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Taghreed Hawsawi[1] and Noura Abouammoh[2]

[1]Field Epidemiology Training Programme, Ministry of Health, Riyadh, Saudi Arabia. [2]Departmen t of Family and Community Medicine, College of Medicine, King Saud University, Riyadh, Saudi Arabia (Correspondence to: Noura Abouammoh: nabouammoh@ksu.edu.sa).

Abstract

Background: Adequate access to health care systems is considered a basic human right. Therefore, it is important that health care services be delivered to those who need them most in the most efficient manner possible.

Aims: We evaluated the distribution of hospital beds across Saudi Arabia from 2015 to 2019 to assess inequalities in hospital resource allocation.

Methods: This cross-sectional study utilized data from the Health Statistical Yearbook published by the Ministry of Health during the period 2015–2019. The number of hospital beds per 100 000 population was calculated for the 20 health regions. Generation of other parameters, such as the Gini index and the Lorenz curve, was performed to assess the distribution of beds. The Pearson coefficient was calculated to assess the correlation between beds and population in each health region

Results: The ratio of hospital beds to population improved from 2015 to 2019 in areas such as Ha'il, Tabouk and Ta'if, which increased by 89.6, 72.5 and 32.5 respectively. The calculated mean Gini index for bed distribution in the public sector was 0.21; in the private sector it was 0.53. There was a strong positive correlation between population and hospital beds in Riyadh, Qaseem, Eastern and Ha'il regions.

Conclusion: In Saudi Arabia the observed inequalities in hospital bed distributions lie mainly in

the private sector. It is recommended that policymakers be aware of such inequalities and work on possible reforms to achieve the goals of Saudi Vision 2030.

Keywords: hospital beds, distribution, inequalities, resource allocation, Saudi Arabia

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Introduction

Health is regarded as the main pillar of the development process among both human beings and civilization (1). Consequently, health care services are important for the promotion of overall fitness, prevention and management of diseases and reduction in avoidable health impairment and unnecessary fatalities. Consequently, equal and prompt access to health care services is a major concern and a fundamental element of many health policies, especially in developing countries (2,3). It is therefore essential that governments distribute these resources fairly through their health care systems. However, allocation of resources is often influenced by political factors which override the actual needs of the population in certain regions (4). This highlights the need for evaluation of resource availability and equality across regions, which can subsequently promote solutions leading to a fair distribution of health resources (e.g. beds, personnel, medical apparatus) with the help of policymakers (5).

In Saudi Arabia, health services have improved exceptionally in the past 20 years as demonstrated by the increased availability of health resources throughout the country. Around 60% of the health services are sponsored by the Ministry of Health while the rest are shared between other governmental and private sectors (6), both subject to the regulations of the Ministry of Health. The improvements in health care delivery can partly be attributed to the contribution of the private sector to the health care system. In the 1980s, the budget deficit experienced by the Saudi Arabian economy led to the government's promotion of privatization

of health care in the 1990s (7). The private sector then served as the main health care provider for workers of foreign descent while the Ministry of Health catered primarily to Saudi nationals. However, statistics from 1995 showed that an estimated 80% of the health care services provided by the private sector went to Saudi Arabian nationals even though they are eligible for the free health care services under the Ministry of Health (8). As of December 2018, 11 million beneficiaries are eligible to receive health care services from the private sector in the form of health insurance coverage (7).

Since the National Transformation Plan 2030 promotes rationalizing resource allocation between primary health care centres and hospitals (9), it is important to evaluate hospital bed distribution and optimize it according to population needs (10).

Similar studies from other countries have focused on the distribution of hospitals and hospital beds aiming to assess inequality in resource distribution applying the Gini index (11–14). This is a statistical variable commonly used to gauge income inequality in a specific population. It can also be used to estimate the degree of inequality in the allocation of other resources, in this case, health resources (15). Its numerical value can range from 0 to 1 as shown in Table 1 (15). In a Chinese study, for example, Gini index analysis revealed a spatial hospital bed clustering that disadvantaged western China, resulting in the region's lower average hospital bed resource availability (11). Another study conducted in 22 regions of Tehran province in the Islamic Republic of Iran calculated the Gini index of hospital bed distribution from 2010 to 2012 to be 0.46, suggesting an unequal distribution across the province (12). Another Iranian study showed that 70% of the hospitals in 5 of its metropolitan cities were located in areas where the top 40% in terms of socioeconomic status reside (13). Assessing inequality according to the geographical distribution of the population is important to identify disadvantaged regions and help policymakers in making informed decisions regarding reallocation of services based on national health plans (14).

Saudi Arabia houses a population of over 34 million (16). The country provides services to 18 million visitors annually during the Hajj and Umrah periods. Achieving a balanced, adequate, and equality-based distribution and delivery of health resources, taking into account the geographic and demographic aspects, is one of the most challenging matters (17). A limited number of studies conducted in Saudi Arabia revealed inequalities in terms of accessibility of health services and resources. A study utilizing a geographic information system (GIS) evaluated the geographic variations in access to health services in Riyadh (18). The results showed significant clustering of health care facilities in central Riyadh compared with the marginal areas, where a considerable proportion of the population had to travel long distances to access public health care (18). In another study, the utilization of hospital beds in a university hospital in eastern Saudi Arabia was assessed to determine the efficiency in which the beds are being used (19). The mean occupancy rate of the hospital ranged from 30.9% to 77.0% and the

observed underutilization of beds had implications on the equality of health resources when compared with other hospitals with limited resources (i.e. hospital beds) (19).

All in all, more research on the extent of inequalities in our health care system is needed, particularly in access and resource distribution. In the absence of evidence-based research covering this aspect, our study aims to investigate one indicator of regional inequality in health care delivery: hospital beds. This study evaluates the allocation of hospital beds across Saudi Arabia from 2015 to 2019 and examines the correlation and trends associated with it. Correspondingly, it will help policymakers to consider the potential redistribution of resources and maximize efficiency so that citizens and residents can further benefit from the health care system.

Methods

Study design and setting

This is a cross-sectional study was designed to evaluate hospital bed distribution among the 20 health regions of Saudi Arabia from 2015 to 2019. Secondary data collected by the Ministry of Health (i.e. number of beds per region, population per region, sociodemographics) were derived from the annually published Statistical Yearbook (16). All hospitals subject to the regulations of the Ministry of Health in the 20 health regions, including governmental and private hospitals, were covered in this study. We included in the calculations the whole population, both Saudi and non-Saudi, in the health regions.

Tools and data extraction

A Microsoft Excel 2016 spreadsheet was developed to extract the data (year, health region, population, hospital beds) from the Ministry of Health Statistical Yearbook (16). The number of hospital beds/100 000 population in each of the 20 health regions was calculated for 2015–2019.

This study defines hospital beds in accordance to the World Health Organisation (WHO) definition, which describes a hospital bed as “a bed that is regularly maintained and staffed for the accommodation and full-time care of a succession of inpatients and is situated in wards or a part of the hospital where continuous medical care for inpatients is provided” (20). This included both occupied and unoccupied beds in all hospitals, encompassing general hospitals and other specialty hospitals, including, but not limited to, rehabilitation, convalescence, eye, psychiatric, paediatric, obstetric, and gynaecology. Surgical tables, emergency stretchers, recovery trolleys, beds for same-day care, provisional and temporary beds, cots for healthy infants, and beds in nursing and residential care facilities were excluded (20).

Statistical analysis

The number of hospital beds for each region over the period of 2015–2019 was recorded. The "bed rate" was then estimated by calculating the number of hospital beds/100 000 population as in the following equation (21).

This variable is an important standardized indicator of health care accessibility, specifically of inpatient services, as it also allows comparisons within and among countries and regions.

The change in the health care service was analysed by calculating the rate of change in the total population and the rate of change in the total number of hospital beds in 2015 and 2019.

100

Where:

PR = percent rate

Vpresent = present value

Vpast = past value

To evaluate the equality in the geographical distribution of hospital beds among the health regions, the Gini index and the Lorenz curve were calculated and constructed using Excel, 2016. The Gini index is a statistical variable used in assessing inequalities (see Table 1). The Lorenz curve is a visual representation used to compare inequalities in reference to "perfect" equality. In the context of the study, the cumulative percentage of beds was represented on the y-axis and the cumulative percentage of population on the x-axis (charts available on request). The chart also shows a diagonal straight line as a reference for perfect equality, and the Lorenz

curve often lies below the straight line. The Gini index can also be calculated from the graph as it is the ratio between the area below the diagonal straight line and the curve to the overall area beneath the line of absolute equality (15).

To analyse the correlation between the changes in population and changes in number of hospital beds in each region from 2015–2019 we used SPSS, version 25, to calculate Pearson's correlation coefficient (r). The correlation is significant at the 0.05 level.

Results

Table 2 shows the demographic characteristics of the Saudi Arabian population as of 2019. The total population was just over 34.2 million, with an annual growth rate of 2.4%.

Data from the Health Statistical Yearbook form 2015 to 2019 were analysed, and descriptive statistics are shown in Table 3 (16). It can be seen that the general trend for number of beds and beds per 100 000 population is increasing over time, although some fluctuations can also be observed. The total number of beds increased with population, from 3469 mean total beds for around 1 576 070 population in 2015 to 3849 mean total beds for approximately 1 710 908 population in 2019 in all the 20 health regions. The total bed rate improved from 237.0 in 2015 to 246.8 in 2019. Similar rate of change in the total population and the rate of change in the total number of hospital beds in the public sector, in 2015 and 2019. However, the total rate of change in both sectors was 10.9% as this was affected by the dramatic change in the number of beds in the private health sector (Table 4).

The trend for hospital beds/100 000 population among the 20 health regions during 2015–2019 has been generally positive. A noticeable increase in the availability of hospital beds provided by the public sector was observed in Ha'il (from 171.3 to 253.7 beds/100 000 population), Tabouk (from 186.3 to 259.3) and Ta'if (from 222.7 to 257.3). For the private sector, a large increase was observed in Hafr Al-Baten (11.2 to 32.1), with smaller, but substantial, improvement in Ha'il (16.0 to 23.3) and Najran (25.8 to 41.1). The greatest improvement in overall bed rates was seen in the health regions of Ha'il (187.4 to 277.0), Tabouk (195.8 to 268.3) and Ta'if (260.7 to 293.2).

The Gini indices for the public and private sectors were calculated and these are summarized in Table 5 . For the public sector, the Gini index hovers around 0.21, while the value is around 0.53 for the private sector. Considering both sectors, the overall Gini index for the 20 health regions is around 0.16.

The Lorenz curve was constructed to demonstrate a visual representation of inequality in hospital bed distribution (charts for the Lorenz curves are available from the authors on request). The wider the gap between the equality line and Lorenz curve, the greater the inequality between the cumulative proportion of the population and the hospital bed rates. In the case of public sector-sponsored hospital beds, the Lorenz curves for 2015–2019 are almost the same and showed that 90% of the population had access to 60% of the hospital beds. For the private sector-sponsored hospital beds, the Lorenz curves for the same 5 years are also similar and all indicate that 90% of the population had access to only 27% of the hospital beds. Lastly, when both sectors are combined their Lorenz curves for the 5 years showed that 90% of the population had access to about 70% of the hospital beds.

The correlation between population and number of hospital beds for each region during 2015–2019 was calculated. The Pearson correlation coefficient r for public hospitals in the Riyadh, Qaseem, Eastern and Ha'il regions showed a strong positive correlation (Table 6). While, in Ta'if and Hafer Al-Baten regions the correlation was weakly positive. For Jazan, Albaha and Quryat regions the correlation was not applicable because the number of hospital beds did not change in the 5 years. The data for all regions combined showed a strong positive correlation (
Table 6
).

Discussion

This study was conducted to elucidate the current status of bed distribution among the 20 health regions in Saudi Arabia during 2015–2019 and to evaluate the equality in hospital bed distribution and its relationship with the population growth. This study assessed the adequacy and availability of health care services, especially inpatient services represented by bed numbers, for all populations in Saudi Arabia.

A general increasing trend was observed in the number of beds, in both public and private sectors. The increase in total bed rates per 100 000 population across time is subtler, characterized by some fluctuations in values. This implies that there are small improvements in the ratio of hospital beds to population and that availability increased over time. A recent study assessed resource availability in the midst of the COVID-19 pandemic and showed that the global average among 183 countries under study was 307.1 hospital beds per 100 000 population (22). In terms of income regions as designated by the World Bank, regions in the low-income category have a mean of 231.79 hospital beds/100 000 population; regions in the lower-middle-income category have a bed rate of 308.85; regions in the upper-middle-income bracket have a bed rate of 283.13, and high-income regions have 356.13 hospital beds/100 000

population (22). The World Bank classifies Saudi Arabia among the high-income regions (23), which means that we lag behind regional averages with our 2019 bed rate of 246.8. In comparison, the G20 countries have a mean rate of 450 beds/100 000 population (24). It is projected that there could be a gap of up to 40 000 hospital beds by 2035 if no adjustments are made by the health sector (25). This could impact resource availability in Saudi Arabia, which may eventually lead to a deterioration in hospital services resulting in problems such as long patient waiting times (26). Interestingly, some countries have nationwide surplus of hospital beds, like Japan which had an estimated 1223 beds per 100 000 population in 2018 (13).

Among the 20 health regions, the greatest improvements in hospital bed rates were observed in Ha'il, Tabouk and Ta'if, owing primarily to investment in the public sector. However, these can also be attributed to the fact that some of these districts, specifically Tabouk, Ha'il and Najran, are characterized by small populations compared with other health regions. Some of the regions characterized by larger populations exhibit a fluctuating pattern due to the disproportionate increases in number of beds and population. It should also be noted that the public health sector has a greater impact on bed rates. This was also highlighted in a study analysing the timeline of health reforms in Saudi Arabia (27).

In terms of providing health care services, the contribution of the private sector is negligible compared with the share of the public sector. This is one of the reasons why the National Transformation Plan 2020 and the Saudi Vision 2030 prioritized developing the private sector through policy reforms to acquire more investment to improve the delivery of health care services to its citizens and residents (27).

No obvious trends were observed using Gini indices for both the public and private sectors across time. The public and private sector Gini indices showed good indicators of equality in the distribution of public sector-sponsored hospital beds among the 20 health regions. However, the Gini index for the private sector indicated a severe equality gap. There is clearly a need for assessment of the distribution of private sector-sponsored hospital beds to deliver health care services efficiently and where they are needed. Overall, the mean Gini index across the 20 health regions for 2015–2019 falls under perfect equality. With more investments anticipated from the private sector due to policy reforms in the coming years, it is fair to expect that the Gini index for the private sector will improve over time (27).

The Lorenz curves also indicated a greater degree of inequality in terms of hospital bed distribution in the private sector. Furthermore, there are no obvious trends on the Lorenz curves for either sector over time. A study conducted in the Tehran province in the Islamic Republic of Iran used the Lorenz curve to illustrate the huge gap between "perfect equality" and the curve,

which suggested unfair hospital bed distribution (12). Another Iranian study in 2014 found a Gini index of 0.68 for Shiraz, which suggested a severe equality gap, and the Lorenz curve constructed was far from the line of “perfect equality” (28).

This study was not without limitations. These included centralization of inpatient services, as outpatient services are not counted in this study. We were unable to make correlations with the degree of urbanization for each health region due to the lack of a reliable, complete and up-to-date source of urbanization data. The comparisons made between countries and regions based on hospital bed per 100 000 population do not take into account differences in culture, values and other socioeconomic and sociodemographic factors, which may or may not affect the magnitude of such comparisons. Lastly, there could be inherent limitations in using secondary data. However, the data used for the study were from government institution and had been used to increase understanding of policymakers about the issue and to make informed decisions.

Conclusion

Saudi Arabia is lagging behind in terms of beds rate. More research should be conducted on the availability and allocation of resources per population and how these affect the efficiency of heath care delivery. Policymakers should pay close attention to the empirical data as these are needed to realize the Saudi Vision 2030 and to sustain the demands of the still-growing population of Saudi Arabia.

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Répartition des lits d'hôpital en Arabie saoudite de 2015 à 2019 : étude transversale

Résumé

WHO EMRO | Distribution of hospital beds across Saudi Arabia from 2015 to 2019: a cross-sectional stud

Contexte : L'accès adéquat aux systèmes de soins de santé est considéré comme un droit humain fondamental. Il est donc important que les services de soins de santé soient fournis de la manière la plus efficace possible à ceux qui en ont le plus besoin.

Objectifs : Nous avons évalué la répartition des lits d'hôpital dans toute l'Arabie saoudite de 2015 à 2019 pour mesurer les inégalités dans l'allocation des ressources hospitalières.

Méthodes : La présente étude transversale a utilisé les données de l'Annuaire des statistiques sanitaires publié par le ministère de la Santé au cours de la période 2015-2019. Le nombre de lits d'hôpital pour 100 000 habitants a été calculé pour les 20 régions sanitaires. D'autres paramètres, tels que l'indice de Gini et la courbe de Lorenz, ont été générés pour évaluer la répartition des lits. Le coefficient de Pearson a été calculé pour évaluer la corrélation entre les lits et la population dans chaque région sanitaire.

Résultats : Le rapport entre le nombre de lits d'hôpital et la population s'est amélioré entre 2015 et 2019 dans des régions telles que Haïl, Tabouk et Taïf, où il a augmenté de 89,6, 72,5 et 32,5 respectivement. L'indice de Gini moyen calculé pour la répartition des lits dans le secteur public était de 0,21 ; dans le secteur privé, il s'élevait à 0,53. Il existe une forte corrélation positive entre la population et les lits d'hôpital dans les régions de Riyad, Al Qassim, Ach-Charqiya et Haïl.

Conclusion : En Arabie saoudite, les inégalités observées en matière de répartition des lits d'hôpital résident principalement dans le secteur privé. Il est recommandé que les décideurs politiques prennent conscience de ces inégalités et élaborent des réformes visant à atteindre les objectifs de la Vision 2030 saoudienne.

توزيع أسِرَّة المستشفيات في أنحا ء المملكة العربية السعودية من عام
2015 إلى عام **2019:** دراسة مقطعية

تغريد هوساوي، نورا أبو أمامة

الخلاصة

: يعد الوصول الكافي لنُظُم الرعاية الصحية حقًا من حقوق الإنسان الأساسية الخلفية.
لذا، من المهم تقديم خدمات الرعاية الصحية إلى الأشخاص الأكثر احتياجًا إليها بأكفأ

10 / 13

WHO EMRO | Distribution of hospital beds across Saudi Arabia from 2015 to 2019: a cross-sectional stud

صورة ممكنة .

: هدفت هذه الدراسة إلى تقييم توزيع الأسرّة في المستشفيات على مستوى المملكةالأهداف
العربية السعودية في الفترة من عام 2015 إلى عام 2019 لتقييم أوجه عدم المساواة في
تخصيص الموارد بالمستشفيات .

: استخدمت هذه الدراسة المقطعية بيانات من الكتاب السنوي للإحصاءات الصحيةطرق البحث
التي نشرتها وزارة الصحة خلال الفترة 2015-2019. وتم حساب عدد أسِرَّة المستشفيات لكل
100 000 نسمة في 20 منطقة صحية . واستخدمت قياسات أخرى، مثل مؤشر جيني ومنحنى لورينز،
لتقييم توزيع الأسِرَّة . وحُسب معامل بيرسون لتقييم الارتباط بين عدد الأسِرَّة
والسكان في كل منطقة صحية .

: تحسنت نسبة أسِرَّة المستشفيات إلى السكان في الفترة من عام 2015 إلى عامالنتائج
2019 في مناطق مثل حائل وتبوك والطائف، حيث زادت بمقدار 89.6 و72.5 و32.5 على التوالي .
وبلغ المتوسط المحسوب لمؤشر جيني لتوزيع الأسِرَّة في القطاع العام 0.21 ، وفي القطاع
الخاص 0.53. وكان هناك ارتباط إيجابي قوي بين عدد السكان وأسِرَّة المستشفيات في مناطق
الرياض والقصيم والمنطقة الشرقية وحائل .

: لُوحِظَ أن أوجه عدم المساواة في توزيع أسِرَّة المستشفيات تقع بالأساسالاستنتاجات
في القطاع الخاص في المملكة العربية السعودية . ويُوصى بأن يكون راسمو السياسات على علم
بأوجه عدم المساواة هذه، وأن يعملوا على إدخال إصلاحات ممكنة لتحقيق الأهداف الخاصة
برؤية المملكة العربية السعودية لعام 2030.

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11 / 13

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