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Workforce trends and distribution of endodontists in Saudi Arabia

Hussam M. Alqahtani[1,2*], Nawaf Alfahad[3], Mohammed Asseery[2,4] and Abdulmohsen Alfadley[2,4]

Abstract

Background Endodontists play a vital role in preserving natural dentition through specialized care. Despite significant growth in the dental workforce in Saudi Arabia, there is limited data on the demographic trends, professional ranks, and regional distribution of endodontists. This study aims to analyze the endodontic workforce in Saudi Arabia, focusing on workforce growth, gender and nationality distribution, professional rankings, and regional variations in training programs and the number of practicing endodontists.

Methods A retrospective analytical study was conducted using data from the Saudi Commission for Health Specialties (SCFHS). All registered endodontists practicing in Saudi Arabia up to December 2024 were included. Descriptive statistics were used to analyze workforce trends, professional ranks, and trainee distribution. The endodontist-to-population ratio was calculated based on Saudi Arabia's 2023 population.

Results A total of 1,336 endodontists were identified, with 61.45% being Saudi nationals. Male practitioners comprised 61.45% of the workforce. Consultants accounted for 33.16% of all endodontists, with Saudi nationals dominating higher professional ranks. Significant regional disparities were observed in the distribution of endodontists and trainees, with Riyadh and Makkah hosting the majority of both groups. The endodontist-to-population ratio reached 4.1 per 100,000 people.

Conclusion This study reveals substantial growth in Saudi Arabia's endodontic workforce, with notable regional disparities in trainee distribution. Future studies should focus on addressing these disparities and assisting policymakers in achieving balanced workforce development. Moreover, future research could explore the impact of these regional disparities on patient care outcomes, including accessibility, quality of care, and treatment success rates in underserved areas.

Keywords Demographics, Endodontics, Saudi Arabia, SCFHS, Workforce distribution

*Correspondence:
Hussam M. Alqahtani
Qahtanihu@ksau-hs.edu.sa
[1]Department of Preventive Dental Science, College of Dentistry, King Saud Bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia
[2]King Abdullah International Medical Research Center, Ministry of National Guard Health Affairs, Riyadh, Saudi Arabia
[3]College of Dentistry, King Saud Bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia
[4]Department of Restorative and Prosthetic Dental Sciences, College of Dentistry, King Saud Bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia

Background

Endodontics is a specialized branch of dentistry that focuses on diagnosing and treating dental pulp and periapical tissue conditions. Endodontists play a critical role in preserving natural teeth by eradicating infection, alleviating pain, and restoring tooth functionality. According to López et al. [1], the global prevalence of individuals with at least one root-filled tooth (RFT) is 55.7%, highlighting the substantial global demand for endodontic treatment. Similarly, a study in Saudi Arabia reported that 52.8% of people had at least one RFT [2], underscoring the significant need for endodontic care in the region.

Globally, a previous study reported that there are at least 1.6 million practicing dentists [3]. For endodontics, previous research has examined workforce trends, often revealing challenges such as shortages and uneven geographic distribution [4–9]. For example, a U.S.-based study reported that rural areas faced a shortage of endodontists compared to urban regions, despite steady growth in the total number of specialists, from 2,124 in 1982 to over 4,000 by 2002 [5]. During this period, the endodontist-to-population ratio has improved, increasing from 1.4 per 100,000 in 1991 to 1.9 per 100,000 in 2006 [5]. A 2009 follow-up study reaffirmed this uneven distribution despite a gradual increase in workforce numbers [6]. These findings highlight the persistent difficulties in meeting endodontic care demands, even in countries with growing endodontic workforces.

In Saudi Arabia, previous research has explored dental workforce trends [10–12]. Alqahtani et al. reported that there are 901 practicing endodontists in Saudi Arabia between 2015 and 2020 [11]. Alqahtani and Alshehri also analyzed the dental workforce by subspecialty, identifying 700 practicing periodontists and a periodontist-to-population ratio of 2.2 per 100,000 [12]. However, there remains to be a lack of detailed analysis specific to endodontics regarding workforce demographics, gender distribution, regional breakdown, and professional ranking in Saudi Arabia.

Understanding the number of practicing endodontists, their annual growth, gender distribution, nationality, professional rankings and their distribution across the regions is critical for several reasons. First, analyzing workforce trends can guide policy-making and educational planning to address gaps in specialized care and meet the Kingdom's growing demand for endodontic services. Second, evaluating the balance between Saudi and non-Saudi endodontists is essential for assessing the Kingdom's self-sufficiency in producing specialized dental professionals, ensuring long-term sustainability and healthcare independence. Therefore, this study aims to provide a comprehensive analysis of the endodontic workforce in Saudi Arabia, focusing on its composition, trends, and alignment with the country's healthcare needs.

Methodology

Study design

A retrospective analytical study was conducted to analyze the demographic profile of endodontists practicing in Saudi Arabia.

Data source

The data were obtained from the Saudi Commission for Health Specialties (SCFHS) on practicing endodontists as of December 2024.

Inclusion and exclusion criteria

The inclusion criteria consisted of all endodontists registered with the Saudi Commission for Health Specialties (SCFHS) and actively practicing in Saudi Arabia. There were no exclusion criteria, as the study aimed for a complete census of the eligible population to ensure comprehensive data collection.

Sampling

Purposive sampling was used, targeting all practicing endodontists in Saudi Arabia. The dataset included all registered endodontists up to December 2024, providing a robust and representative sample size.

Variables of interest

The study variables, adapted from Alqahtani et al. [12], included several key aspects. These were the total number of endodontists and their annual growth trends, gender distribution (male vs. female), and nationality (Saudi vs. non-Saudi). Professional ranking was also assessed, covering consultants, senior registrars, registrars, training residents, and general dentists. Additionally, the geographic distribution of endodontists and trainees was analyzed across the 13 regions of Saudi Arabia. These regions are Riyadh, Makkah, Madinah, Eastern Province, Asir, Tabuk, Hail, Al-Qassim, Jazan, Najran, Al-Baha, Al-Jouf, and Northern Borders. Endodontists who did not specify their practicing location were categorized as "Unknown."

Endodontist-to-population ratio calculation

The endodontist-to-population ratio was calculated using the equation from Alqahtani et al. [12]. The total number of practicing endodontists was divided by Saudi Arabia's 2023 population of 32,175,224 [13], and the result was multiplied by 100,000 to express the ratio.

Ethical approval

The study protocol was approved by the Institutional Review Board (IRB) at King Abdullah International

Table 1 Distribution of endodontists by gender and nationality

Gender	Saudi *N* (row %)	Non-Saudi *N* (row %)	Total *N* (column %)
Male	483 (58.83%)	338 (41.17%)	821 (61.45%)
Female	338 (65.63%)	177 (34.37%)	515 (38.55%)
Total	821 (61.45%)	515 (38.55%)	1336

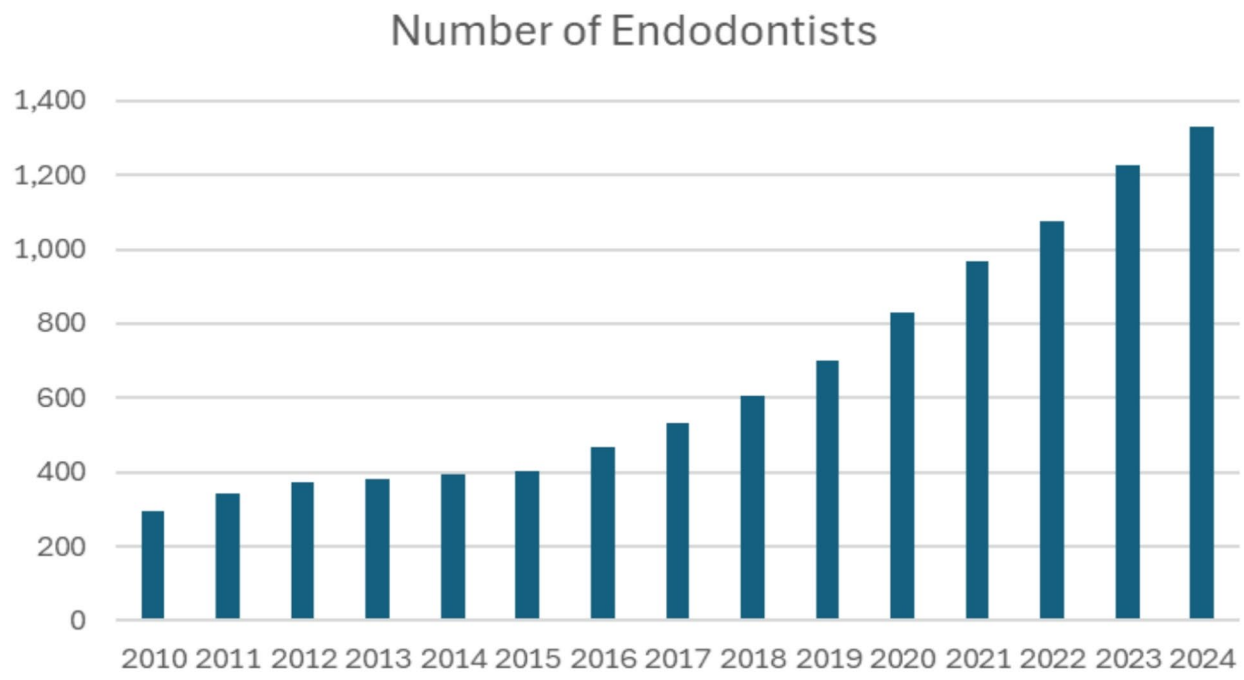

Fig. 1 Number of practicing endodontists in Saudi Arabia (2010–2024)

Medical Research Center (IRB# NRR24/011/11). The IRB waived the need for informed consent, as the study did not involve direct contact with human subjects or the use of identifiable personal data.

Statistical analysis

Descriptive statistics were performed using Microsoft Excel 2016, and the results were presented as frequencies, percentages, and ratios for categorical variables. Growth trends in the endodontic workforce were analyzed over time to identify patterns. The demographic and professional characteristics of endodontists were assessed by gender (male, female), nationality (Saudi, non-Saudi), and professional rank (consultant, senior registrar, registrar, training resident, general dentist). The proportions of male and female endodontists within each rank were compared. Additionally, a bar graph was used to examine the geographic distribution of trainees across the 13 regions of Saudi Arabia.

Results

Distribution of endodontists by gender and nationality

As of December 2024, there were 1,336 endodontists practicing in Saudi Arabia, of whom 821 (61.45%) were male and 515 (38.55%) were female. Among Saudi nationals, 483 (58.83%) were male and 338 (41.17%) were female, comprising a total of 821 (61.45%) Saudi practitioners. Non-Saudi endodontists made up 515 (38.55%) of the workforce, with 338 (65.63%) males and 177 (34.37%) females. Table 1 provides a detailed breakdown of the distribution of endodontists by gender and nationality.

Growth in the endodontic workforce

The data demonstrated a steady increase in the number of endodontists over the years. In 2010, there were approximately 250 endodontists. By 2015, the number exceeded 400, and by 2018, it had grown to around 600. From 2019 onward, workforce growth accelerated significantly, reaching 1336 in 2024. This equates to an endodontist-to-population ratio of approximately 4.1 per 100,000 people. Figure 1 illustrates this workforce growth over the past 14 years

Professional ranking

Table 2 presents the distribution of endodontists practicing in Saudi Arabia, categorized by nationality (Saudi vs. non-Saudi), gender, and professional rank. The five professional ranks are consultant, senior registrar, registrar,

Table 2 Endodontist workforce by professional rank and demographics

Rank	Saudi Male *N* (%)	Saudi Female *N* (%)	Non-Saudi Male *N* (%)	Non-Saudi Female *N* (%)	Total *N* (%)
Consultant	255 (57.56%)	151 (34.09%)	29 (6.55%)	8 (1.80%)	443 (33.16%)
Senior Registrar	89 (40.83%)	83 (38.07%)	26 (11.93%)	20 (9.17%)	218 (16.32%)
Registrar	45 (10.37%)	22 (5.07%)	243 (55.99%)	124 (28.57%)	434 (32.49%)
Training Resident	94 (39.50%)	81 (34.04%)	38 (15.96%)	25 (10.50%)	238 (17.81%)
General Dentist	0	1 (33.33%)	2 (66.67%)	0	3 (0.22%)
Total	**483**	**338**	**338**	**177**	**1336**

Table 3 Regional distribution of endodontists across Saudi Arabia's regions

Regions of Saudi Arabia	Male *N*	Female *N*	Total *N* (column%)
Al Bahah	7	3	10 (0.75%)
Al Jawf	11	3	14 (1.05%)
Al Madinah	54	34	88 (6.59%)
Al-Qassim	35	24	59 (4.42%)
Asir	56	18	74 (5.54%)
Eastern Province	87	53	140 (10.48%)
Hail	13	6	19 (1.42%)
Jizan	18	5	23 (1.72%)
Makkah	186	144	330 (24.70%)
Najran	11	0	11 (0.82%)
Northern Borders	7	1	8 (0.60%)
Outside KSA	51	31	82 (6.14%)
Riyadh	260	187	447 (33.46%)
Tabuk	16	2	18 (1.35%)
Unknown	9	4	13 (0.97%)
Total	816	512	1,336

training resident, and general dentist. Among consultants, there were 443 practitioners (33.16%), with 255 Saudi males (57.56%) forming the majority, followed by 151 Saudi females (34.09%). Non-Saudis represented smaller proportions, with 29 males (6.55%) and 8 females (1.80%). For senior registrars, a total of 218 practitioners (16.32%) were recorded. This group included 89 Saudi males (40.83%) and 83 Saudi females (38.07%), while non-Saudis comprised 26 males (11.93%) and 20 females (9.17%). The registrar rank included 434 individuals (32.49%), where non-Saudi males made up the majority with 243 practitioners (55.99%), followed by 124 non-Saudi females (28.57%). Saudi nationals were fewer, with 45 males (10.37%) and 22 females (5.07%). Among the 238 training residents (17.81%), Saudi nationals constituted the majority, comprising 94 males (39.50%) and 81 females (34.04%). Non-Saudi residents included 38 males (15.96%) and 25 females (10.50%). The general dentist category was the smallest, with only 3 individuals (0.22%), including 2 non-Saudi males and 1 Saudi female.

Regional distribution of endodontists

Among the 1,336 registered endodontists in Saudi Arabia, Riyadh had the highest concentration with 447 (33.46%), followed by Makkah with 330 (24.70%), together comprising 58.16% of the total. The Eastern Province accounted for 140 endodontists (10.48%), while Al Madinah and Asir contributed 88 (6.59%) and 74 (5.54%), respectively. Al-Qassim reported 59 (4.42%), with Jizan and Tabuk having 23 (1.72%) and 18 (1.35%). Smaller numbers were recorded in Al Jawf with 14 (1.05%), Hail with 19 (1.42%), Najran with 11 (0.82%), and Al Bahah with 10 (0.75%). The Northern Borders had the lowest representation with 8 (0.60%). Additionally, 82 endodontists (6.14%) were registered outside Saudi Arabia, while 13 (0.97%) were categorized as "Unknown." This distribution reflects the concentration of endodontic specialists in major regions, with fewer practitioners in less populated areas. A detailed regional breakdown is provided in Table 3

Regional distribution of trainees

Among the 238 trainees in endodontic programs, the majority were concentrated in Riyadh with 87 trainees (48 males and 39 females) and Makkah with 52 trainees (26 males and 26 females), together comprising most of the total. Geographical disparities were noted, as other regions reported lower trainees' numbers. The Eastern Province recorded 19 trainees (8 males and 11 females), followed by Al Madinah with 17 trainees (11 males and 6 females) and Asir with 16 trainees (8 males and 8 females). Al-Qassim also had 8 trainees (4 males and 4

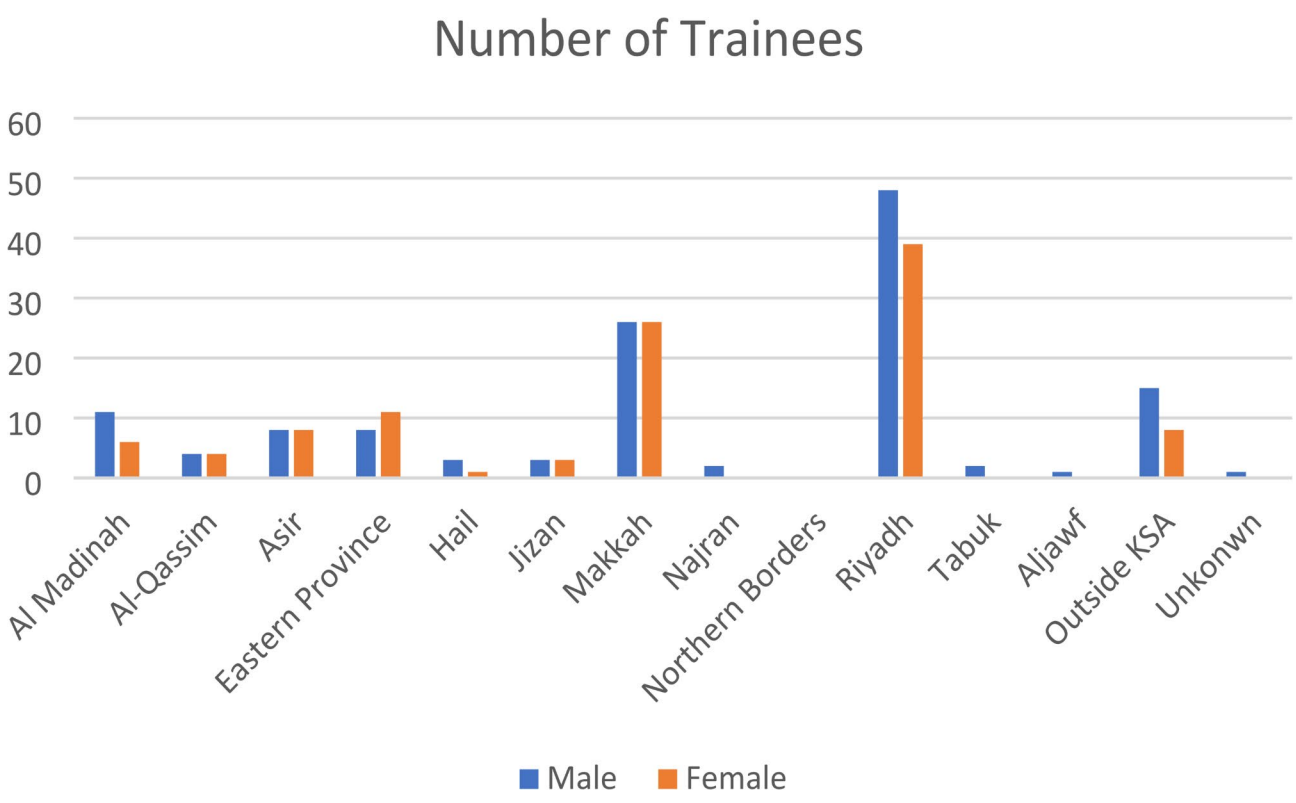

Fig. 2 Geographic distribution of endodontic trainees in Saudi Arabia

females), while Jizan accounted for 6 trainees (3 males and 3 females). Hail recorded 4 trainees (3 males and 1 female), Tabuk had 2 trainees (2 males), and Al Jawf had 1 trainee (1 male). Najran reported 2 trainees (2 males), with no trainees in the Northern Borders. A total of 23 trainees were outside Saudi Arabia (15 males and 8 females), and 1 trainee (1 male) was listed under the "Unknown" category. Figure 2 provides a detailed overview of the trainee distribution across Saudi Arabia

Discussion

This study provides a thorough evaluation of the endodontic workforce in Saudi Arabia, offering insights into workforce growth, demographic distribution, and professional rankings. The findings demonstrate a significant increase in the number of practicing endodontists, rising fivefold over the past 14 years—from approximately 250 in 2010 to 1,336 in 2024. A previously published study by Alqahtani et al. [11] identified 901 endodontists practicing between 2015 and 2020. The accelerated growth of endodontists in Saudi Arabia contrasts with the 1.5-fold increase observed in the United States between 1991 and 2006 [5]. This growth reflects Saudi Arabia's substantial investment in dental education, specialization programs, and its commitment to improving oral healthcare services.

When compared to the global trends, the current endodontist-to-population ratio in Saudi Arabia is at 4.1 per 100,000 people, which is significantly higher than the 1.9 per 100,000 reported in a 2009 study conducted in the United States [6]. This disparity may stem from differences in population size and demographics; Saudi Arabia's smaller population amplifies its specialist-to-population ratio.

Several factors may explain the rapid expansion of the endodontic workforce in Saudi Arabia. The establishment of new dental colleges and postgraduate training programs has increased the number of qualified specialists entering the field [10]. Saudi Arabia's rising population and greater awareness of endodontic care have driven the demand for specialized treatments. Additionally, there has been a noticeable shift in treatment needs, with more emphasis on preserving natural teeth through root canal treatments rather than extractions, necessitating the recruitment of more endodontists to meet this demand [14].

The study revealed that Saudi nationals dominate the consultant and senior registrar ranks, representing 91.65% and 78.90%, respectively. Non-Saudis, however, are concentrated at the registrar level, where they account for 84.56%. This distribution highlights the success of workforce development strategies in training and advancing Saudi professionals to higher ranks. It also

underscores a continued reliance on non-Saudi practitioners for mid-level roles, which may require long-term policies to ensure workforce self-sufficiency. Gender disparities were also evident across all professional ranks, with males representing the majority of practitioners. While female participation is growing, particularly among Saudi nationals in senior positions, targeted efforts may be needed to further support and encourage female professionals in endodontics.

The results of this study revealed significant regional disparities in the distribution of endodontists across Saudi Arabia, with the majority concentrated in major urban areas. This pattern mirrors the findings of Alqahtani and Alshehri [12], who reported similar disparities in the distribution of periodontists, with most specialists also clustered in urban centers. Moreover, our findings are consistent with studies conducted in other countries [4–7], which similarly highlight an uneven geographic distribution of dental specialists, favoring densely populated urban regions over rural or less populated areas.

The study identified strong interest among recent graduates in the endodontic specialty, with 238 out of 1,336 endodontists in Saudi Arabia being current trainees. This trend aligns with previous studies, which reported 410 endodontists in 2016 [10] and 901 between 2015 and 2020 [11]. Additionally, more than 60 non-Saudi trainees are enrolled in endodontic training programs, likely due to the reputation of Saudi endodontic education. However, significant regional disparities exist in the distribution of trainees. Riyadh and Makkah had the majority of the trainees, while regions such as the Eastern Province and Northern Borders areas have minimal representation. This uneven distribution may limit access to specialized care in underserved regions, highlighting the need for strategies to expand training opportunities nationwide. In addition, these trends present both opportunities and challenges for graduates. While the growing number of endodontists reflects workforce expansion, it also raises concerns about potential job market oversaturation and future unemployment.

The strengths of this study are attributed to its thorough analysis of the endodontic demographic profile in Saudi Arabia, covering key variables such as workforce size, gender, nationality, professional rank, and geographic distribution of trainees. By using reliable data from the Saudi Commission for Health Specialties (SCFHS), the study provides an up-to-date and detailed overview of the current workforce. The inclusion of both Saudi and non-Saudi endodontists offers a broader perspective on workforce composition, while the observed increase in training residents highlights a growing interest in the endodontic specialty. This data serves as a valuable resource for policymakers and educators in planning workforce needs and ensuring that training programs align with the demand for endodontic services.

The findings of this study have several important implications for clinical practice, workforce planning, and healthcare policy in Saudi Arabia. Policies should aim to reduce reliance on non-Saudi practitioners by expanding local training programs and ensuring equitable distribution of specialists across the country. Increasing the availability of endodontics training programs in underserved regions can enhance access to care and reduce geographic disparities. Clinically, the growing number of endodontists presents opportunities to improve patient care, reduce wait times, and meet the increasing demand for specialized dental services.

This study has certain limitations. Although the comprehensive data provides insights into the current endodontic workforce, it may not capture all dentists who are practicing endodontists, such as general dentists or those with advanced training in endodontic treatment. Future research should focus on ensuring more inclusive data collection to reflect the true size of the workforce. Additionally, the study did not explore the reasons behind workforce growth and regional disparities, nor did it assess whether current workforce trends are sustainable or sufficient to meet actual demand. Further studies should investigate these factors, evaluate how workforce distribution aligns with the need for endodontic services, and address concerns about potential job market oversaturation and future unemployment. Moreover, general dentists were included because those who hold a degree in endodontics but are not classified as specialists or consultants by the Saudi Commission for Health Specialties (SCFHS) are still categorized as general dentists.

Conclusion

This study highlights the significant growth of the endodontic workforce in Saudi Arabia, with a current ratio of 4.1 endodontists per 100,000 people. Saudi nationals predominantly occupy higher professional ranks, reflecting the success of workforce development initiatives. However, the concentration of endodontists and trainees in Riyadh and Makkah underscores regional disparities in access to training programs. Future research on workforce distribution and sustainability is essential to ensure a balanced and robust endodontic workforce that meets the evolving healthcare needs of Saudi Arabia. Additionally, further studies could investigate how these regional imbalances affect patient care outcomes, particularly in terms of accessibility, quality of care, and treatment success rates in underserved areas.

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Author contributions
HA generated the research idea. All authors (HA, NF, MA, AF) participated in writing the proposal, obtaining the data, analyzing the data, and writing the manuscript. All authors (HA, NF, MA, AF) have read and approved the final version of the manuscript.

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Data availability
The data that support the findings of this study are available from SCFHS, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of SCFHS.

Declarations

Ethics approval and consent to participate
The study complied with the ethical standards stated in the Declaration of Helsinki. The study protocol was approved by the Institutional Review Board (IRB) at King Abdullah International Medical Research Center (IRB# NRR24/011/11). The IRB waived the need for informed consent, as the study did not involve direct contact with human subjects or the use of identifiable personal data.

Consent for publication
Permission for publication was granted by the Saudi Commission for Health Specialties (SCFHS), the data owner.

Competing interests
The authors declare no competing interests.

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