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The Association Between National Economic and Educational Indicators and the Quacquarelli Symonds (QS) World University Rankings for Medicine.

La asociación entre los indicadores económicos y educativos nacionales y la clasificación mundial de universidades de Quacquarelli Symonds (QS) en medicina.

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Abstract.

Background: University and medical school rankings have long been published by media outlets and various organizations, particularly in the United States. **Objectives:** This study aimed to examine the association between the number and proportion of medical schools from 55 countries included in the top 500 of the QS World University Rankings for Medicine and each country's economic and educational indicators, using a ranking system with publicly available criteria and independently evaluated methodology. **Methods:** The average number of medical schools listed in the QS World University Rankings for Medicine in 2017, 2019, 2021, 2023, and 2024 was calculated for each of the 55 countries and statistically analyzed. Correlations between national economic and educational indicators and QS ranking performance were assessed using correlation and regression analyses. No significant correlation was found between the total number of medical schools in a country and the number of those schools included in the QS top 500 list (r=0.112; p=0.510). The strongest predictor of the ratio of top-ranked medical schools to the total number of medical schools was per capita national income (β=2.522; p=0.03). **Conclusion:** These findings suggest that better economic conditions are associated with greater representation in the QS Medicine rankings; however, this relationship should not be interpreted as causal or independent of other factors. The findings suggest that simply increasing the number of medical schools or the proportion of students enrolled in secondary or tertiary education may not, by itself, improve national representation in QS Medicine rankings. The results of this study may contribute to the literature on international medical school rankings and national educational performance.

Keywords: Top global medical schools, ranking list, medical faculty, medical education.

Resumen.

Antecedentes: Los medios de comunicación y diversas organizaciones llevan mucho tiempo publicando clasificaciones de universidades y facultades de medicina, especialmente en Estados Unidos. Objetivos: Este estudio tuvo como objetivo examinar la asociación entre el número y la proporción de facultades de medicina de 55 países incluidas en las 500 mejores posiciones de la clasificación *QS World University Rankings* en el área de Medicina y los indicadores económicos y educativos de cada país, utilizando un sistema de clasificación con criterios de acceso público y una metodología evaluada de forma independiente. **Métodos:** Se calculó el número promedio de facultades de medicina incluidas en la clasificación *QS World University Rankings* de Medicina

en los años 2017, 2019, 2021, 2023 y 2024 para cada uno de los 55 países, y se realizó un análisis estadístico. Se evaluaron las correlaciones entre los indicadores económicos y educativos nacionales y el desempeño en la clasificación QS mediante análisis de correlación y regresión. No se halló una correlación significativa entre el número total de facultades de medicina de un país y el número de dichas facultades incluidas en la lista de las 500 mejores de QS (r=0,112; p=0,510). El factor predictivo más fuerte de la proporción entre las facultades de medicina mejor clasificadas y el número total de facultades de medicina fue la renta nacional per cápita (β=2,522; p=0,03). **Conclusión:** Estos hallazgos sugieren que unas mejores condiciones económicas se asocian con una mayor representación en las clasificaciones QS de Medicina; sin embargo, esta relación no debe interpretarse como causal ni independiente de otros factores. Los resultados indican que el simple aumento del número de facultades de medicina o de la proporción de estudiantes matriculados en educación secundaria o terciaria podría no mejorar, por sí solo, la representación nacional en las clasificaciones QS de Medicina. Los resultados de este estudio pueden contribuir a la literatura existente sobre las clasificaciones internacionales de facultades de medicina y el desempeño educativo nacional.

Palabras clave: Principales facultades de medicina del mundo, lista de clasificación, profesorado de medicina, educación médica.

1. Introduction

McGaghie argued that, although the reputation and scientific performance of some medical schools are widely recognized, concerns remain that some ranking systems may be influenced by commercial interests. He attributed this skepticism to the lack of transparency regarding the evaluation criteria (1). This perspective is supported by a 2007 study by Ioannidis et al. (2). More recently, ranking systems with clearly published evaluation criteria and externally evaluated methodologies have become more common and are generally considered more reliable. (3). The most prominent among these are the Academic Ranking of World Universities (ARWU), QS World University Rankings, and the Times Higher Education (THE) World University Ranking systems (4).

The ARWU, known as the Shanghai ranking, was developed by Liu and Chang at Shanghai Jiao Tong University in 2005 (5). It evaluates universities based on four main criteria: education quality, faculty quality, research output, and the receipt of Nobel Prizes and other major scientific awards. It also considers the number of publications indexed in databases, such as the Science Citation Index-Expanded (SCIE) (6). The rankings use thirteen indicators, including reputation, faculty-to-student ratio, doctorate and graduate rates, research performance, international recognition, industry collaboration, and knowledge transfer (7). The QS World University Rankings assess several performance domains, including research, teaching, academic and employer reputation, student-to-faculty ratio, internationalization, field specialization, and graduate employability in national and international markets, based on academic and social data (8).

In a 24-year archival review, Lerman et al. reported a positive correlation between the scientific performance of internal medicine departments and economic status (9). Günay also reported a significant association between World University Rankings and national income in Türkiye (10). Pietrucha evaluated three major World University Ranking systems—ARWU, QS, and THE—and assessed factors such as economic potential, research and development expenditure, long-term political stability (including freedom from war, occupation, coups, and major political changes), and institutional variables such as government effectiveness. He found a strong correlation between per capita national income and the number of universities ranked. Furthermore, Pietrucha noted that political instability, government interference with university autonomy, and appointment of unqualified academic personnel can moderately affect rankings, with varying degrees of impact (4).

In many developing countries, including Türkiye, increasing literacy rates and improving secondary and tertiary education attainment are considered important national priorities. This approach is often accompanied by policies aimed at increasing the number of physicians per capita. Expanding the number of medical schools is often viewed as one strategy to achieve this goal. Improving the quality of education and scientific performance in medical schools, and achieving high standards in education, will improve the quality of healthcare services across the country (11). Few studies in the literature have examined whether this approach improves international medical education performance. Therefore, this study aimed to examine whether an association exists between the number of universities from 55 countries ranked among the top 500 in the Quacquarelli Symonds (QS) World University Rankings for Medicine and the countries' economic and educational indicators, using an evaluation method that is transparent and independently validated for reliability.

2. Methods

This study used the QS World University Rankings for Medicine from 2017, 2019, 2021, 2023, and 2024, which employ an evaluation method that is publicly disclosed and whose validity and reliability have been confirmed by independent parties (3, 8). Based on these rankings, the number of top-ranked medical schools was recorded for 55 countries: three from North America (United States, Canada, and Mexico), five from South America (Argentina, Brazil, Colombia, Peru, and Chile), six from Africa (Egypt, Kenya, Nigeria, Uganda, Ghana, South Africa), 11 from Asia (Japan, China, India, Pakistan, Philippines, Indonesia, Taiwan, Thailand, South Korea, Singapore, and Malaysia), six from the Middle East (Saudi Arabia, Qatar, Lebanon, Iran, Kuwait, and Israel), two from Oceania (Australia and New Zealand), 22 from Europe (United Kingdom, France, Germany, Spain, Italy, Denmark, Finland, Sweden, Norway, Belgium, Netherlands, Ireland, Portugal, Hungary, Austria, Poland, Czech Republic, Greece, Bulgaria, Romania, Serbia, Russia), and Türkiye. Data on the total number of medical schools in these 55 countries were then obtained from official national sources. Countries were first ranked in descending order according to the number of their medical schools included in the QS top 500 list (e.g., USA: 99 medical schools in 2024). Countries were first ranked in descending order according to the number of their medical schools included in the QS top 500 list. This approach enabled a more statistically meaningful comparison by evaluating not only the absolute number of medical schools from each country included the QS top 500 medical schools list but also the proportion of each country's total medical schools achieving top five hundred status-The average ratios across the study years were then statistically compared. Changes in the rankings based on these ratios over the years were analyzed, with specific attention given to Türkiye according to available data.

The study further aimed to determine whether the proportion of top-ranked medical schools was associated with national economic and educational indicators including Türkiye. Using this approach, associations between educational and economic indicators and global medical school ranking performance were investigated. The analysis examined correlations between QS ranking performance and national economic status, represented by per capita national income from the OECD 2024 report, as well as educational indicators including literacy rate, high school graduation rate, and tertiary education rate with both the average number of top-ranked medical schools (12).

Statistical analyses were performed using SPSS version 21. The relationship between the ratio of top 500 medical schools and each country's per capita national income and educational indicators was evaluated using the Pearson correlation test, and the effects of these variables were further examined using multiple linear regression analysis. Statistical significance was set at $p < 0.05$.

Ethical approval for this study was obtained from the Üsküdar University Non-Interventional Ethics Committee (approval date: September 30, 2024; approval number: 61351342/020-450). No

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3. Results

In the QS World University Rankings for Medicine published in 2017 the top five countries with the most medical institutions in the top 500 were-the United States (n=47), the United Kingdom (n=25), Germany (n=19), Canada (n=11), and Japan (n=10); these rankings remained unchanged in 2019 and 2021. However, in 2023, China and Italy rose to fourth and fifth place with twenty-two medical schools each, and in 2024, Australia ranked fourth with twenty-four schools, while China and Italy dropped to fifth and sixth, respectively. Changes among these leading countries in the QS top 500 medical schools list between 2017 and 2024 were not statistically significant ($p>0.01$). Nonetheless, the United States showed a consistent upward trend during this period (figure 1). Among the 55 countries analyzed, all countries except the United States had fewer than 40 medical schools in the QS top 500 list.

Notably, throughout 2017–2024, the United States consistently had approximately twice as many medical schools in the QS top 500 list as the United Kingdom, which ranked second. The average number of medical schools in the United States that ranked in the top 500 was 92.5 ± 6.3 (range: 47–103). Based on average values across the study years, six countries—the United Kingdom, Germany, Japan, Italy, China, and Australia—had between 20 and 40 medical schools in the QS top 500 list (21.2 ± 1.8 to 37.4 ± 2.9) (Group 1). Five countries—South Korea, Canada, France, Brazil, and Spain—had averages between 10 and 20 (13.6 ± 0.5 to 16.8 ± 2.8) (Group 2). Fourteen countries were categorized in Group 3, with averages between 5 and 10 (5.0 ± 0.0 to 8.8 ± 1.5), and 29 countries (Group 4) had between 0 and 5 (1.0 ± 0.0 to 4.6 ± 1.7). Approximately eleven of these countries had only one medical school in the top five hundred. Türkiye ranked 21st in Group 3 with an average of 5.6 ± 1.8 (table 1).

For 2024, data on the total number of medical schools were available for 37 countries to evaluate each country's overall representation in high-ranking medical education the ratio of medical schools in the QS top five hundred to the total number of medical schools in each country was calculated. Although the United States had the highest absolute number of top 500 schools, when adjusted for its total of 158 medical schools it ranked 12th, with a ratio of 62.7%. Countries with the same ratio were ordered according to their absolute number of medical schools in the QS World's top 500. Accordingly, three countries achieved a 100% ratio, indicating that all their medical schools were listed in the QS top 500: Australia (first), Israel (second), and New Zealand (third). They were followed by Italy (95.5%), Canada (94.1%), and the Netherlands (91.7%), while seven other countries had ratios between 50% and 90%. Türkiye ranked 31st with a ratio of 6.25%. No significant correlation was observed between the total number of medical schools in a country and the number of those schools appearing in the QS top 500 list ($r=0.112$; $p=0.510$) (figure 2).

The main objective of this study was to assess whether economic indicators, particularly per capita national income, and educational indicators, including literacy rate, high school graduation rate, and tertiary education rate, were associated with the number of medical schools listed in the QS top 500 list (Table 2). Because the ratio of QS top 500 medical schools to the total number of medical schools provides a more representative measure of a country's medical education performance, associations were examined using these ratios. Multiple linear regression analysis was conducted to evaluate the independent associations of these variables with QS ranking performance. Per capita national income showed the strongest association ($\beta=2.522$; $p=0.03$), followed by tertiary education rate ($\beta=1.031$; $p=0.041$), both showing moderate and positive correlations ($r=0.635$ and $r=0.553$, respectively). High school graduation rate and literacy rate showed weaker and statistically non-significant positive associations ($\beta=0.584$, $p=0.449$, $r=0.134$;

β=0.743, p=0.453; r=0.133, respectively). The independent variables collectively explained 44.7% of the variance in the dependent variable (R^2=0.447), and the overall regression model was statistically significant (F=6.472; p=0.001).

Table 1. Ranking of countries based on the average number of medical schools included in the QS World's top 500 medical schools between 2017 and 2024.

Order	Country	Mean	SD		Order	Country	Mean	SD
1	USA	94.8	6.3		27	Russia	4.6	1.7
2	England	37.4	2.9		28	Portugal	4.6	0.6
3	Germany	30	1.2		29	India	4.4	0.9
4	Japan	24.8	5.7		30	Norway	4	0
5	Italy	23.6	2.1		31	Hungary	4	0
6	Chinese	22	0.7		32	Greece	4	1
7	Australia	21.2	1.8		33	Thailand	4	0.8
8	S. Korea	16.8	2.8		34	Chile	4	1.6
9	Canada	16.4	0.9		35	Iranian	3	1.7
10	France	15.8	1.9		36	Austria	2.8	0.5
11	Brazil	14.2	1.6		37	Czech Republic	2.8	0.5
12	Spain	13.6	0.5		38	Indonesia	2.6	0.9
13	Holland	8.8	1.5		39	Argentina	2.2	0.8
14	Taiwan	8.8	1.1		40	Saudi Arabia	2	2.1
15	Belgium	7.2	0.5		41	Poland	1.6	0.9
16	Swedish	6	0		42	Singapore	1.6	0.6
17	Ireland	6	0		43	Lithuanian	1.2	0.8
18	Israel	6	1.2		44	Philippines	1.2	0.4
19	Egypt	5.6	0.6		45	Estonia	1	0
20	Colombia	5.6	0.6		46	Croatia	1	0
21	Türkiye	5.6	1.8		47	Serbia	1	0
22	Malaysia	5.4	0.6		48	Romania	1	0
23	Mexican	5.2	0.5		49	Train	1	0
24	Denmark	5	0		50	Kuwait	1	0
25	Finland	5	0		51	Nigeria	1	0
26	South Africa	5	0		52	Uruguay	1	0
					53	Pakistan	1	0
					54	Peru	1	0
					55	Uganda	1	0

Table 2. Comparison of the number of medical schools in the World's Top 500 Medical Schools List in 2024, based on the ratio of the total number of medical schools in the country, OCD education level, and per capita national income rate and statistical analysis (MS, medical school).

Order	Country	Number of MS in the top 500 (a)	MS in the top 500 according to MS in the country [a/bx 100)(%)	Literacy rate	High school graduate rate	Rate of university and post-university education	Per capita national income (USD)
1	Australia	23	100.0	8	36	56	64,820.9
2	Israel	5	100.0	9	45	46	52,642.4
3	New Zealand	4	100.0	12	42	46	48,280.8
4	Italy	21	95.5	20	50	31	39,003.3
5	Canada	16	94.1	5	28	67	53,431.2
6	Holland	11	91.7	11	35	55	64,572.0
7	England	38	82.6	12	28	60	49,463.9
8	Ireland	6	75.0	5	32	63	103,887.8
9	Spain	13	68.4	26	22	52	33,509.0
10	Germany	28	66.7	16	45	39	54,343.2
11	Norway	4	66.7	15	28	46	87,925.1
12	USA	99	62.7	6	42	52	82,769.4
13	Austria	3	50.0	10	47	44	64,820.9
14	Belgium	7	43.8	14	36	50	54,700.9
15	France	15	40.5	11	37	52	44,690.9
16	Denmark	5	41.7	18	33	49	68,453.9
17	South Korea	15	37.5	1	29	70	33,121.4
18	Switzerland	6	31.7	9	39	52	99,564.7
19	Greece	3	30.0	8	48	44	23,400.7
20	Brazil	12	24.0	27	50	24	10,294.9
21	Swedish	7	22.4	15	30	54	55,516.8
22	South Africa	5	20.8	44	47	9	6,022.5
23	Chile	6	20.0	11	48	41	17,067.8
24	Bulgaria	1	20.0	14	50	36	15,885.5
25	Hungary	4	19.1	13	57	29	22,141.9
26	Finland	5	18.5	10	51	39	52,925.7
27	Portugal	4	13.3	18	41	41	27,331.2
28	Colombia	5	10.4	22	43	35	6,947.4
29	Argentina	3	10.3	26	55	19	14,187.5
30	Czech Republic	2	9.5	8	58	34	31,591.2
31	Türkiye	7	6.25	30	27	43	13,105.7
32	Romania	1	5.6	25	52	22	18,404.3
33	Mexican	5	5.2	42	30	28	13,790.0
34	Poland	3	4.6	5	48	46	22,056.7
35	Indonesia	4	4.4	42	40	18	4,876.3
36	Peru	1	2.1	22	32	46	7,906.6
37	India	5	0.7	61	16	23	2,480.8

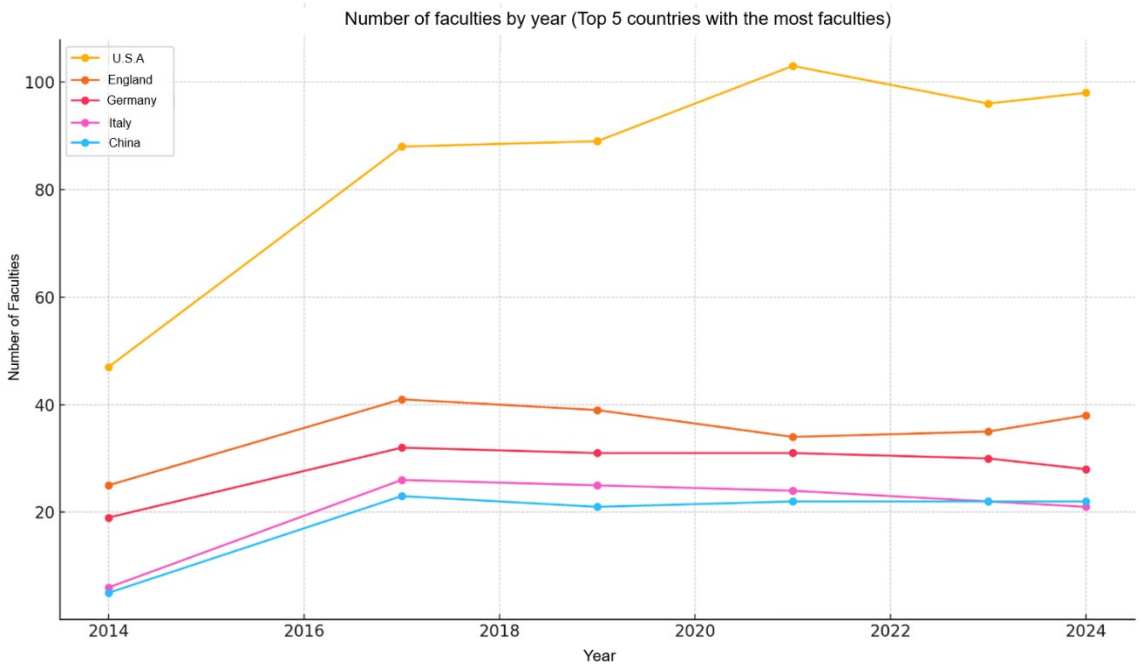
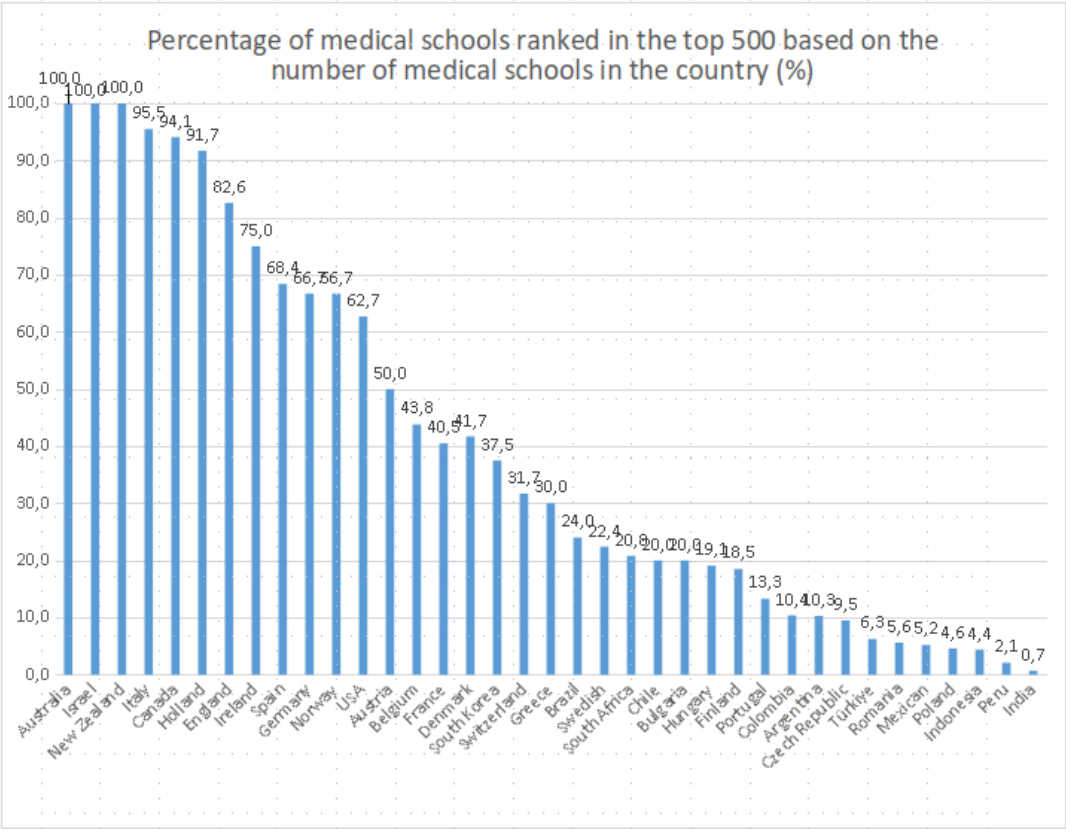


Figure 1. QS Ranking of the top 5 countries with the most medical schools in the world's top 500 medical schools by year.

Figure 2. Ranking of countries in 2024 based on the ratio of the number of medical schools included in the World's Top 500 Medical Schools List to the total number of medical schools in the country.



4. Discussion

In the present study, we used the QS World University Rankings for Medicine, which are based on publicly available evaluation criteria and a multi-indicator assessment framework. In this respect, our study is among the few to use this ranking system to evaluate national medical education performance. Based on the average number of listed medical schools, the United States ranked first, followed mainly by countries belonging to the G7 and G20 groups according to the official US Treasury Department website (13-14).This suggests that medical schools in economically developed countries are more strongly represented in international rankings, both numerically and proportionally. No statistically significant change was observed in the number of medical schools from individual countries listed in the QS top 500 between 2017 and 2024. Changes were minimal, typically involving only one or two schools entering or dropping from the list.

In this study, a new ranking was developed by calculating the ratio of medical schools listed in the QS World's Top 500 Medical Schools to the total number of medical schools in thirty-seven countries with accessible data. This ratio was considered a more meaningful indicator of each country's relative representation in high-ranking medical education. Using this approach, the USA dropped from first to twelfth place. Three countries achieved a 100% ratio—indicating that all their medical schools were in the top 500: Australia (first), Israel (second), and New Zealand (third). They were followed by Italy (95.5%), Canada (94.1%), and the Netherlands (91.7%), with seven other countries ranging between 50% and 90%. Türkiye ranked 31st, with a ratio of 6.25%. Among countries with low ratios expanding the number of medical schools in response to population needs does not necessarily increase representation in the QS World's Top 500 Medical Schools list-Country rankings based on the absolute number of medical schools included in the QS list differed from rankings based on the proportion of listed schools relative to the national total. This discrepancy may stem from the fact that not all medical schools within a country share the same standards. Country rankings based on the absolute number of medical schools included in the QS list differed from rankings based on the proportion of listed schools relative to the national total. However, this interpretation remains hypothetical and cannot be confirmed based on the present data alone.

Our study found a significant positive association between per capita national income and the ratio of medical schools listed in the 2024 QS World's Top 500 Medical Schools to the total number of medical schools in each country. This finding is consistent with previous studies in the literature. To our knowledge, this is one of the first studies to examine the correlation between OECD educational indicators—such as literacy rate, high school graduation rate, and tertiary education rate— and this ratio. The analysis revealed moderate positive correlations for per capita national income and tertiary education rate (r=0.635; r=0.553, respectively). High school graduation and literacy rates showed weaker but positive effects on the ratio (β=0.584, p=0.449, r=0.134; β=0.743, p=0.453; r=0.134, r=0.33, respectively). The proportion of variance in the dependent variable explained by these predictors was moderate (R^2=0.447), and their combined contribution to a predictive model was statistically significant (F=6.472; p=0.001).

Türkiye ranked 21st based on the average number number of medical schools listed in the QS World's top five hundred Medical Schools. This number did not change significantly over time (p>0.05). However, since 2014, the number of medical schools affiliated with state and foundation universities starting education each year has increased. In 2024, the proportion of Turkish medical schools listed in the QS top 500 was 6.25%. This low ratio may be partly associated with Türkiye's recent economic challenges and lower per capita national income.

As suggested by Pietrucha, broader governance-related factors, political instability, and limitations in academic autonomy may also contribute to ranking performance. Economic challenges and concerns regarding academic promotion practices may also affect the attractiveness

and competitiveness of medical education. In addition, expanding student admissions may alter the academic profile of incoming medical students. Research output and scientific performance may also be limited by increasing clinical workload and insufficient financial support.

Limitations

World ranking systems have faced substantial criticism (11), mainly because of vague evaluation criteria and weighting methodologies, the difficulty of translating qualitative indicators of academic quality into quantitative measures, and the omission of some relevant indicators (2-3, 13). Soh summarized the methodological and statistical shortcomings of World University Ranking systems, highlighting issues such as the simple weighting and summation approaches commonly used in these rankings. Soh argued that methodological weaknesses, such as false precision (rankings exaggerate small differences in total scores), weight inconsistencies, assumed mutual compensation, indicator redundancy, inter-system inconsistency, neglect of indicator scores, and inconsistency between changes in ranking and overall scores limit their reliability (14). These limitations should also be considered when interpreting the findings of the present study.

The QS World University Rankings (for the field of medicine) used in this study was constructed based on numerous dimensions and indicators (3). However, the reliance on a limited number of economic and educational criteria—when considering the number of medical schools included in the QS list of the world's top 500 medical schools and their ratio to the total number of medical schools in a given country—can be regarded as a significant limitation. External variables influencing the number of medical schools featured in the QS top 500 list and their proportion relative to the country's total medical schools include the implementation of diverse educational models, the country's social structure, ethnic and cultural differences, the preferences of university administrations, and general national policies regarding medical education. This aspect may be considered a limitation of the study.

5. Conclusions

- Countries in the G7 and G20 groups had a high level of representation in the QS World's Top 500 Medical Schools lists, both numerically and proportionally. The number of medical schools from these countries included in the QS top 500 list did not change significantly between 2017 and 2024. The top five countries by average number of medical schools in the QS Top 500 during this period were the United States, the United Kingdom, Germany, Canada, and Japan.
- Evaluating countries according to the proportion of their medical schools included in the QS top 500 list provided a more informative measure of relative national performance revealing that having many medical schools does not necessarily translate into higher representation in the QS rankings. Türkiye ranked 31st with a ratio of 6.25%. A statistically significant positive association was found between this ratio and per capita national income.
- Additionally, tertiary education rates showed a moderate positive correlation with the ratio, while other OECD educational indicators, such as literacy and high school graduation rates, had weak correlations. This study suggests that per capita national income and certain educational indicators are associated, to varying degrees, with the number of medical schools from a given country appearing on the QS list of the world's top 500 medical schools, as well as with the ratio of these schools to the country's total number of medical schools.
- Further studies are needed to clarify whether international ranking performance reflects the actual quality of national medical education and the ability of medical schools to train physicians with adequate, up-to-date knowledge and skills. Future research should also incorporate additional external variables that may influence ranking performance.

Nevertheless, the findings of this study may provide a basis for more comprehensive research in this field.

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