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The impact of Saudi Arabia – United States clinical pharmacy post-graduate training programs agreements on clinical pharmacy faculty in Saudi universities: A retrospective descriptive study focused on history and future recommendations

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ABSTRACT

Background: There has been a growing demand for clinical pharmacy services in the Kingdom of Saudi Arabia (KSA) in the past 3 decades. The Ministry of Education has established agreements with several institutions in the United States to secure clinical pharmacy residency and research fellowship programs opportunities for Saudi scholars. The aims of this study were to describe the Saudi scholars' clinical pharmacy training pathways and their contribution to the pharmacy profession in KSA.

Methods: This is a retrospective, descriptive study conducted on clinical pharmacy faculty in governmental Saudi universities who graduated from the US until 2023. The study outcomes included the post-graduate year-1 (PGY-1) residency match rate, post-graduate year-2 (PGY-2) acceptance rate, the PGY-2 specialties of Saudi scholars, and the number of clinical pharmacy programs established in KSA.

Results: In total, 115 Saudi scholars have pursued clinical pharmacy pathway in the US. The PGY-1 residency match rate was 80 % (92/115). In contrast, the PGY-2 acceptance rate was 60.9 % (70/115). The most common PGY-2 specialty was in infectious diseases (N = 17; 24 %). Two pharmacy colleges had established residency programs and 1 pharmacy college had established a research fellowship.

Conclusion: The Ministry of Education's efforts for clinical pharmacy program agreements were fundamental for advancing clinical pharmacy in Saudi universities. A significant number of Saudi scholars returned to KSA with clinical pharmacy degrees. There are more opportunities for further development, including expanding the clinical pharmacy program collaboration in the US and increasing the number of residency and research fellowship positions in KSA.

1. Introduction

The concept of clinical pharmacy was first introduced in the US in the 1960s as it plays a major role in pharmacotherapeutic interventions for optimal therapeutic plans and saving costs in healthcare systems (Miller,

1981). Thirty years later, the Kingdom of Saudi Arabia (KSA) adopted the clinical pharmacy services model due to the growing demand for clinical pharmacy services (Korayem et al., 2021). With more educated Saudi scholars who graduated from the US, they have become the nucleus for clinical pharmacy advocacy and initiatives in KSA.

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Since clinical pharmacy adoption in KSA, there has been a growing demand for clinical pharmacists in academia, healthcare sectors, and regulatory agencies (Korayem et al., 2021). Therefore, the number of pharmacy colleges and the diversity of pharmacy programs has increased (Badreldin et al., 2020). In 2020, there were 30 pharmacy colleges in KSA that offer Doctor of Pharmacy (PharmD), Bachelor of Pharmacy, or both. Among these colleges, 63 % (19/30) offer PharmD degrees. Notably, the PharmD degrees have a heavy emphasis on clinical pharmacy practice (Korayem et al., 2021). However, graduates of PharmD degrees are not considered clinical pharmacists unless they complete post-graduate residency training. Also, some pharmacy colleges have established master's degrees in clinical pharmacy. Therefore, the need for clinical faculty who completed post-graduate pharmacy residency training with or without research fellowship or master's degrees in clinical pharmacy was fundamental. Those faculty are equipped with the knowledge and skills allowing them to teach didactic pharmacotherapy courses, precept pharmacy students during Advanced Pharmacy Practice Experience, and precept pharmacy residents and/or fellows. That is why in the past 3 decades (especially from 2010), Saudi universities started investing in the clinical faculty track by offering scholarships to pursue either accelerated PharmD degree or Foreign Pharmacy Graduate Equivalency Certificate (FPGEC) to facilitate post-graduate training; specifically, residency and research fellowship (Badreldin et al., 2021).

In KSA, there are 2 pathways for pharmacy graduates to become clinical pharmacists (Korayem et al., 2021). The first pathway to becoming a clinical pharmacist that is recommended by the Saudi Society of Clinical Pharmacy is pursuing a structured, post-graduate pharmacy practice residency. When completing a specialized pharmacy practice residency, pharmacists will become experts in numerous specialties. Notably, most pharmacy colleges in KSA choose to train their faculty through residency training pathway. Therefore, newly hired faculty (teaching assistants) are granted scholarships to pursue post-graduate training, including residency and research fellowship. The second pathway is through completion of a master's degree in clinical pharmacy that encompasses a minimum of 6 months of clinical rotations. The master's degree prepares the graduates as a general clinical pharmacist and will not be specialized. Therefore, graduates with master's degrees will not be classified by the Saudi Commission for Health Specialties (SCFHS) as a consultant in clinical pharmacist (Badreldin et al., 2020). Faculty members usually do not complete a master's degree alone because they will not be appointed assistant professors with only a master's degree.

Pursuing post-graduate clinical pharmacy residency and research fellowship programs for Saudi pharmacy scholars in the US is challenging (Badreldin et al., 2021). Specifically, these programs are employment-based and prioritize the acceptance of US citizens, there are a limited number of residency positions, and there are many logistical and immigration requirements. These challenges urged the KSA government represented by the Ministry of Education – the Saudi Arabia Cultural Mission (SACM) to establish agreements with several academic institutions and hospitals in the US to secure residency positions for Saudi scholars to obtain clinical pharmacy residency and research fellowship training. After more than 15 years of SACM – US programs agreements in clinical pharmacy programs, numerous advantages have been achieved by returning Saudi faculty members. Nonetheless, the positive impact of these agreements and the benefits of the clinical pharmacy faculty brought back to Saudi universities and the pharmacy profession have not been documented. The aims of this study were to describe the clinical pharmacy training pathways of the Saudi scholars who were enrolled in clinical pharmacy scholarship, to illustrate the contribution of these agreements on the development of the pharmacy profession and education in Saudi Universities, and to provide recommendations to achieve the Saudi Vision, 2030 for Health Sector Transformation Program (Saudi Vision, 2030).

2. Methods

2.1. Design and inclusion/exclusion criteria

This is a retrospective, descriptive study that was conducted on clinical pharmacy faculty members in Saudi governmental universities who graduated from the US from 1990 until 2023. We excluded faculty members who work in private pharmacy colleges and those working as adjunct pharmacy faculty. The research project was approved by the Research Ethics Committee at the University of Hail (Research# H – 2023 – 362) on 19 September 2023.

2.2. Study objectives

The study outcomes included PGY-1 pharmacy residency match rate, PGY-2 pharmacy residency acceptance rate, number of scholars who completed PGY-1 only, number of scholars who completed PGY-1 + PGY-2, number of scholars who completed PGY-1 + PGY-2 + research fellowship, number of scholars who completed PGY-1 + research fellowship, and number of scholars who completed PGY-1 residency + Doctor of Philosophy (PhD), number of Saudi scholars who completed research fellowship only, PGY-2 residency specialty of Saudi scholars, and number of pharmacy residency programs established by Saudi scholars, and number of research fellowship programs opened by Saudi scholars.

2.3. Data collection

Our data were retrieved from public websites of Saudi universities. We collected the data using a predeveloped worksheet. For each governmental university, we collected the following information: region in KSA, the number of faculty who pursued clinical pharmacy track, their educational background (PGY-1, PGY-2, research fellowship, and PhD), specialty of PGY-2, and establishment of residency and research fellowship programs. The research data was collected from 20 September 2023 to 15 October 2023.

2.4. Statistical analysis

Our descriptive statistics were performed using Microsoft Excel. We used Adobe Photoshop to create the KSA map.

2.5. Definitions

- Clinical pharmacy faculty track: Saudi pharmacy scholars who completed an accelerated PharmD program or obtained FPGEC followed by completing residency with or without research fellowship training.
- Change clinical pharmacy track to graduate education: scholars who completed PGY-1 then changed their route to PhD because due to their inability to complete the subsequent programs (PGY-2 and/or research fellowship) that are needed to qualify them for the assistant professor position in Saudi universities. Notably, Saudi universities differ in their requirements for assistant professor positions.
- Match rate: the percentage of the total number of Saudi scholars who matched for PGY-1 residency.
- Acceptance rate: the percentage of the total number of Saudi scholars accepted for PGY-2 residency, whether accredited or not.
- Regions of KSA: Central (Riyadh and Al Qassim Provinces), Northern (Hail, Tabuk, Aljof, and Northern Border Provinces), Western (Makkah Al Mukarramah and Al Madinah Al Munawwarah), Southern (Aseer, Jazan, Najran, and Al Bahah provinces), and Eastern (Al Dammam and Al Ahsa).
- PGY-1: first year of general pharmacy residency (The definitions of pharmacy residencies and fellowships. *Am J Hosp Pharm.* 1987).

- PGY-2: second year of specialized pharmacy residency ([The definitions of pharmacy residencies and fellowships. Am J Hosp Pharm. 1987](#)).
- Research fellowship: directed, highly individualized, post-graduate programs focus on study design, statistical analysis, and scholarly writing to prepare scholars to become independent researchers ([The definitions of pharmacy residencies and fellowships. Am J Hosp Pharm. 1987](#)).
- Research unit: the unit KSA universities use for research count consideration for promotion. The first author among multiple co-authors = 0.5 points, the contributing author (not the first author) with multiple authors = 0.25 points, and the sole author = 1 point. Universities in KSA vary in their decision regarding published abstracts for research unit count consideration.

3. Results

3.1. General characteristics of Saudi clinical pharmacy faculty member

There were 21 Saudi governmental universities that had pharmacy colleges. In total, 115 Saudi scholars have pursued clinical pharmacy pathways in the US, of whom 67 % (79/115) have enrolled in PharmD degrees while only 31 % (36/115) have enrolled in FPGECE as their initial education route. The PGY-1 pharmacy residency match rate of Saudi scholars was 80 % (92/115). In contrast, the PGY-2 acceptance rate of Saudi scholars was 60.9 % (70/115). The breakdown of Saudi scholars' training pathways is available in [Table 1](#).

3.2. Saudi clinical pharmacy faculty scholars by region

The highest number of Saudi scholars who completed at least PGY-1 were from the Central region 79.6 % (43/54) and Western region regions 81.6 % (31/38). Notably, from the Western region, 71 % (27/38) of Saudi scholars were enrolled in FPGECE as their initial educational pathway route, [Fig. 1](#).

3.3. PGY-2 specialty of Saudi clinical pharmacy scholars

Among all the Saudi scholars, 60.9 % (70/115) have completed PGY-2 pharmacy residency training. Many of those Saudi scholars who completed PGY-2 specialized in infectious diseases [(ID) 24 % (17/70)] followed by ambulatory care 17.1 % (12/70), internal medicine 15.7 % (11/70), cardiology 14.2 % (10/70), and critical care 8.5 % (6/70), [Fig. 2](#).

3.4. Establishment of pharmacy residency programs by Saudi clinical pharmacy scholars

Among the 21 governmental universities in this study, only 2 pharmacy colleges (one in the Central region and the other in the Western region) have established pharmacy residency programs by Saudi clinical pharmacy faculty scholars. The pharmacy college in the Central region had established numerous PGY-2 pharmacy residencies, including ID, cardiology, critical care, hematology/oncology, internal medicine, and

ambulatory care. Whereas the other pharmacy college in the Western region had established PGY-1 pharmacy residency and numerous PGY-2 pharmacy residencies, including ID, critical care, and internal medicine.

3.5. Research fellowship statistics and establishment by Saudi clinical pharmacy scholars

Among the 115 Saudi clinical pharmacy faculty scholars, 43.5 % (50/115) have completed research fellowship training. However, only one pharmacy college had established a research fellowship program in the Central region.

4. Discussion

In the past 3 decades, there has been a growing demand for clinical pharmacy services across several sectors in KSA in academia, healthcare, and regulatory agencies ([Korayem et al., 2021](#)). Ministry of Education – SACM has responded to this demand by establishing several training agreements in the US to enable Saudi scholars to have pharmacy residency and research fellowship training opportunities. In this study, we described the clinical pharmacy training pathways of the Saudi scholars and evaluated the impact of these agreements on the development of pharmacy practice and education in Saudi Universities. In this study, the PGY-1 pharmacy residency match rate was 80 %, while the PGY-2 pharmacy residency acceptance rate was 60.9 %. The majority of Saudi scholars who returned to work at their universities are concentrated in the Central and Western Regions. The most common PGY-2 specialty among Saudi scholars was ID.

The PGY-1 pharmacy residency match rate was 80 %, which was comparable to the PGY-1 match rate for PGY-1 residency in the US of 82 % ([Matching 2023. American Society of Health-System Pharmacists Resident Matching Program](#)). In contrast, the PGY-2 acceptance rate was lower at 60.9 %. A likely explanation is that Saudi scholars pursuing clinical pharmacy programs face many obstacles ([Badreldin et al., 2021](#)). First and foremost, the number of PGY-1 pharmacy residency positions for Saudi applicants is very limited and even lower for PGY-2 residency. Notably, the number of these positions is lower than the number of Saudi scholars who seek residency training every year. As of 2020, only 16 US institutions were offering PGY-1 positions, and 8 institutions were offering PGY-2 residency positions for Saudi scholars. Secondly, there are immigration obstacles to completing residency training in the US because Saudi scholars need Optional Practical Training or employment-based visas. Not all US institutions can sponsor these kinds of visas. Third, Saudi scholars enrolled in FPGECE have specific TOEFL iBT requirements that can be challenging (reading 22/30 points, listening 21/30 points, speaking 26/30 points, and writing 24/30 points). Lastly, the residency program requires passing licensure examinations and obtaining a pharmacy license within a specific time period; otherwise, the residency training could be terminated. Moreover, the lower number of Saudi Scholars completing PGY-2 may be because some universities require only PGY-1 residency for assistant professors' appointments. In contrast, Saudi scholars in universities requiring PGY-1 + PGY-2 for assistant professor appointments may be forced to switch to graduate education to obtain a PhD. Our findings

Table 1

Breakdown of Saudi scholars' training pathways for residency and research fellowship.

Initial clinical pharmacy pathway					
PharmD N = 79		FPGECE N = 36			
The breakdown of residency with or without research fellowship combination					
PGY-1 only N = 10	PGY-1 + PGY-2 N = 31	PGY-1 + PGY-2 + Research fellowship N = 39	PGY-1 + Research fellowship N = 9	PGY-1 + PhD N = 3	Research fellowship only N = 3

Abbreviations: PGY-1: post-graduate year-1, PGY-2: post-graduate year-2, PharmD: Doctor of Pharmacy, PhD: Doctor of Philosophy, and FPGECE: Foreign Pharmacy Graduate Equivalency Certification

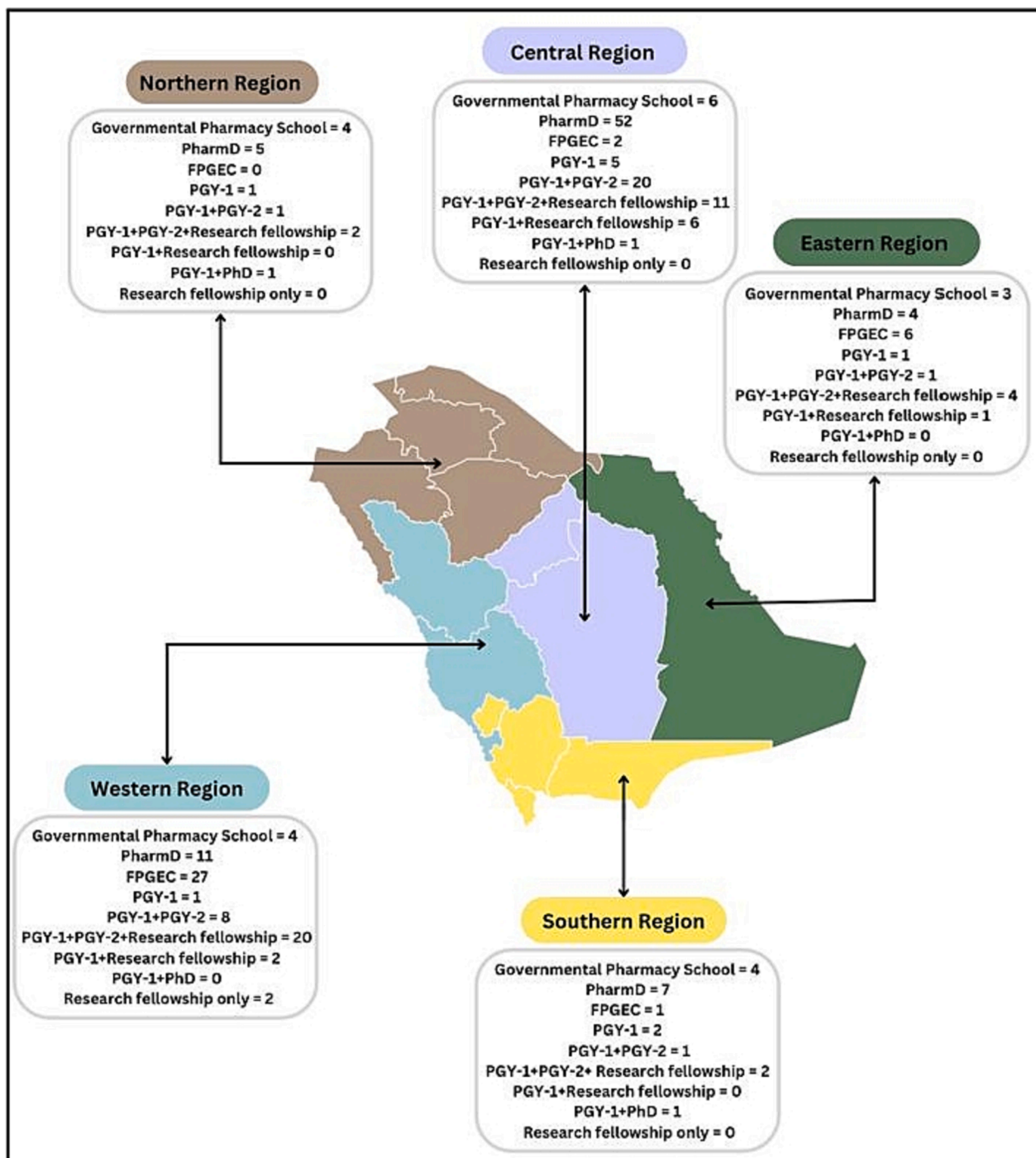


Fig. 1. Saudi Clinical Pharmacy faculty scholars by region in KSA Abbreviations: PGY-1: post-graduate year-1, PGY-2: post-graduate year-2, PharmD: Doctor of Pharmacy, PhD: Doctor of Philosophy, and FPGEC: Foreign Pharmacy Graduate Equivalency Certification.

revealed that 2.6 % (3/115) of Saudi scholars have completed PGY-1 + PhD.

Among the 115 Saudi clinical pharmacy scholars, only 43.5 % have completed research fellowship training. Notably, the low research fellowship completion rate is due to marked variations in assistant professor appointment rules of Saudi universities. For example, based on the initial route (PharmD vs FPGEE), some universities require PGY-1 residency only. In contrast, other universities require PGY-1 + PGY-2 residencies, PGY-1 + PGY-2 + research fellowship, or PGY-1 + research fellowship. Our findings reflect that variation since 8.7 % (10/115) have completed PGY-1 only, 27 % (31/115) have completed PGY-1 + PGY-2,

34 % (39/115) have completed PGY-1 + PGY-2 + research fellowship, and 7.8 % (9/115) have completed PGY-1 + research fellowship. To elaborate, Saudi universities' rules also differ in research fellowship requirements; some require 1 year research fellowship, while others require 2 years research fellowship. Moreover, all Saudi universities require 1 published research unit for appointment to assistant professor.

Additionally, most faculty who completed at least PGY-1 are concentrated in the Central and Western regions. The number of faculty who completed at least PGY-1 were from the Central region 79.6 % (43/54) and Western region regions 81.6 % (31/38), Fig. 1. These regions are the most populated in KSA and have more educational institutions.

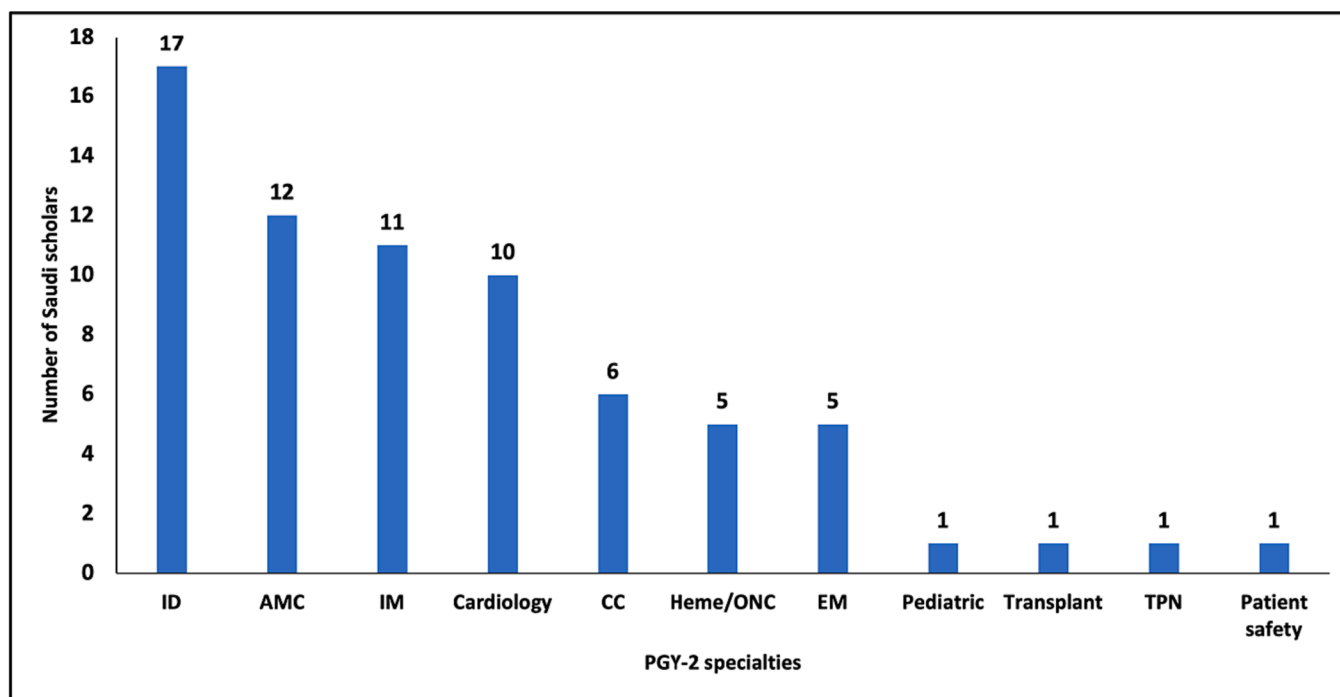


Fig. 2. PGY-2 Specialty Distribution among Saudi Scholars. Abbreviations: AMC: ambulatory care, CC: critical care, EM: emergency medicine, Heme/ONC: hematology/oncology, ID: infectious diseases, IM: internal medicine, and TPN: total parenteral nutrition, PGY-2: post-graduate year-2.

Based on KSA statistics, 20 million people live in Central and Western regions compared to 8.8 million people in all other regions (Population. Saudi Census).

Among the 21 governmental pharmacy colleges included, only 2 pharmacy colleges had established pharmacy residency programs by Saudi clinical pharmacy scholars. Noteworthy, some of these universities had residency programs established before the return of their scholars. Nonetheless, the low number of established residency programs after the return of the scholars may be related to other challenges facing clinical pharmacy faculty members. First, not all Saudi universities have affiliated teaching hospitals. Second, the SCFHS requires that residency program directors be classified as “consultant clinical pharmacist” which requires 3 years of clinical experience after completing PGY-1 + PGY-2 residency training, and not all faculty members have obtained PGY-2 (Accreditation Standards. Saudi Commission For Health Specialties). Furthermore, only one pharmacy college in KSA has established a research fellowship program. Establishing a research fellowship program has other obstacles that may limit the number of programs established in KSA. Specifically, the SCFHS may classify research fellowship program graduates as a consultant in clinical pharmacy under specific circumstances that usually do not apply to research fellowship programs. Currently, there is no stipend for research fellowship positions (Executive Rules of the General Regulations. Saudi Commission For Health Specialties).

Additionally, Saudi clinical pharmacy scholars have specialized in various PGY-2 specialties. The most common specialty was ID at 24 %, Fig. 2. On the other hand, only 1 Saudi scholar obtained PGY-2 in one of these specialties: Pediatric, Transplant, Patient Safety, or Total Parenteral Nutrition Residency programs. Moreover, only 5 Saudi scholars completed Hematology/Oncology or Emergency Medicine residency programs. That is because there are a limited number of residency positions in these specialties in the US, which made it difficult for SCAM to collaborate with these institutions for a limited number of positions (Badreldin et al., 2021).

The Ministry of Education created residency and research fellowship training opportunities for Saudi scholars supporting clinical pharmacy in KSA. Thus, many Saudi scholars returned to KSA to advance the

clinical pharmacy profession. However, there are chances for further development. To elaborate, SACM should expand efforts to collaborate with more pharmacy residency and research fellowship programs in the US, especially in PGY-2 specialties with a low number of Saudi faculty. Moreover, leaders and policymakers should support establishing more local residency programs and expanding the number of positions since pursuing pharmacy residency and research fellowship programs in the US is challenging. Furthermore, policymakers should support expanding the number and variety of residency programs established in Northern, Southern, and Eastern KSA since clinical pharmacy is scarce in these regions. Lastly, scholarship positions should be based on specialties that are needed to accomplish the healthcare plan of the Saudi Vision, 2030 (Saudi Vision, 2030).

To our knowledge, this is the first study focusing on statistics of the Saudi clinical pharmacy workforce after more than 2 decades of scholarship to the US. The present study can inform policymakers on the status of the clinical pharmacy workforce in Saudi universities which can help in future development. Nonetheless, this study has some limitations. This study is retrospective in nature and there may be missing data and recall bias. We could not evaluate how many attempts it took Saudi scholars to match for PGY-1 residency because some scholars did not match for PGY-1 residency from the first attempt. Lastly, we could not evaluate the economic impact of Saudi scholars after they return from their scholarship in the US.

5. Recommendations for future development

Below are some recommendations for further development of clinical pharmacy scholarship for Saudi scholars in KSA as well as the clinical pharmacy workforce in KSA:

- Open local residency and research fellowship programs in KSA and encourage policymakers to facilitate opening new programs led by Saudi scholars, especially in the Northern, Southern, and Eastern KSA

- Addressing the common challenges that face Saudi scholars such as visa requirements, residency start and end dates, and the number of available PGY-1 and PGY-2 residency positions.
- Address possible educational or training pathways for scholars who are not accepted for PGY-1 or PGY-2 positions to avoid switching to a PhD degree to serve the interests of the Saudi population.
- Focus on the efforts of collaboration with US institutions to offer specialized residency training in areas that serve the health priorities of the Saudi population.
- Support the distribution of Saudi clinical pharmacy scholars to serve the Saudi population in regions outside the Central and Western KSA to prevent health disparities and improve access to clinical pharmacy services.
- Support establishing new residency and research fellowship programs in KSA by returning Saudi scholars to help increase the number of specialized clinical pharmacists in KSA.
- Encourage Saudi scholars to pursue an education that matches the national transformation plan Saudi Vision, 2030 with specialties that have a high burden on the Saudi population.
- Encourage Saudi universities to unify clinical pharmacy faculty appointment requirements for assistant professor positions.
- Encourage Saudi scholars to focus their research efforts on the National Health Priorities that include obesity, diabetes, ID, and congenital heart diseases (Research Priorities. Research Development and Innovation Authority and Alsowaida et al., 2022).

6. Conclusion

Clinical pharmacy education has advanced enormously with Ministry of Education scholarship program agreements for clinical pharmacy residency and research fellowship training. A significant number of Saudi scholars have completed general and specialized clinical pharmacy residency with or without research fellowship. The majority of Saudi clinical pharmacy faculty are concentrated in the Central and Western regions. Those returning clinical pharmacy faculty have a positive impact on the clinical pharmacy profession and some of them have created residency and research fellowship training programs in KSA. There are more opportunities for further development, including expanding the residency and research fellowship program collaboration in the US and expanding the local residency training programs, especially in the Northern, Southern, and Eastern KSA. Future studies should focus on economic evaluations of pharmacy residency and research fellowship scholarship programs in the US.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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