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## Research barriers in Saudi pharmacy residency training programs

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## ABSTRACT

**Background:** The aim of this study is to identify potential barriers to conducting and publishing pharmacy residency research.**Methods:** A cross-sectional study surveyed pharmacy residents in Saudi Arabia from August to September 2020. The online survey assesses residents' characteristics, residency research experience, barriers to completion, and challenges in publishing. A Likert scale assessed factors and barriers to conducting and publishing research during residency. Descriptive statistics were performed for binary variables, with Likert scale responses visualized using Gantt charts.**Results:** A total of 69 residents completed the survey, of whom 63.5 percent were female, and the median age was 28 years. More than half of the residents were in R2 (56.5 %), followed by R1 (24.6 %) and R3 (4.4 %). Half of residents had prior research experience, while 84.1 % had prior research training in workshops or courses. Cohort study design was the most common type of residency research project conducted. According to residents, the main barriers to conducting research were a lack of allocated time for research during rotations (81.7 %) and a lack of a realistic timeline determined by the SCFHS to finish the research project (66.2 %). Regarding barriers to publishing research, the majority of residents reported lack of time to work on the publication process (78.6 %), lack of previous publication experience (60 %), and lack of guidance from mentors (55.7 %) as the most important barriers.**Conclusion:** Pharmacy residents face barriers to conducting research during their residency program, including limited allocated time during rotations, a lack of realistic timelines, and data collection limitations. Additionally, they face challenges in publishing their research due to a lack of experience, mentorship, and guidance. Future research should consider seeking the perspective of residency program directors and preceptors on research barriers and evaluating the publication rate of residents' projects.

## 1. Introduction

The Saudi commission for health specialties (SCFHS) has been in charge of the residency programs for pharmacists in Saudi Arabia for a number of years (Badreldin et al., 2020; Trainee | Saudi Commission for Health Specialties, n.d.). Currently, there are more than 20 pharmacy residency programs across the country, and the number is increasing. All these programs are under the supervision and approval of the SCFHS (Badreldin et al., 2020; Trainee | Saudi Commission for Health Specialties, n.d.).

In addition, several programs have sought the American Society of Health-System Pharmacists (ASHP) accreditation in the US. To date, there are 15 ASHP-accredited programs in Saudi Arabia. Of those, 7 postgraduate year one (PGY-1) programs and 8 postgraduate year two (PGY-2) programs (Al-Qadheeb et al., 2012; Badreldin et al., 2020; Trainee | Saudi Commission for Health Specialties, n.d.).

There are notable differences in the pharmacy residency training between Saudi Arabia and the US, which warrant consideration. In the US, the expected time for the residency program completion is two years of training, that includes: PGY-1 and PGY-2 residencies (ACCP - What Is

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a Residency and How Do I Get One?, n.d.; Residency Information - ASHP, n.d.). PGY-1 typically includes extensive training that covers general clinical practice and exposes residents to a broad range of pharmacy experience, whereas the PGY-2 includes more in-depth and specialized training through focused rotations such as oncology, critical care, and organ transplantation. (ACCP - What Is a Residency and How Do I Get One?, n.d.; Residency Information - ASHP, n.d.) On the other hand, PGY-1 in Saudi Arabia has been extended to two years of training, called, (R1) and (R2). PGY-2 is a one-year training, referred to as (R3) (Al-Jedai et al., 2016; Al-Qadheeb et al., 2012; Badreldin et al., 2020). Unlike the US, residents in Saudi Arabia must pass a promotional exam after their first year of residency R1 to advance to the second year R2 (Trainee | Saudi Commission for Health Specialties, n.d.). Residents must also pass a written and oral exam at the end of R2 to earn the residency certificate, after which they can proceed to the third year R3. In R1, the training is more focuses on basic pharmacy operations and one or two clinical rotations, usually in internal medicine. During R2 year, residents complete clinical rotations that are similar to PGY-1 in the US (Trainee | Saudi Commission for Health Specialties, n.d.).

The ASHP recognizes research during residency as an aspect of resident skill and competency development (Grace, 2020). Although the ASHP does not mandate the publication of research during residency training, pharmacy residency programs in the US require the completion of a research project (Weathers et al., 2019). In Saudi Arabia, research is required during pharmacy residency training, however, residents are only required to submit an abstract by the end of the R2 and R3 years to set for the examinations (Badreldin et al., 2020; Trainee | Saudi Commission for Health Specialties, n.d.).

The disparity between pharmacy residents' clinical research abilities and the quality of their research has been the subject of several investigations in the US (Deal et al., 2016; Vouri et al., 2015). Some of these studies have explored the potential barriers in both completing and publishing research during residency (Bookstaver et al., 2015; Irwin et al., 2013; Rothberg, 2012; Weathers et al., 2019). In the past 20 years, a relatively low publication rate in peer-reviewed journals has been recorded, despite the large number of abstracts that have been presented in national and regional events in the US (McKelvey et al., 2010; O'Dell & Shah, 2012; Olson et al., 2012; Weathers et al., 2019).

According to our knowledge, there are no studies evaluating pharmacy residency research in Saudi Arabia. In addition, information regarding the number of publications by residents in peer-reviewed journals and the number of approved abstracts at national and international conferences and meetings is limited. Consequently, the objectives of this study are to identify potential barriers to conducting and publishing pharmacy residency research.

## 2. Methods

### 2.1. Study design, data, and settings

A cross-sectional analysis that electronically surveyed current and pharmacy residents from all regions across Saudi Arabia, distributed from August to September 2020. The study obtained the institutional review board (IRB) approval from the regional research ethics committee at Qassim region (registration number H-04-Q-001).

### 2.2. Survey development, distribution, and collection

The online survey was developed using Qualtrics (Qualtrics, Provo, UT) as the survey platform and distributed to all pharmacy residents in Saudi Arabia at SCFHS system from August to September of 2020. Several segments of the survey were adapted from previous publications (Irwin et al., 2013; Weathers et al., 2019). The survey consists of four sections. The first section assesses general resident characteristics, such as gender, age, qualifications prior to starting the residency (e.g., PharmD or bachelor of pharmaceutical sciences), years of residency (R1,

R2, R3), residency accreditation status (e.g., ASHP-accredited or non-ASHP-accredited), type of specialty for the R3 or PGY-2, geographic region for the current residency program, years since graduation from pharmacy school, years of experience as a pharmacist before the residency, and number of publications before the residency. The second section of the survey focuses on the residency research experience. This section includes items such as research type, involvement in additional research projects, level of comfort with the research process, interest in publishing and presenting the research at conferences and meetings, and the time during residency when the residency research was started. The survey's third section explores the barriers to completing the research project, while the final section explores the challenges they experienced in publishing the residency research project.

Current residents were identified by using the SCFHS list. One senior resident from each program was contacted in advance of distributing the surveys to facilitate the process. The senior residents received an email with a link to the survey and a brief explanation of the study purpose in English and Arabic. The email was distributed to all current residents in that program, and a total of three email reminders were sent one week apart. Prior to that, the survey was sent to two pharmacy residents and two program directors for validation. The responses from the validation step were not included in the analysis, and the comments received were used to modify and improve the survey.

### 2.3. Measurements

A five-point Likert scale [strongly agree (1), agree (2), neutral (3), disagree (4), strongly disagree (5)] was used to assess 23 items regarding the factors and barriers associated with conducting and publishing research during residency and included 19 items on background information, location, residency program features, and research experience information.

### 2.4. Statistical analysis

Descriptive statistics, including the mean, standard deviation (SD), frequencies, and percentages, were performed for each of the variables by gender and region. Likert scale responses were visualized as a Gannt chart, and the mean of each item response was reported using Tableau software. Statistical analyses and data management were performed using SAS version 9.4 statistical software (SAS Inc., Cary, North Carolina).

## 3. Results

### 3.1. Demographic characteristics

Among pharmacy residents who received the survey, 89 residents from 20 programs participated in the study. However, only 69 residents from different demographic distributions completed the survey. Of the respondents, 42 were female representing 63.5 % of the total residents (Table 1). The median age was 28 years (SD = 2.6), and the majority of the residents (82.6 %) received a PharmD degree as their qualifications. More than half of the residents were in R2 (56.5 %), (24.6 %) were in R1, three residents (4.4 %) were in R3, and 10 residents (14.5 %) had graduated from the residency program. The demographic characteristics of the residency programs participants are presented in Table 1.

Regarding residency accreditation, 40 residents (58 %) were enrolled in non-ASHP accredited programs. The majority of the participants were located in the central region (52.2 %), and the remaining participants were distributed across the other regions of Saudi Arabia. Of the participants who were asked about the years since graduation, 70 % said they graduated within 5 years. Most participants have conducted or participated in research before residency. Of the residents, 45 were co-authors and 16 were primary investigators. Moreover, 35 residents (50.7 %) had the experience of publishing one or two research papers

**Table 1**  
Demographic characteristics of the residency programs participants.

Variable	No. (%)
Mean $\pm$ S.D. age, year	28.0 (2.6)
Sex	
Male	27 (36.5)
Female	42 (63.5)
Qualifications	
Bachelor's in pharmacy	7 (10.1)
Pharm.D.	57 (82.6)
Master's Degree	4 (5.8)
Other	1 (1.5)
Residency Program	
R1	17 (24.6)
R2	39 (56.5)
R3	3 (4.4)
Graduated	10 (14.5)
Geographic region of the residency program	
Central	36 (52.2)
Western	15 (21.8)
Eastern	14 (20.3)
Southern	3 (4.3)
Northern	1 (1.4)
Years since graduation	
Less than 5 years	48 (69.6)
5 – 10 years	19 (27.5)
11 – 20 years	2 (2.9)
More than 20 years	0 (0)
Conducted or participated in research before residency	
Yes (as a principal investigator)	16 (23.2)
Yes (as a co-author)	45 (65.2)
Yes (acknowledged)	4 (5.8)
No	4 (5.8)
Number of publications before residency	
None	28 (40.6)
1 – 2	35 (50.7)
3 – 4	5 (7.2)
More than 5	1 (1.5)
Previous research training or participating in research related workshops, courses, or sessions	
Yes	58 (84.1)
No	49 (71)
No	11 (15.9)
Taking an elective research rotation during the PharmD internship	
Yes	20 (29.0)
No	49 (71.0)
<b>Total</b>	<b>69 (100)</b>

before starting the residency training. Furthermore, most residents (84.1 %) had prior research training experience, such as participating in research-related workshops, courses, or sessions. Approximately (29.5 %) of the residents reported being involved in an elective research rotation during their PharmD internship.

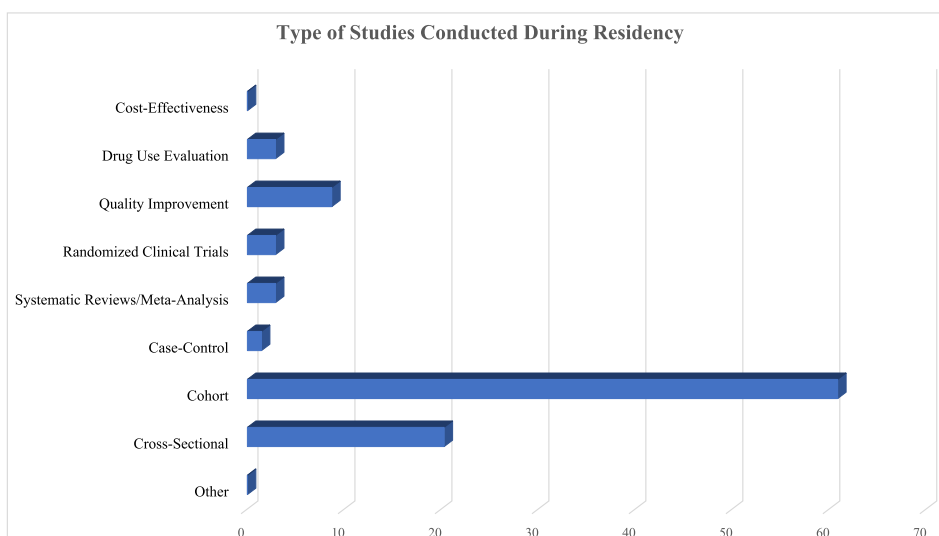
### 3.2. Program and residency research experience

Upon assessing research experience, we found that the majority of residents were involved in several types of projects to fulfil the residency program research requirement. The types of research projects that residents conducted were cohort study (60.86 %), cross-sectional studies (20.28 %), quality improvement projects (8.7 %), systematic reviews/meta-analyses (2.89 %) and randomized clinical trials (2.89 %) (Fig. 1). In terms of the timing of starting residency research, most residents (44.9 %) started conducting research in their second or third month of training, followed by (23.18 %) in their fourth or fifth month, and (23.2 %) in their sixth month or later. Only (8.6 %) started in their first month of training (Fig. 2).

Interestingly, around two-thirds (66.7 %) of residents generated research ideas during the program, and (44.9 %) of the residents contributed to an additional research project during the residency training. Overall, the vast majority of residents (94.2 %) who participated in this study stated that their residency program required them to complete a research project during training (Table 2). The majority of residents felt comfortable with the research process during residency training, with only a small percentage (11 %) reported feeling uncomfortable (Fig. 3).

### 3.3. Conducting research barriers

The most commonly reported barriers to conducting research during residency were a lack of allocated time for research during rotations (81.7 %) and a lack of a realistic timeline determined by the SCFHS to finish the research project (66.2 %). Additionally, (64.8 %) of residents either strongly agreed or agreed that there was difficulty in data collection or a lack of good data to utilize to conduct research. On the other hand, (33.8 %) of residents do not see the value of research during residency training, while (32.4 %) faced challenges in obtaining the IRB and/or departmental approval for their research projects (Fig. 4).



**Fig. 1.** The distribution of study designs of the research conducted by residents.

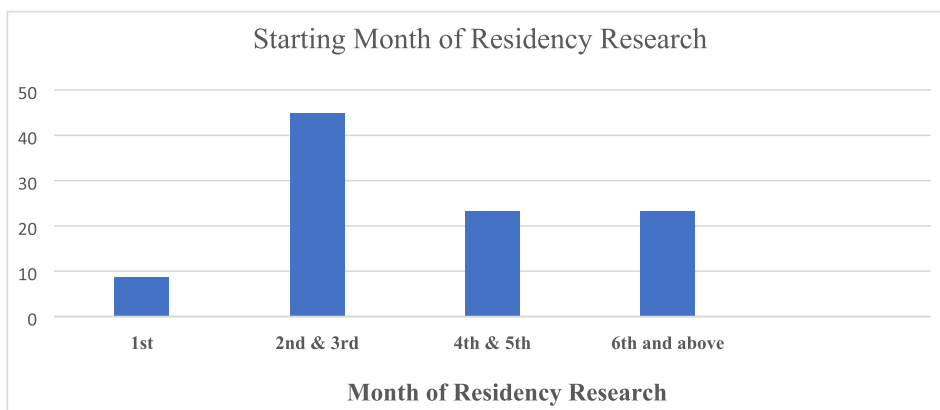


Fig. 2. The timing of starting research projects during residency.

**Table 2**  
Program and residency research experience.

Variable	No. (%)
Residency program joined requires a research project completion	
Yes	65 (94.2)
No	4 (5.8)
Resident generated research idea during the program	
Yes	46 (66.7)
No	23 (33.3)
Resident participated in additional research during residency	
Yes (as a principal investigator)	7 (10.1)
Yes (as a co-author)	23 (33.3)
Yes (acknowledged)	1 (1.5)
No	38 (55.1)
<b>Total</b>	<b>69 (100)</b>

3.4. Publication barriers

Regarding the challenges of publishing research, the majority of residents reported that there is a lack of time to work on the project publication process during residency training (78.6 %). And 60 % of the participants attributed the challenge that hindered them from publication to the lack of previous publication experience and the lack of

guidance from mentors (55.7 %). Only a small percentage of the residents felt that publication will not help them advancing their career (17.2 %), (20 %) believed that their study idea was not publishable, and (14.3 %) reported that their research idea was outdated (Fig. 5).

4. Discussion

The pharmacy profession in Saudi Arabia has evolved over the past two decades, resulting in an increasing number of pharmacy residency programs. This increase in clinical training programs has produced more clinically sound pharmacists and is expected to improve pharmaceutical care overall. As more residents go through these programs, more research projects have been conducted, raising the need to evaluate the current situation in terms of feasibility, quality, and resources available. The lack of published data addressing this issue led us to conduct this study to highlight the main barriers to conducting and publishing research from pharmacy residents' perspectives.

Our results showed that the majority of the residents considered that the lack of allocated time for research during rotations was a barrier to conducting research. Although there is no available data regarding pharmacy residents' research in the country, studies of other medical trainees' experiences have reported that a lack of dedicated research

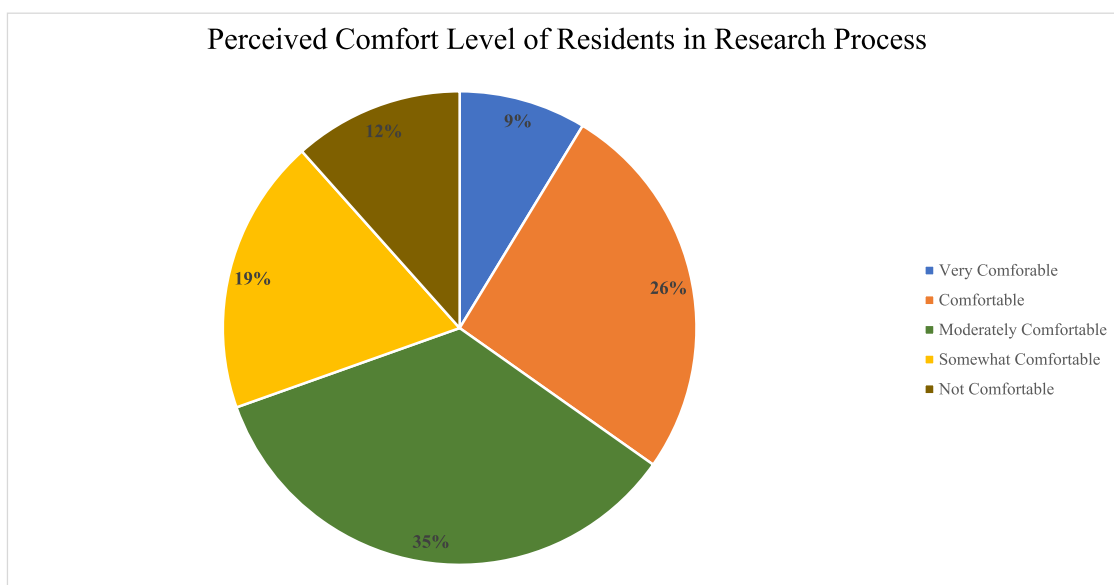


Fig. 3. Pie chart depicting the perceived comfort level of pharmacy residents towards the research process. Figure 4. Likert scale responses of pharmacy residents on factors perceived as barriers to conducting research during residency training. The mean value for each factor is displayed in the circle. Likert Scale ranks responses from strongly agree to strongly disagree [strongly agree (1), agree neutral (2), neutral (3), disagree (4), strongly disagree (5)].

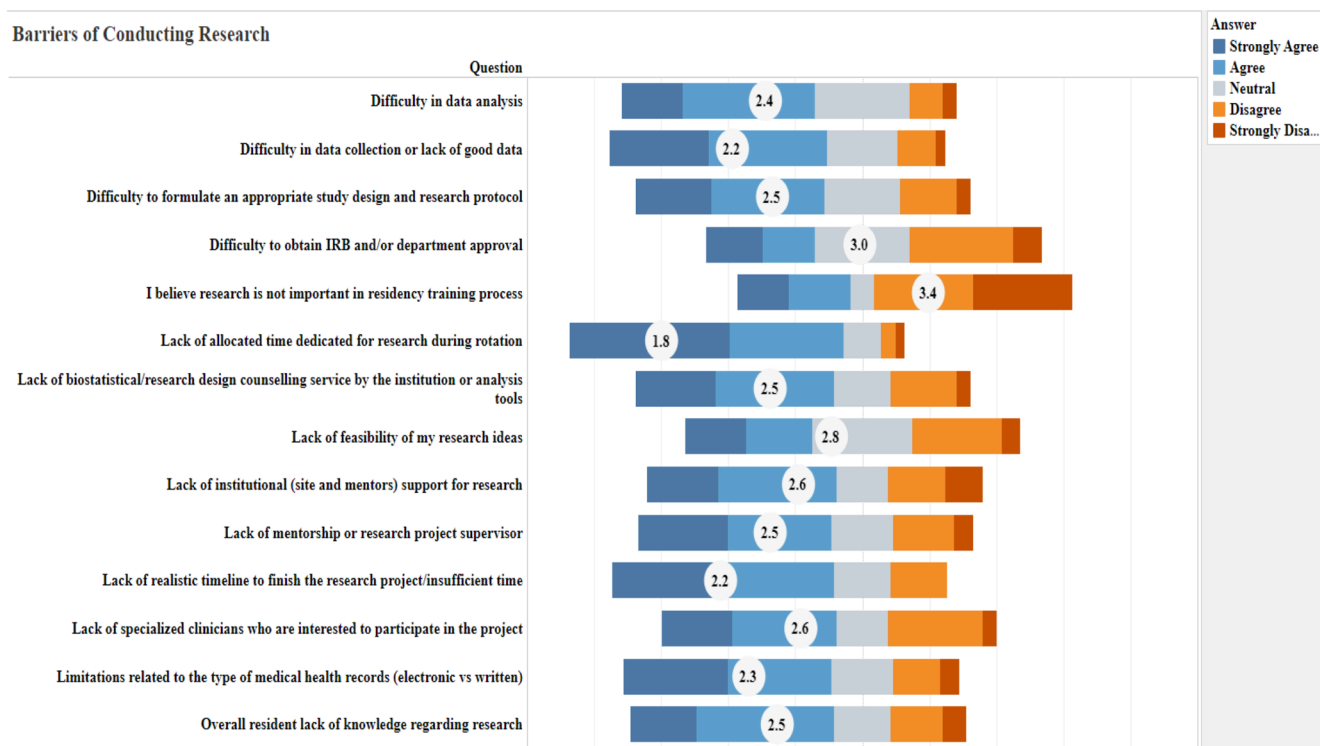


Fig. 4. Likert scale responses of pharmacy residents on factors perceived as barriers to conducting research during residency training. The mean value for each factor is displayed in the circle. Likert Scale ranks responses from strongly agree to strongly disagree [strongly agree (1), agree neutral (2), neutral (3), disagree (4), strongly disagree (5)].

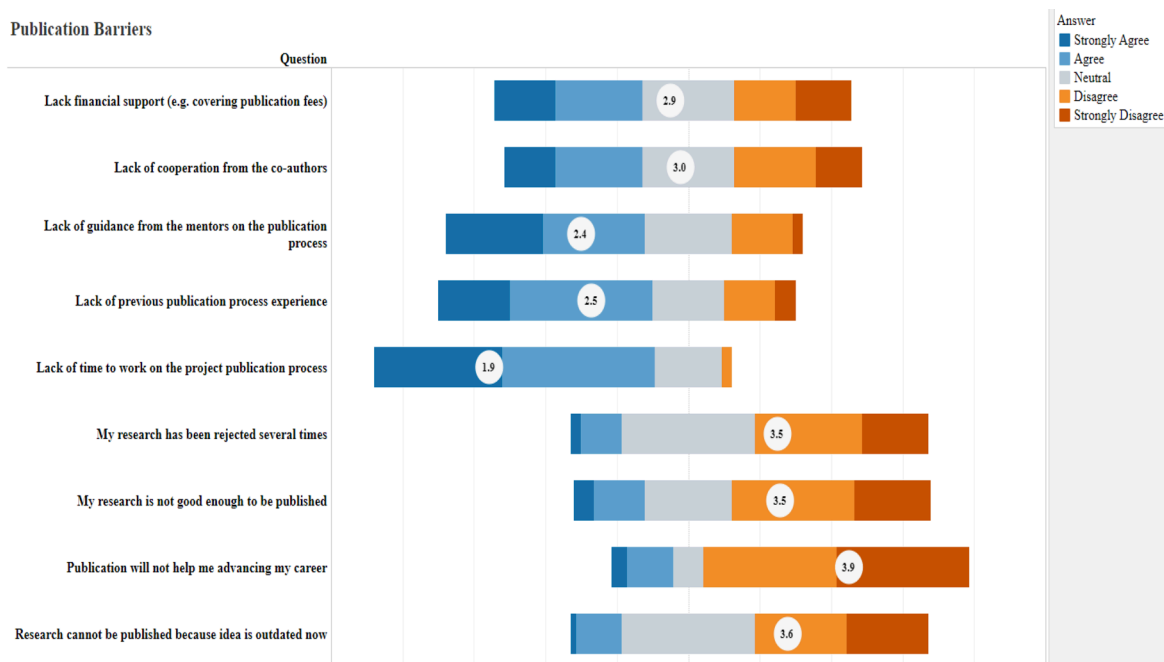


Fig. 5. Likert scale responses of pharmacy residents on factors perceived as barriers to publication during residency training. The mean value for each factor is displayed in the circle. Likert Scale ranks responses from strongly agree to strongly disagree [strongly agree (1), agree neutral (2), neutral (3), disagree (4), strongly disagree (5)].

time was considered one of the main barriers (Alhaider et al., 2015; AlSohime, 2018; Mitwalli et al., 2014). Similarly, US pharmacy residents considered lack of research time to be a barrier as reported by Bookstaver et al (Bookstaver et al., 2015). In addition to insufficient research time, more than half of the residents in our study reported an

unrealistic timeline determined by the SCFHS to finish the research project.

One third of residents had difficulties obtaining IRB approval. This was unexpected, given that accredited residency programs in Saudi Arabia require submitting the research proposal by the 10th month of R1

and the abstract of the research project towards the end of R2. These deadlines in Saudi Arabia seemed realistic for completing research projects, especially when compared to the US.

Nearly one-third of the residents did not see the value of research during residency training. This may be because research publication is not essential for advancing their career and will not provide them with any financial incentives after completing their residency training. Similarly, 56 % of Saudi family medicine residents reported not being interested in conducting research during residency (Soubhanneyaz et al., 2019). On the other hand, a study that included pediatric medical residents reported the lack of interest in research as the least significant barrier to conducting research during residency training, and residents stated that research must be obligatory during residency training (Alhaider et al., 2015; AlSohime, 2018). Also, the majority of pharmacy residents in the US did not find lack of interest to be a barrier (Bookstaver et al., 2015).

The rate of publication in peer-reviewed journals has been quite low, despite the vast number of abstracts that have been presented at national and regional conferences in the US (McKelvey et al., 2010; O'Dell & Shah, 2012; Olson et al., 2012; Weathers et al., 2019). This can be attributed to several factors, such as lack of time, lack of motivation, study design limitations, lack of mentorship or guidance, lack of cooperation among coauthors, and residents' knowledge gaps (Irwin et al., 2013; Weathers et al., 2019). Our study reported that residents considered a lack of time to work on the research project publication process during residency training to be the main barrier to publishing their research. Moreover, the lack of previous publication experience was a major barrier for two-thirds of residents, who stated that this barrier was a major obstacle to their research productivity. Interestingly, the majority of residents said that they had prior experience conducting or participating in research before residency. Although most residents had the opportunity to participate in research before residency, they still considered a lack of experience in the publication process to be the second main barrier to their research productivity. It is worth noting that publishing a paper can increase an applicant's chances of getting accepted into a residency program (Alahmed et al., 2022). This may lead some residents to participate in research projects to increase their admission chances rather than out of a genuine interest in research.

In the literature, there are a number of suggested solutions to overcome the barriers. To motivate residents to conduct research, it is important to provide them with mentorship and allow them to choose research topics that they are interested in and that align with their clinical interests. This can also be accomplished by sharing previous residents' research accomplishments, such as research awards obtained by a former colleague or a successful publication in a high-quality peer-reviewed journal (Deal et al., 2016; Rothberg, 2012).

Preceptors should be guiding residents from the initial step of developing the research question or choice of available projects, through finalizing the completed report that is required for graduation. Therefore, having a preceptor with experience in research or who is required to do research by job description, may improve residents' research experience and increase the chances of publishing their projects. In a study conducted by Stranges et al., pharmacy residents working under the supervision of research preceptors with a higher H-index had an increased chance of publishing their research projects (Stranges & Vouri, 2017).

Furthermore, implementation of a structured research curriculum, a research team, or an advisory board to assist with all aspects of a residency research project was shown to improve the quality and publication rate of pharmacy residents (Baker et al., 2014; Clemmons et al., 2015; Olson et al., 2015; Swanoski et al., 2012). Moreover, implementing a writing program for PGY-1 and PGY-2 residents was found to increase the number of published papers, as reported by Clemmons and colleagues (Clemmons et al., 2015).

In our opinion, several approaches may be implemented by local residency programs or the SCFHS to enhance the research experience of

the residents. The residency advisory committee (RAC) should receive any prospective research ideas or projects from preceptors rather than the residents before the start of the residency year and is encouraged to offer feedback on the suitability of each proposed project. Before beginning the project, the RAC should consider the project's goals, study design, potential obstacles, and feasibility of conducting the project. The RAC shall offer the residents with a list of projects that have been approved in the first month of the R1 year. This list should include some details of the project including but not limited to the project title, aim and little background about the project as well as the name of the preceptor who should have extensive research experience. The RAC is encouraged to provide the resident and the research preceptor with a clear timeline of conducting the project and to offer the residents a protected time for research.

Currently, the deadline for submitting the proposal for the research project is ten months into the R1 year, which may delay conducting the next steps, including data collection and analysis. Utilizing more research time during the R1 year may allow residents to put more time into their research projects. Even though residents can submit their research proposals earlier, having an earlier deadline should allow more research time for all residents, which in turn may improve the quality of their research.

Moreover, requiring a manuscript in a publishable format instead of only an abstract, may mandate residents and preceptors to put more effort into their projects, hence, improved quality and more research activity exposure for the resident. Additionally, local residency programs should facilitate dedicated sessions with research experts to answer residents' questions and provide expert opinions on the feasibility and research rigor (methodology) of residents' projects, starting with the initial steps of those projects. This may be difficult in residency programs with limited resources; however, those programs may collaborate with other residency programs with more research resources, such as programs that are affiliated with universities or large research centers. Finally, we recommend that residents and their preceptors or research teams to have frequent meetings to discuss different steps of the project and make sure that residents adhere to the pre-set timeline of the project.

The study is limited by the fact that the results may not be generalizable to all pharmacy residents in the same way. Although the survey was distributed to pharmacy residents of all years (R1, R2, and R3), only 4.4 % of the residents were in R3. Therefore, the results mainly represent those in the first two years. Moreover, although 89 residents participated in the study, approximately 22 % responses were deleted because of incomplete responses. In addition, this study did not survey residency program directors for their perspective. This could have provided valuable insight into the barriers to research productivity that pharmacy residents face. Also, this study was conducted during the COVID-19 pandemic, which may have affected the residents' research. However, the survey did not assess the impact of the pandemic on research. Lastly, the study only explored and described the barriers to research productivity in pharmacy residency programs. It did not investigate the impact of these barriers, conduct statistical analyses to assess the relationship between certain variables, or evaluate the effect of the differences in residents' characteristics that may contribute to their research productivity.

## 5. Conclusion

In conclusion, our cohort of pharmacy residents considered a lack of allocated time for research during rotations, a lack of a realistic timeline to finish the research project, and data collection limitations to be the main barriers to conducting research during the residency program. Further, lack of time to work on the project publication process, lack of previous publication experience, and lack of guidance from mentors were reported as the main barriers to publishing the research conducted during residency. Future research should focus on other aspects not

studied in this article, such as seeking the perspective of residency program directors and preceptors on research barriers.

### 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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### Author contributions

All authors made a significant contribution to the work reported, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

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