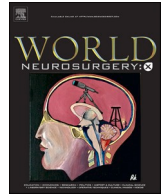




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## Saudi women pioneers in neurological surgery: Insights into progress and inclusion

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### ABSTRACT

Forty years ago, General Professor Dr. Khalaf Al-Mouteary established the first neurosurgical department in the Kingdom of Saudi Arabia. Here, we explored various pieces of evidence on the progress and inclusion of Saudi female pioneers in the neurosurgical workforce of the Kingdom of Saudi Arabia. We gathered information data on the inclusion of women in neurological surgery retrieved from open-resource online documentation of the Ministry of Health and direct communication with Saudi Commission for Health Specialties (SCFHS) administrative services. Furthermore, regional neurosurgery program directors, four active registered consultants, were either interviewed live or through offline communications. Data on the current number of board-certified, active female neurosurgeons in either the government or private sectors, along with the number of current neurosurgery postgraduate residency program trainees, were obtained from the registered database of the SCFHS. Since 2002, 18 women (29 %) have graduated from the Saudi Neurosurgical Residency Training Program (SNRTP), in contrast, 71 % of the graduates were male. The SNRTP is now training more than 34 females (30 %), who are progressing in their neurosurgical training across the country. The first Saudi woman to pursue neurosurgery was Dr Samia Abdel-Rahim Maimani, while the first woman to pass the Saudi Neurosurgery Board was Dr Aisha Al-Hajjaj in 2002. In 2021, board-certified female neurosurgeons in Saudi Arabia will represent approximately 3 % of all practicing neurosurgeons.

### 1. Introduction

King Abdul-Aziz founded the Kingdom of Saudi Arabia (KSA) in 1932. Primary education for girls only began in 1959. Saudi women only began to pursue higher education in 1961, only four years after the foundation of the first Saudi university.<sup>1</sup> At the time, the first Saudi woman who attempted to study medicine, Dr. Nawal Jmal, reached the World Health Organization to facilitate her journey abroad. Dr. Jamal postponed her postgraduate medical education to fulfill a royal order to go with and lead sixty other women to study medicine abroad.<sup>2</sup> The first Saudi female neurosurgeon was Dr. Samia Abdel-Rahim Maimani. (1955–1997) who graduated from King Faisal University with a Bachelor's degree in medicine and surgery. Women's empowerment is not new to Saudi Arabia, as efforts have always been made by the Saudi

government. A significant example is the progress of these pioneers in male-dominated specialties, such as neurosurgery.

### 2. Material and methods

The first four female neurosurgeons in Saudi Arabia and other neurosurgery trainees participated in the project using the chain-referral sampling method. All participants were interviewed live or offline in 2020. Information was retrieved from an open-resource database published by the Ministry of Health and through direct contact with the Saudi Commission for Health Specialties (SCFHS) administrative services and regional neurosurgery program directors. The following information was retrieved: (1) the current number of board-certified, active female neurosurgeons in either the governmental or private

Abbreviations: SNRTP, SCFH.

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sectors; (2) the number of current neurosurgery postgraduate residency program trainees; and (3) significant events, obstacles, and milestones facing female neurosurgeons.

### 3. Results

In 1995, Saudi Arabia established its first national residency program in neurosurgery. The Saudi Neurosurgery Residency Training Program (SNRTP) is under the umbrella of the SCFHS. Before that, trainees such as Dr. Samia Maimane went abroad to acquire a neurosurgery education. Fig. 1 shows notable historical events that led to the inclusion of women in the field. In 2002, the first woman to graduate from the Saudi Board of Neurosurgery was Dr Aisha Al-Hajjaj, followed by Dr. Jameelah Mortadha. In 2013, Dr. Taghreed Al-Sinani was the first woman in the Western region to be board-certified in neurosurgery in Saudi Arabia.

Dr Ikhlas Al-Tweijry was the first female neurosurgeon to return to the Canadian board (Fig. 2). She was the first resident to be accepted into the neurosurgery residency program at her local hospital, King Saud University Medical City, in 2002–2003. However, because the local program was still in its early years, she decided to complete her residency through a more established program at the University of Ottawa in Japan. Another notable name was Dr. Soha Al-Omar, who obtained her bachelor’s degree in medicine and surgery (MBBS) from King Abdulaziz University, Jeddah, KSA in 2004. During her training, Dr. Al-Omar won multiple merit awards from the Saudi Cultural Bureau in Canada for excellent academic achievement.

Dr. Al-Hajjaj obtained two fellowships, one training in combined neurovascular and interventional neuroradiology and the other in spine surgery, both from the Western University of London, Ontario, Canada. (Aug 2002–Feb 2006). In Oct 2015, Dr. Al-Hajjaj completed a third fellowship in Advanced Neuro-Interventional Techniques at Beaujon/Bicetre Kremlin Hospital in France. Dr. Mortadha received her residency education and Pediatric Neurosurgery Fellowship at King Faisal Specialist Hospital and Research Center. Subsequently, she started her practice at King Fahad General Hospital for a couple of years until she finally settled in Yanbu Industrial City at the Royal Commission Yanbu Hospital. Dr. Al-Sinani specializes in general neurosurgery, and the bulk of her training is in trauma, as she works at the largest trauma center in the western region of King Fahad Hospital.

#### 3.1. Saudi women in neurosurgery: inventors and pioneers

In 1996, a year before her unfortunate death, Dr. Maimani applied to patent the surgical device with which she shares her name. Maimani’s aneurysm clip applicator and remover took three years to be patented and was published in 1999.<sup>2</sup>

In 2013, in collaboration with the Ear, Nose, and Throat Department at King Abdulaziz Hospital, Dr. Al-Tuwaijri was one of the leading surgeons to successfully perform auditory brainstem implantation in the Middle East.<sup>3</sup>

#### 3.2. Saudi women in neurosurgery: leadership and academia

Senior and young Saudi female neurosurgeons have demonstrated outstanding leadership qualities throughout their careers. At the annual 12th meeting of the Saudi Association of Neurological Surgery (SANS) in 2018, Drs. Al-Tuwaijri, Al-Omar, and Al-Sinani were all chairpersons. Dr. Al-Hajjaj was the chairperson of the Arab Women in the Neurosurgery Seminar, Pan Arab Society Meeting, 2014, Abu-Dhabi, UAE. In 2020, Dr. Al-Hajjaj was the chairperson at the 14th annual meeting of SANS. Furthermore, Dr. Al-Hajjaj was the Neurosurgery Program Director of the Eastern Province from Nov 2016 to March 2018. Dr. Al-Hajjaj is currently the Head of the Neuroscience Department and Deputy Head of Postgraduate Training & Academic Affairs since December 2019 at the Saudi German Hospital in the eastern province. In addition, Dr. Al-Omar has been the Treasurer of the Asian Congress of Neurological Surgeons Women in Neurosurgery Chapter since 2018. Dr. Al-Omar was the program director of neurosurgery training at King Abdulaziz University Hospital in 2017 and 2019. Since 2009, Dr. Al-Tuwaijri has been the only Saudi neurosurgeon specializing in pediatrics at King Khalid University Hospital, Riyadh. In addition, Dr. Al-Sinani was recently appointed the acting head of the neurosurgery department at King Fahad Hospital in Jeddah. Saudi women hold ten academic positions, the highest among all Arab countries. The Kingdom empowers women to occupy higher positions and pursue careers in predominantly male fields. Dr. Soha Alomar was the Program Director of the Neurosurgery Residency Program 2019 at King Abdulaziz University Hospital in Jeddah. Moreover, Dr. Taghreed Alsinani is currently the head of the Neurosurgery Department at King Fahad Hospital and the Program Director of Neurosurgery. Additionally, Dr. Alsinani was appointed as the regional coordinator of the Western Province by the Saudi Ministry of Health in 2018.

## Historical Path of Progress & Inclusion of Saudi Women in Neurosurgical Workforce

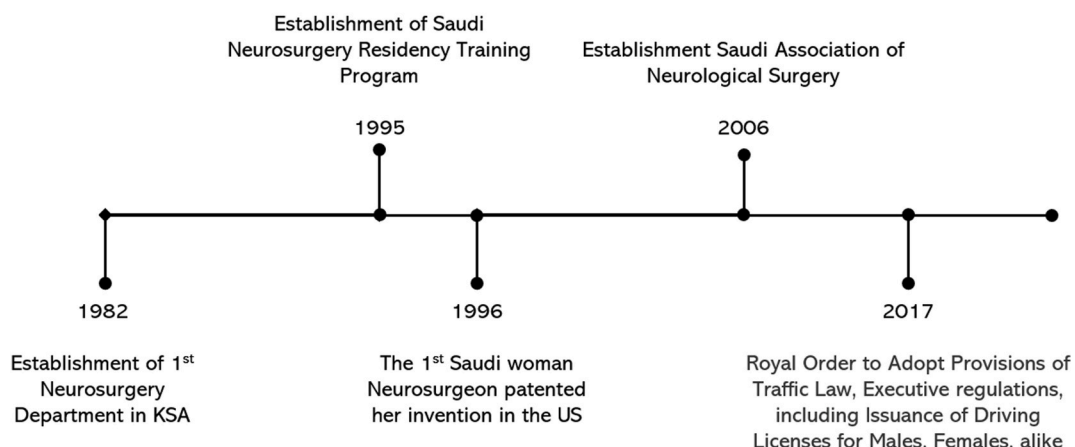
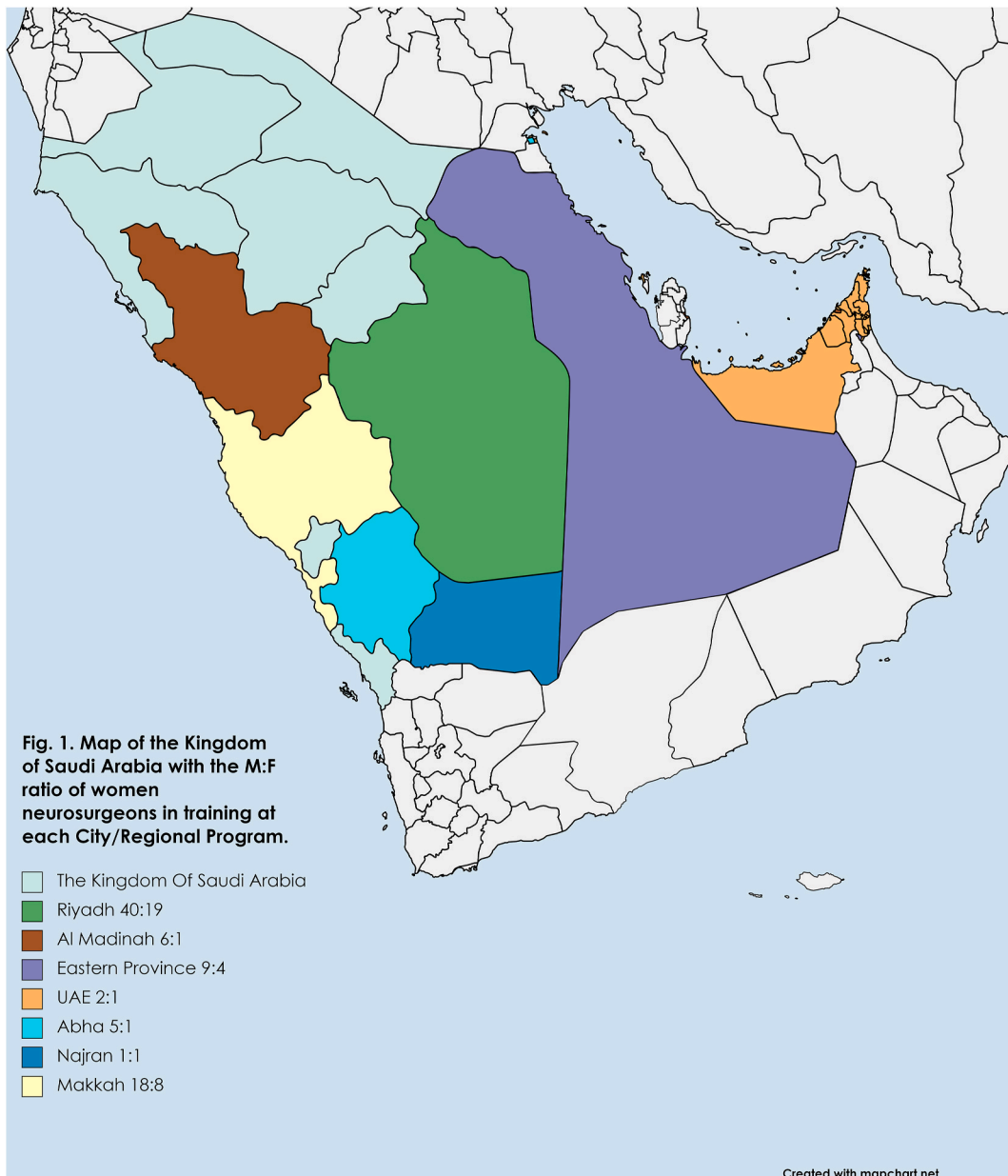


Fig. 1. Timeline of notable events led to inclusion of Saudi women pioneers in neurosurgery.



**Fig. 2.** Map of neurosurgery residents’ (M: F) distribution across the Kingdom of Saudi Arabia Ministry of Health (MOH), direct communication with Saudi Commission for Health Specialties (SCFHS), Saudi Neurosurgical Residency Training Program (SNRTP), Kingdom of Saudi Arabia (KSA).

**4. Discussion**

Despite the growing number of female neurosurgeons in Saudi Arabia, personal choices, beliefs, and misconceptions deter younger women from pursuing neurosurgery. A cross-sectional study in Saudi Arabia revealed that approximately 82.7 % of female medical students found neurosurgery an exciting specialty, and 33.1 % considered it a career. Only 36.5 % of male students and 12.3 % of female students agreed that neurosurgery was a male specialty. Motherhood is another critical factor that influences the choice to pursue a demanding specialty such as neurosurgery. Saudi medical students responded with 61.4 % agreement that neurosurgery impedes family life.<sup>4</sup> Similarly, an Irish study reported that medical students consider neurosurgery a highly demanding specialty, with an agreement of 87 %, expressing their concerns that it is a rigorous, time-consuming specialty with more responsibilities.<sup>5</sup> A European study showed that female neurosurgeons postpone child-bearing; approximately 78 % of female neurosurgeons had no children,

at an average age of 35.<sup>6</sup> A US study showed personal preferences for childbearing before residency.<sup>7</sup>

Lack of mentorship is a challenge for female trainees and aspiring candidates. For example, a study in the United States showed that the number of female attending physicians was among the lowest five factors influencing female decision-making regarding residency programs. However, this may influence the perception of neurosurgery and contribute to a higher attrition rate among female neurosurgeons in the United States.<sup>8</sup> In a study aimed at assessing Saudi medical students’ perceptions of neurosurgery, 65.3 % of female medical students agreed that seniors/teachers had a significant impact on their choice of specialty.<sup>4</sup> This conclusion is also consistent with the findings of Omani’s research, which found that the presence of a mentor increased interest in neurosurgery by 98 %.<sup>9</sup>

Women’s empowerment is vital for the latest structural reforms required to attain Saudi Arabia’s Vision 2030. This program prohibits discrimination based on sex in occupational preferences, field of work,

hours of work, and salary. As a result, women are increasingly included in the workforce. As an essential step towards promoting women's progress, the government has adopted a cohesive approach to achieve equality of representation and responsibilities between men and women across all fields.<sup>10</sup> Nowadays, the majority (55.8 %) of Saudi Arabia's university graduates are women, and 99.4 % of young women are literate (ages 15–24).<sup>11</sup> In Saudi Arabia, women first entered the medical field in 1975, and this number has steadily increased over the past few decades. The gender gap narrowed in 2016 when 40.5 % of Saudi medical graduates were women.<sup>12</sup> An online survey conducted in Saudi Arabia among male and female physicians revealed that the majority believed that doctors were treated equally in terms of salaries, benefits, and opportunities for promotion.<sup>13</sup>

Contrary to popular beliefs about the Kingdom, politics, religion, and cultural forces have not hindered the progress of Saudi women in pursuing a competitive, male-dominated field, such as neurosurgery. Two of the most conservative countries in the Middle East, Saudi Arabia and Iran, have the highest number of women in neurosurgery. Interestingly, Lebanon had the lowest proportion of female physicians, with no female physicians in neurosurgery, oncological surgery, or vascular surgery despite being known as one of the most liberal Arab countries.<sup>14</sup> The United Arab Emirates, for instance, has only one neurosurgery residency program, established in 2015, and has three female practicing neurosurgeons and only three trainees. In Kuwait, there are 40 board-certified neurosurgeons, five of whom are women and three are female neurosurgery residents. There are four female neurosurgeons in Qatar, whereas in Jordan, Yemen, and Palestine there is only one each. Female neurosurgeons working in Syria or Oman are yet to be identified.<sup>15</sup>

Approximately 20 years have passed since the first Saudi woman became a board-certified neurosurgeon. In 2013, the first female neurosurgeon became board-certified in Saudi Arabia, following the beginning of board programs in 1996. There are currently 19 neurosurgery residency programs in Saudi Arabia. There were 300 neurosurgeons, of whom were women, and 42 were women undergoing residency training. On an international level, the United Kingdom faces a similar situation, as only around 20 % of its neurosurgery consultants are women. In the United States, there has been a significant increase in the total number of female residents in neurosurgery, from 12.7 % to 17.6 %, and women are still underrepresented in leadership positions.<sup>16</sup> Additionally, there are no professional, sex-based societies with any medical subspecialty in Saudi Arabia. Interestingly, a recent global census found that separated Women In Neurosurgery society can inadvertently create professional segregation.<sup>17</sup>

## 5. Conclusions

Despite the cultural, social, and political barriers faced by Saudi women, opportunities have continuously improved and the number of female Saudi neurosurgeons has increased significantly over the following decades.

## Limitations

This study had a few limitations; first, although the number stated in this article is for all board-qualified neurosurgeons according to the Saudi Commission for Health Specialties, the authors could not determine the level and independence of the neurosurgical practice of each surgeon as some of them are consultants, and some are senior registrars. Furthermore, we could not determine the total number of Saudi trainees abroad, especially because many sponsoring agencies in the country would send trainees abroad.

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## CRedit authorship contribution statement

**Nada A. Alkahtani:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Data curation, Conceptualization. **Thana S. Namer:** Writing – original draft, Resources, Project administration, Methodology, Investigation, Data curation, Conceptualization. **Afnan AlKhotani:** Writing – original draft, Supervision, Investigation, Data curation, Conceptualization. **Nora Z. Bensaeed:** Writing – review & editing, Writing – original draft. **Munira W. Alsowailam:** Writing – review & editing, Writing – original draft.

## Declaration of competing interest

Authors of this study had no conflict of interest.

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