hospital beds varied significantly across regions. Regions such as Riyadh and Makkah, which have large urban centers, had the highest number of beds. In contrast, regions like Al-Bahah and Najran had fewer beds, reflecting disparities in resource allocation in relation to population in the region. Overall, regions with a population of less than one million have private sector beds which range from 0 to 270 beds in the region.

The percentage of private beds in each region varied from 2015 to 2022 (Shown in Table 3). The general trend showed an increase in public beds and a slight decrease in the ratio of private beds. Despite some regions experiencing an increase in private beds, others like Riyadh, Tabouk, Ha'il, and Najran experienced a decrease.

The optimal number of beds for 2022 was calculated based on population projections. Table 4 shows the disparity from the optimal number of beds. In 2015, six regions had fewer beds than optimal, while in 2022, only four regions were below the optimal number. Disparities ranged from -19.63% in Jazan to 60.24% in the Northern region. These findings highlight the need for targeted interventions to address regional

disparities. As for the private sector the regions that had numbers below the optimal number were 10, which was unchanged between 2015 and 2022.

Pearson's correlation coefficient was used to assess the relationship between population changes and hospital bed numbers. The majority of regions had a high to moderate degree of correlation between all beds and population, and between public beds and population. Although private bed and population correlations were weak or moderate in the majority of regions, even negative in some regions as well (Shown in Table 5). A strong positive correlation existed between population and private hospital beds in Riyadh, Ha'il, Al-Jouf, and Najran. Regions like Madinah, Qaseem, Al-Bahah, and the Eastern region showed a negative correlation. Makkah, due to its unique status as a religious tourism center, was an outlier with a negative correlation for both public and private hospital beds.

Table 6 provides a summary of the public and private sector Gini indices that were calculated. The Lorenz curve and Gini index were used to measure inequality in hospital bed distribution. The mean Gini index was 0.3 for the public sector and 0.52 for the private sector. These values indicate moderate inequality in the public sector and significant inequality in the private sector. The Gini index has increased for both the public beds and for public and private beds altogether. The public bed Gini index increased by 1.88%, while the public and private index increased by 3.54%. lower gini index scores are an indicator of equality since the closer the Gini index is to 0, the better the equality (Shown in Table 7). While the Lorenz curve is a visualization of the Gini index where a larger curve further from the perfect line of 0.0 indicates a larger disparity in equality between the variables. In the case of public and private beds, the Lorenz curve was not noticeably changed across the years included in the study and the most recent curve for private beds in 2022 is shown in Figure 8 illustrating the degree of inequality. The change in Gini index variance across all Saudi regions was insignificant.

Discussion

The aim of the study was to evaluate the distribution of beds across all 13 administrative regions of Saudi Arabia and to assess the inequalities in distribution within the public and private sectors, and the study found

notable findings showcasing the difference between the public and private sectors within the kingdom and in comparison, to other countries.

The findings of this study reveal significant disparities in hospital bed distribution across different regions in Saudi Arabia, with these disparities being more pronounced in the private sector. Economic factors and healthcare policies heavily influence the allocation of resources, leading to unequal access to hospital beds. The study shows that regions with higher populations, such as Riyadh and Makkah, have a higher number of hospital beds, particularly in the private sector. This trend is likely driven by economic activity and urbanization, which attract more private investment in healthcare facilities. In contrast, less developed regions like Al-Bahah and Najran have fewer hospital beds, reflecting economic disparities and lower healthcare investments.

The Kingdom of Saudi Arabia has a Gross National Income (GNI) per capita of $27,680 which classifies it as a high-income economy country according to the World Bank, due to having a GNI per capita of $13,846 or more. Saudi Arabia's healthcare system, specifically the hospital bed distributions, is lacking in comparison to countries with similar income classifications.[9] This can be shown further due to Saudi Arabia having a bed rate of 2.5 per 1,000 of the population in 2021 which is less than the OECD average of 4.3 beds per 1,000 of the population in 2021.[10]

An official suggested ideal bed to population ratio in either private or public sectors has not been announced by any organization yet. Nevertheless, the method used to calculate an optimal distribution according to the total number of beds in this research has shown that Jazan, Makkah, Medinah, and Riyadh all have an insufficient number in comparison to the calculated optimal number of beds in 2022. On the other hand, some areas such as the Northern region (60.31%), Al-Bahah (60.24%), Najran (34.84%), Tabouk (33.51%), Al-Jouf (27.36%), and Ha'il (21.51%) have a noticeable increase from the optimal number of beds which needs to be justified. Having 22% or more beds than the calculated need for each region could cause insufficient healthcare standards being provided in other regions which could need it more.

Furthermore, studying hospital bed distribution inequalities in Saudi Arabia in relation to population size involves looking into healthcare

infrastructure and its alignment with demographic needs, so comparison in accordance to international benchmarks such as the United Arab Emirates, Kuwait, Bahrain, and Qatar which are countries with high-income economies and similar healthcare systems in the middle east would assist in articulating a reasonable suggested bed to population ratio for Saudi Arabia.[11]

One may note that weak correlation shows less response of healthcare services, whether it is private or public or both together, to the population increase the positive correlation between population and private hospital beds in regions like Riyadh, Ha'il, Al-Jouf, and Najran indicates that private healthcare providers prioritize areas with higher demand and greater economic potential. This market-driven approach can lead to inequitable distribution of healthcare resources, disadvantaging less populous and economically weaker regions. Public sector hospital bed distribution showed moderate inequality, suggesting that government policies have been relatively effective in promoting equitable healthcare access. However, significant disparities remain, particularly in regions like Makkah and the Eastern region, where the negative correlation between population and hospital beds indicates a mismatch in resource allocation.

Healthcare policies under Vision 2030 aim to enhance healthcare access and quality across all regions and increase private sector participation. The disparities identified in this study highlight the need for policy adjustments to ensure that these goals are met. For instance, regions with negative correlations between population growth and hospital bed numbers may require targeted interventions, such as increased public investment in healthcare infrastructure and incentives for private sector participation. Partnerships with the private sector to enhance its contribution to health development in Saudi Arabia have already been conducted, especially during the COVID-19 pandemic, and they continue to this day in the pharmaceutical and ophthalmological fields.[3] Although further efforts to address regional disparities in hospital bed distribution is crucial to achieving the ambitious targets set by Vision 2030, which seeks to enhance the quality and accessibility of healthcare across Saudi Arabia.

Makkah is the only region with negative correlation in all 3 bed categories of public, private, and public & private combined. This could be due to

Makkah's special circumstances as it is a hub for religious tourism which accommodates millions of visitors annually, where the number of pilgrims in 2022 was 24,715,307 and that resulted in a negative correlation due to not having a proportionate number of beds to the population, but instead, a proportionate number of beds to visitors.[12]

Using Gini index calculations, no clear patterns were seen over time in either the public or private sectors. Adequate indices of equality in the allocation of beds among the 13 administrative regions were shown by the public sector Gini index. As for the private sector, a severe equality gap was noticed across all 8 years apart from the last two, which indicates an ongoing improvement in the levels of equality in the distribution of beds in the private sector. There are no obvious trends on the Lorenz curves for either sector over time. The Lorenz curves also indicated a greater degree of inequality in terms of hospital bed distribution in the private sector. Moreover, the graphs indicated the presence of an overall adequate equality for public beds and all beds combined.

To address the disparities identified, policymakers should consider increasing public investment in regions with significant disparities, such as Al-Bahah and Najran, to bridge the gap between population growth and healthcare capacity. Offering incentives for private healthcare providers to invest in underserved regions can also help balance the distribution of hospital beds and decrease the load carried by the public healthcare system. Policies such as tax breaks, subsidies, and public-private partnerships can encourage private sector participation. Special attention should be given to regions with negative correlations between population growth and hospital bed numbers.

Continuous monitoring and evaluation of healthcare policies are essential to ensure that they effectively address regional disparities. Data-driven decision-making can help identify areas needing intervention and measure the impact of policy changes. Policymakers should prioritize equitable resource allocation, considering both population size and regional needs. Strategies such as adjusting budget allocations and redistributing resources can help achieve a more balanced healthcare system.

This study was not completely free of limitations. The reliance on secondary data from the Health Statistical Yearbooks may introduce inaccuracies due to reporting errors. Additionally, the study does not

account for qualitative aspects of healthcare, such as the availability of specialized medical services or healthcare outcomes. Future research should incorporate these factors to provide a more comprehensive assessment of healthcare equity. Longitudinal studies tracking changes in hospital bed distribution over time can offer a deeper understanding of the factors driving healthcare inequalities. By combining quantitative and qualitative approaches, future research can provide a more comprehensive assessment of healthcare equity in Saudi Arabia.

Conclusion

The findings of this study reveal significant disparities in hospital bed distribution across different regions in Saudi Arabia. These disparities are more pronounced in the private sector, where economic factors and healthcare policies influence resource allocation. Policymakers must consider these findings to improve resource allocation and achieve the healthcare goals outlined in Vision 2030. By addressing these inequalities, Saudi Arabia can ensure that all regions have equitable access to essential healthcare services, thereby improving the overall quality of life for its citizens.

References

1. Hassoun, N. (2020b). *Global Health Impact*. Oxford University Press, USA. http://books.google.ie/books?id=g_LuDwAAQBAJ&printsec=frontcover&dq=9780197514993&hl=&cd=1&source=gbs_api
2. Kruk, M. E., & Freedman, L. P. (2008). Assessing health system performance in developing countries: A review of the literature. Health Policy, 85(3), 263–276. https://doi.org/10.1016/j.healthpol.2007.09.003
3. MOH. (2024). Partnerships with the Private Sector. Ministry of Health Saudi Arabia. Retrieved August 16, 2024, from https://www.moh.gov.sa/en/Ministry/Partnerships/Pages/private-sector.aspx
4. Love-Koh, J., Griffin, S., Kataika, E., Revill, P., Sibandze, S., & Walker, S. (2020). Methods to promote equity in health resource allocation in low- and middle-income countries: an overview. Globalization and Health, 16(1). https://doi.org/10.1186/s12992-019-0537-z
5. Chowdhury, S., Mok, D., & Leenen, L. (2021). Transformation of health care and the new model of care in Saudi Arabia: Kingdom's Vision 2030. Journal of Medicine and Life, 14(3), 347–354. https://doi.org/10.25122/jml-2021-0070

6. Health Sector Transformation Program. (2016). Retrieved August 16, 2024, from https://www.vision2030.gov.sa/en/explore/programs/health-sector-transformation-program
7. Asmri, M. A., Almalki, M., Fitzgerald, G., & Clark, M. (2020). The public health care system and primary care services in Saudi Arabia: a system in transition. Eastern Mediterranean Health Journal, 26(04), 468–476. https://doi.org/10.26719/emhj.19.049
8. Jones, R. P. (2023). Addressing the Knowledge Deficit in Hospital Bed Planning and Defining an Optimum Region for the Number of Different Types of Hospital Beds in an Effective Health Care System. International Journal of Environmental Research and Public Health, 20(24), 7171. https://doi.org/10.3390/ijerph20247171
9. World Bank Country and Lending Groups – World Bank Data Help Desk. (2024). Retrieved August 16, 2024, from https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups
10. OECD. (2023). Health at a Glance 2023. In Health at a glance. https://doi.org/10.1787/7a7afb35-en
11. FAO. (2021). Near East and North Africa – Regional Overview of Food Security and Nutrition 2021. In FAO eBooks. https://doi.org/10.4060/cb7495en
12. GASTAT. (2023, June 20). Total number of Umrah performers and pilgrims for 2022. General Authority for Statistics. Retrieved August 16, 2024, from https://www.stats.gov.sa/en/news/463
13. The data used in this study were acquired from public governmental websites for public use. Ministry of Health: https://www.moh.gov.sa/en/Ministry/Statistics/book/Pages/default.aspx
14. General Authority for Statistics: https://database.stats.gov.sa/home/landing

Table 1. Descriptive statistics of beds and bed rates in Saudi Arabia, 2015-2022

Bed rate per 1k of population												
Parameter	**2015**			**2016**			**2017**			**2018**		
	Public	Private	Total	Public	Private	Total	Public	Private	Total	Public	Private	Total
Minimum	1.93	0.0	1.40	1.89	0.0	1.35	1.89	0.0	1.43	1.91	0.0	1.52
Maximum	4.04	0.97	3.97	3.92	0.99	3.83	3.93	1.02	3.93	4.06	1.09	3.95
Mean	0.40	2.33	2.69	2.67	0.40	2.31	2.73	0.41	2.37	2.87	0.46	2.47
(SD)	0.72	0.26	0.84	0.69	0.26	0.84	0.70	0.27	0.84	0.67	0.28	0.82
Average	1.77	0.56	2.33	1.73	0.56	2.29	1.79	0.57	2.36	1.87	0.63	2.49
Parameter	**2019**			**2020**			**2021**			**2022**		
	Public	Private	Total	Public	Private	Total	Public	Private	Total	Public	Private	Total
Minimum	1.91	0.0	1.54	1.84	0.0	1.47	1.91	0.0	1.53	1.95	0.0	1.50
Maximum	4.05	1.15	3.92	4.03	1.02	4.30	4.06	0.77	4.06	3.90	0.81	3.90
Mean	2.51	0.47	2.92	2.49	0.45	2.87	2.56	0.42	2.91	2.50	0.34	2.85
(SD)	0.78	0.30	0.63	0.84	0.28	0.70	0.84	0.24	0.65	0.81	0.23	0.62
Average	1.92	0.64	2.56	1.88	0.62	2.49	1.93	0.58	2.51	1.88	0.55	2.44

Table 2. Rate of change in total population and number of hospital beds in Saudi Arabia, 2015–2022

	2015	2022	Percent Change
Public Beds	52,746	60,627	14.9%
Private Beds	16,635	17,813	7%
Total Beds	69,381	78,440	13%
Total Population	29,816,382	32,175,224	7.9%

Table 3. Percentage of private beds from all beds in the 13 administrative regions in Saudi Arabia, 2022

Region	Percentage of Private 2015	Percentage of Private 2022
Riyadh	28.01	29.44
Makkah	27.25	25.90
Eastern	33.96	31.41
Medinah	23.24	19.54
Aseer	24.31	21.79
Jazan	9.96	9.08
Qaseem	12.27	9.29
Tabouk	3.85	2.98
Ha'il	8.56	0.34
Al-Jouf	0	1.62
Najran	9.06	12.84
Northern	0	0
Al-Bahah	7.91	2.26
Total in Saudi Arabia	23.9	22.7

Table 4. Disparity from optimal number of all hospital beds in the 13 administrative regions in Saudi Arabia, 2015 and 2022

Region	Difference from optimal number of all hospital beds 2015	Difference from optimal number of all hospital beds 2022
Riyadh	-5.08%	-2.33%
Makkah	-16.78%	-16.61%
Eastern	19.05%	6.97%
Medinah	-3.36%	-3.82%
Aseer	11.85%	4.50%
Jazan	-15.58%	-19.63%
Qaseem	10.43%	13.89%
Tabouk	-2.89%	33.51%
Ha'il	-15.38%	21.51%
Al-Jouf	42.07%	27.36%
Najran	35.41%	34.84%
Northern	70.87%	60.31%
Al-Bahah	73.93%	60.24%

Table 5. Correlation between number of hospital beds in private and governmental hospitals and population for the 13 administrative regions in Saudi Arabia, 2015–2022

Region	Correlation Public Beds	Correlation Private Beds	Correlation for All Beds
Riyadh	0.5615	0.4145	0.5077
Makkah	-0.2394	-0.2478	-0.3058
Eastern	0.6618	-0.2898	0.0537
Medinah	0.5596	-0.5517	0.4632
Aseer	0.9710	0.2563	0.9517
Jazan	0.8166	0.0	0.8166
Qaseem	0.6430	-0.3734	0.6341
Tabouk	0.8759	0.0	0.8759
Ha'il	0.7659	0.8583	0.7988
Al-Jouf	0.6051	0.6932	0.8250
Najran	0.7616	0.6490	0.7773
Northern	0.9255	0.0	0.9255
Al-Bahah	0.8531	-0.5785	0.6200

Table 6. Gini coefficients for equality of all hospital's beds relative to population in all 13 administrative regions in Saudi Arabia 2015-2022

Year	Gini Index Public Beds	Gini Index Private Beds	Gini Index for All Beds
2015	0.3578	0.5700	0.4000
2016	0.3475	0.5493	0.3949
2017	0.3521	0.5884	0.3960
2018	0.3478	0.5718	0.3953
2019	0.3439	0.5778	0.3912
2020	0.3409	0.5707	0.3913
2021	0.3640	0.3883	0.4183
2022	0.3645	0.4150	0.4142

Table 7: Interpretation of Gini index values

Gini Index	*Result Interpretation*
≤ 0.2	Perfect equality
> 0.2 – 0.3	Relative equality
> 0.3 – 0.4	Adequate equality
> 0.4 – 0.5	Large equality gap
> 0.5	Severe equality gap
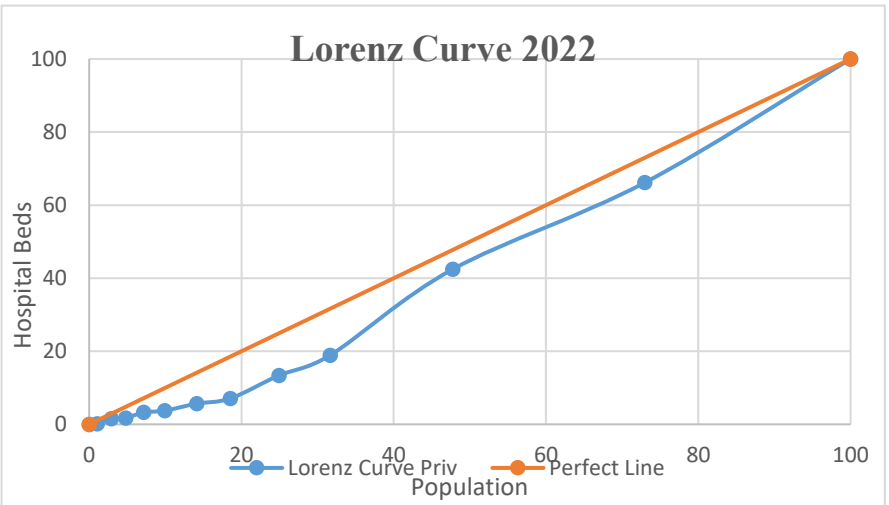
Figure 1. Scatter Plot Graph for The Lorenz Curve of Private Beds and Population in 2022