

Original Article

# The impact of surgical training on the practice of recently graduated ophthalmologists at Riyadh's ophthalmology residency program



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## Abstract

**Purpose:** To evaluate how well the training residency program prepared recent graduates to practice comprehensive ophthalmology with special focus on surgical competency.

**Methods:** This is a cross-sectional study that included Ophthalmologists who graduated from Riyadh ophthalmology residency program between the years 2002–2012. A total of 126 graduates were invited through e-mails and electronic social media platforms to anonymously complete an electronic survey. The survey included questions that aim to assess the surgical competency of graduated ophthalmologists in doing various surgical procedures that were among the requirements of residency training.

**Results:** Ninety participants in the mean age of 38.7 years completed the survey. The majority of respondents (93%) joined fellowship programs and around half of them sub-specialized in anterior segment. More than half (55.6%) of the respondents reported that the acquired surgical skills during residency training were adequate. By the end of the residency period, the respondents' competency in doing extra capsular cataract extraction was better than phacoemulsification while 52% of them reported incompetence in both glaucoma and strabismus surgeries whereas the majority were incompetent in oculoplastics' procedures (e.g. entropion repair). However, the majority felt competent in doing primary repair, minor and laser procedures. Lack of exposure was the major cause of such incompetency.

**Conclusion:** This self-reported survey showed that the lack of adequate surgical exposure during residency training was the main reason of incompetency. This resulted in reduction of ophthalmologists' future practice of surgical procedures outside the scope of their sub-specialty. This emphasizes that physicians mainly practice what they surgically acquire during their fellowship training.

**Keywords:** Ophthalmology, Residency, Surgical skills, Cataract, Surgical training

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## Introduction

Residency training represents the pillar and foundation for any subspecialty training in medicine. The ophthalmology

residency program in Riyadh, Saudi Arabia is a well-structured program that was established more than 30 years ago and it has grown impressively since then. The program is a joint four years' competency-based-curriculum where

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residents rotate mainly in accredited tertiary eye care hospitals.<sup>1</sup> The primary objective of the residency program is to graduate highly competent ophthalmologists who are capable of diagnosing and managing various ocular diseases medically and/or surgically. Knowing that ophthalmology is a delicate specialty that requires fine dexterity, high level of surgical training is mandatory to help minimize complications.

Cataract surgery is the most common procedure performed by ophthalmology residents during their training. In the United States, Rowden et al. reported that 73% of the residents started their cataract surgery-learning journey by performing extra capsular cataract extraction (ECCE), whereas 24% began with phacoemulsification.<sup>2</sup> Nevertheless, 63% of the US programs mandated learning ECCE first.<sup>3</sup> Learning cataract surgery is challenging where Binensbaum et al. reported that one in ten residents faced difficulty in learning cataract surgery and 80% of their surgical experience occurred in the third year.<sup>3</sup>

The assessment of the acquired surgical skills during residency is one of the major areas of interest to ensure residents' competency and patients' safety. This can be achieved by closely monitoring the resident's surgical performance qualitatively by operating under the supervision of senior surgeons and quantitatively by completing an adequate number of cases in addition to evaluation of the surgical outcome. Randleman et al. demonstrated that residents were more likely to have complications in their first eighty cases<sup>4</sup>; therefore, the minimum required number of cataract cases to be completed before graduating from our training program is 80.<sup>1,4</sup>

Nowadays, surgical training using simulation has become essential for beginner ophthalmology residents.<sup>5</sup> In fact, wet-laboratories and surgical simulators may be considered ideal training platforms because they allow residents to experience various intra-operative situations that may help in improving their cognitive judgment and adequate management of complications.<sup>6</sup> In the United States, 98% of surgical training programs provide surgical practice facilities, such as microsurgery laboratories. Moreover, 64% of the programs implemented a formal microsurgery-teaching course, and 45% required evaluating the residents' surgical skills before attempting the first intraocular procedure.<sup>3</sup> Similarly, our program requires the completion of a one-week cataract hands-on course where junior residents are trained in settings mimicking real life situations by operating on goat and artificial eyes.<sup>7</sup>

This study aims to evaluate the graduates' perception of their professional surgical competency after the residency program. To the best of our knowledge, the quality of training infrastructure and its impact on practice was never evaluated in our region. Identifying the difficulties residents face in acquiring surgical skills while in training will certainly enhance the surgical training by proposing effective solutions.

## Materials and Methods

An electronic survey designed by the research team on the Survey Monkey website was used to collect data for this cross-sectional study that targeted 126 (109; 86.5% males and 17; 13.5% females) ophthalmologists who graduated from Riyadh Ophthalmology Residency program between

2002 and 2012. The graduate ophthalmologists were invited to participate in this study through emails and electronic social media platforms. Confidentiality and anonymity were maintained and assured throughout the entire study period. To maximize the response rate, the survey was resent and a follow-up phone call was carried out to serve as a reminder.

The semi-structured survey questionnaire consisted of 13 questions that recorded demographic data and inquired about post-residency further training (fellowship, attachment or any additional surgical training) and practice. Participants were questioned about their feedback regarding their acquired surgical skills during residency and how well they were prepared to practice comprehensive ophthalmology. In addition, a dedicated section dealt with the competency of graduates in performing all of the procedures that are among the requirements of residency training and whether they are still practicing these procedures in their current practice (beside their current subspecialty). The cause of incompetency or lack of practice was further noted. Other procedures the respondents wished they had the opportunity to learn during residency training were also surveyed. Ethical approval was sought from the Institutional Review Board of College of Medicine, King Saud University.

The collected data were exported to Microsoft Excel 2010 (Microsoft Co., Redmond, Washington, USA). Data were managed, cleaned and coded then imported to SPSS<sup>®</sup> version 22.0 (IBM Inc., Chicago, Illinois, USA). Descriptive analysis was done where numerical values were presented in frequencies and percentages while continuous variables were presented as mean ( $\pm$ SD). Inferential analysis was done using Chi<sup>2</sup> test. A confidence interval level was set to 95% where a corresponding p value threshold was identified, as 0.05 where any output p value below 0.05 would be interpreted as an indicator of statistical significance.

## Results

The total number of graduates between the years 2002–2012 was 126; yet, only 118 survey links were distributed due to missing or changed contact information for the remaining graduates. Ninety ophthalmologists completed the survey with a response rate of 76%. The majority of respondents were males with the mean ( $\pm$ SD) age of 38.7 ( $\pm$ 4.5). The practice locations were divided into urban or rural areas based on the availability of tertiary ophthalmology service. More than two thirds of the respondents are practicing in urban areas in Saudi Arabia while 61.1% of those are currently practicing in the capital, Riyadh. More than 90% of the responding ophthalmologists further subspecialized by joining different fellowship programs where anterior segment was the most popular subspecialty while neuro-ophthalmology was drastically rare. Graduates' demographic and training information are presented in [Table 1](#).

The respondents' personal main scope of practice showed that only 4.4% of them were practicing comprehensive ophthalmology and those were mostly working in rural areas. ([Fig. 1](#)). Meanwhile, 20% of the respondents were focusing on their subspecialty in less than 50 % of their practice time, which was quite common among all respondents. Moreover, around 41.1% were almost limiting their practice solely to their subspecialty.

**Table 1.** Demographics and training information of Riyadh ophthalmology residency training program (graduates from 2002–2012).

Characteristic	Mean ± SD [Range]
<b>A. Demographics</b>	
- Age in years	38.7 ± 4.5 [30–50]
- Gender	No. (%)
Male	80 (88.9)
Female	10 (11.1)
- City of practice (by service availability and accessibility)	
Urban	66 (73.3)
Rural	14 (15.6)
Missing	10 (11.1)
- Year of graduation from residency	
2002–2007	44 (48.9)
2008–2012	41 (45.6)
Missing	5 (5.6)
<b>B. Fellowship Training</b>	
- Joining fellowship program after residency	84 (93.3)
1-year program	26 (31.0)
2-year program	50 (59.5)
- Did not join fellowship	6 (6.7)
<b>C. Primary Subspecialty</b>	
Anterior Segment	48 (53.3)
Uveitis	21 (23.3)
Pediatric/Strabismus	17 (18.9)
Retina/Vitreous	14 (15.6)
Oculoplastics	11 (12.2)
Glaucoma	10 (11.1)
Medical Retina	2 (2.2)
Neuro-Ophthalmology	1 (1.1)
Ocular genetics, stem cells and medical retina (USA)	1 (1.1)

**Key findings from the survey**

*Perception of preparation to practice comprehensive ophthalmology and the acquired surgical skills*

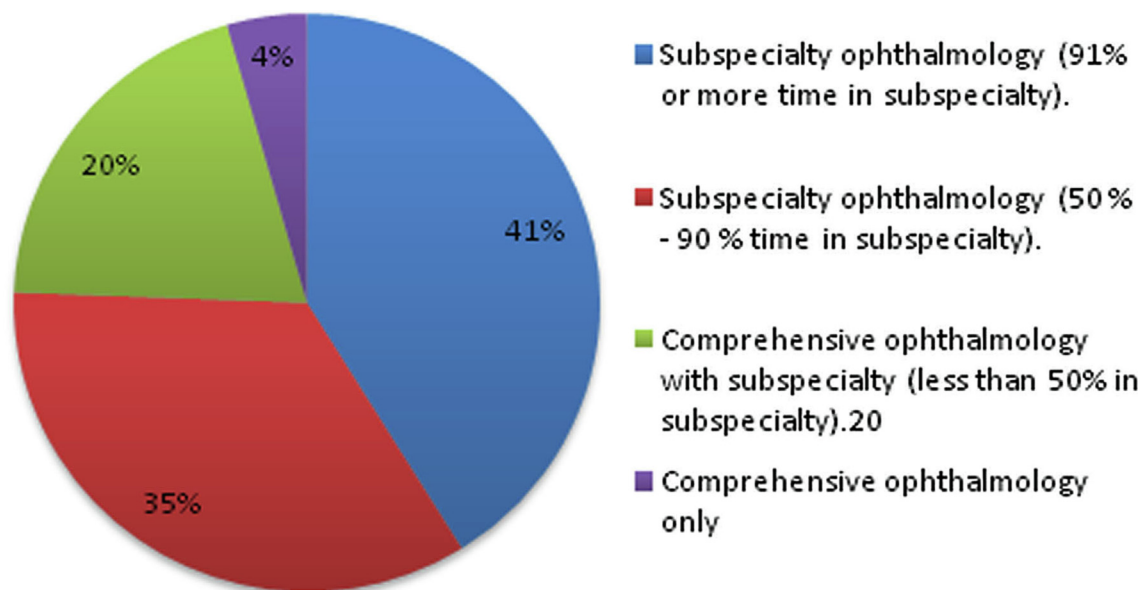
Generally speaking, the majority of participants reported that the residency-training program provided adequate

training that enabled them to well-practice general ophthalmology. In contrary, a lower proportion of graduates reported that their residency surgical training was satisfactory (Table 2). The respondents were subdivided into two groups based on their graduation year (2002–2007 and 2008–2012) where comparison revealed no significant difference between both groups.

Nearly two thirds (59.9%) of the graduates indicated that they opted to obtain additional surgical training after residency through attending seminars and meetings (53.3%), reading book, following journals, or viewing scientific DVDs (48.9%), observing other ophthalmologist (46.7%), communication with other colleagues for advise (42.2%), available online education, participating in internet forums (31.1%), instrument company sponsored courses (23.3%), residency training CME programs/wet labs (18.9%) and contacting residency mentors for advise (13.3%). As pursuing fellowship training after residency was a common practice in this study cohort, 41.1% of the respondents reported that additional training after completing fellowship was not needed. This clearly highlighted the vital role of fellowship training on their practice after residency.

*Graduates’ competency in performing the required surgical procedures upon completion of Riyadh ophthalmology residency training program*

The main procedures included in our program’s curriculum which residents are required to complete before graduating are presented in Table 3. The majority of graduates generally felt competent doing cataract surgery. They reported feeling more competent doing ECCE than phacoemulsification, 90% and 65.6%, respectively. Comparing the graduates’ competency in performing ECCE revealed no statistically significant difference among those who graduated between 2002–2007 (50.6%) and those who graduated between 2008–2012 (49.4%),  $p = 0.5$ . However, for phacoemulsification, results showed that those who graduated between 2008–2012



**Fig. 1.** Respondents’ primary scope of practice.

**Table 2.** Perception of Preparation to Practice Comprehensive Ophthalmology and Acquired Surgical skills.

Characteristic	Graduates 2002–2007	Graduates 2008–2012 (n = 41)	P value
A. Overall preparation to practice comprehensive ophthalmology			0.803
- Provided enough training	40 (90.9)	36 (87.8)	
- Training was not enough	3 (6.8)	3 (7.3)	
- No answer	1 (2.3)	2 (4.9)	
B. Surgical skills			0.360
- Provided enough training	24 (54.5)	25 (61.0)	
- Training was not enough	19 (43.2)	13 (31.7)	
- No answer	1 (2.3)	3 (7.3)	

(56.9%) felt more competent compared to the former graduates between 2002–2007 (43.1%),  $p = 0.019$  (Fig. 2).

Almost all our program graduates (95%) felt competent repairing open globe injuries and more than half of them expressed being competent doing several minor and laser procedures. Interestingly, the main areas of reported surgical deficiency were glaucoma, pediatric and oculoplastic procedures where at least 50% of the graduates felt incompetent performing filtering surgeries, strabismus surgeries and oculoplastic procedures such as dacryocystorhinostomy (DCR) and entropion repair. The common underlying cause of incompetency for all listed procedures was the lack of adequate exposure. Other less common causes included lack of interest, which was more evident in the field of oculoplastics.

*Performance of surgical procedures in the current practice apart from the ophthalmologist’s subspecialty*

The majority of ophthalmologists are performing phacoemulsification (85.6%) compared to ECCE (75.6%) in their current practice though a higher percentage of graduates were more competent doing ECCE than phacoemulsification upon residency completion as inferred above. Furthermore,

83.3% of the respondents are performing primary repair proficiently in their current practice.

Fewer ophthalmologists are performing glaucoma filtering procedures and strabismus surgery in their current practice, which reflects a decline in competence after starting practice. Likewise, the competency of doing different minor and laser procedures also regressed. The majority of the surveyed graduates still feel incompetent to perform oculoplastic procedures in their current practice such as DCR, enucleation/evisceration, entropion repair and probing (77.8%, 68.9%, 75.6% and 58.9% felt incompetent, respectively). Obviously, the commonest justification for this noticeable decline of practice of various procedures was the availability of specialized ophthalmologists. Other causes included the lack of interest, skills, and resources.

*Surgical procedures ophthalmologists wished to be trained for during residency whether being currently practiced or not*

The most common procedure that graduates perform now but wished if they were trained for during residency was refractive surgery. This desire was more prominent among anterior segment specialists (18.8%) than other subspecialty graduates (9.5%). On the other hand, non-anterior segment respondents (28.6%) reported that refractive surgeries were the most common procedures they are not practicing currently but wished they were trained for whilst pars-plana-vitreotomy (22.9%) was the most common among anterior segment specialists.

*Opinions on what role the residency program should play in assisting the transition to practicing comprehensive ophthalmology after residency*

Increasing surgical exposure was the most common recommendation suggested by 27.8% of the respondents. Others advised encouraging comprehensive ophthalmology practice and promoting the theoretical knowledge.

**Table 3.** Competency of ophthalmologists in doing the required surgical procedures upon completion of Riyadh residency training program.

Procedure	Yes	No	Reason for incompetency			
			Lack of interest	Lack of exposure	Lack of supervision	Others
ECCE+IOL	81 (90.0)	9 (10.0)	1 (11.1)	5 (55.6)	4 (44.4)	1 (11.1)
Phaco+IOL	59 (65.6)	31 (34.4)	0 (0.0)	29 (93.5)	8 (25.8)	0 (0.0)
Primary repair	86 (95.6)	4 (4.4)	0 (0.0)	4 (100)	0 (0.0)	0 (0.0)
Filtering procedures	43 (47.8)	47 (52.2)	20 (42.6)	33 (70.2)	4 (8.5)	0 (0.0)
Strabismus	43 (47.8)	47 (52.2)	21 (44.7)	26 (55.3)	3 (6.4)	0 (0.0)
DCR	19 (21.1)	71 (78.9)	35 (49.3)	49 (69.0)	11 (15.5)	1 (1.4)
Enucleation/Evisceration	46 (51.1)	44 (48.9)	22 (50.0)	31 (70.5)	3 (6.8)	1 (2.3)
Entropion	25 (27.8)	65 (72.2)	26 (40.0)	45 (69.2)	9 (13.8)	1 (1.5)
Probing +/- Stent	55 (61.1)	35 (38.9)	13 (37.1)	23 (65.7)	5 (14.3)	1 (2.9)
Chalazion excision	82 (91.1)	8 (8.9)	2 (25.0)	6 (75.0)	3 (37.5)	0 (0.0)
Tarsorrhaphy	55 (61.1)	35 (38.9)	15 (42.9)	25 (71.4)	6 (17.1)	0 (0.0)
Conjunctival flap	66 (73.3)	24 (26.7)	3 (12.5)	23 (95.8)	3 (12.5)	0 (0.0)
Vitreous Tap	65 (72.2)	25 (27.8)	5 (20.0)	21 (84.0)	9 (36.0)	0 (0.0)
Intravitreal injection	76 (84.4)	14 (15.6)	3 (21.4)	11 (78.6)	7 (50.0)	1 (7.1)
Yag laser PI	88 (97.8)	2 (2.2)	0 (0.0)	1 (50.0)	1 (50.0)	0 (0.0)
Yag laser capsulotomy	89 (98.9)	1 (1.1)	0 (0.0)	0 (0.0)	1 (100)	0 (0.0)
Cyclophotocoagulation	75 (83.3)	15 (16.7)	7 (46.7)	9 (60.0)	4 (26.7)	0 (0.0)
Retinal laser (PRP)	88 (97.8)	2 (2.2)	1 (50.0)	1 (50.0)	1 (50.0)	0 (0.0)
Retinal laser (focal)	64 (71.1)	26 (28.9)	5 (19.2)	16 (61.5)	9 (34.6)	0 (0.0)

ECCE = Extra capsular cataract extraction; IOL = Intraocular lens; DCR = Dacryocystorhinostomy; PI = Peripheral iridotomy; PRP = Panretinal photocoagulation.

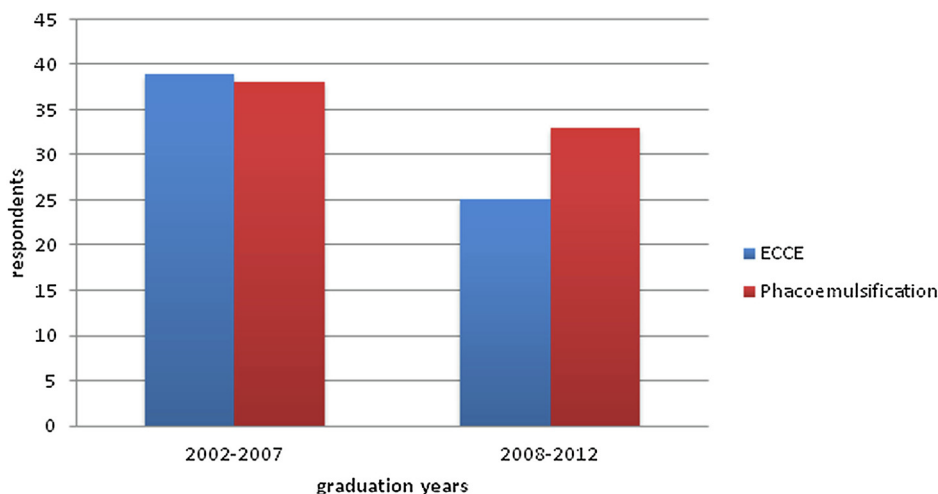


Fig. 2. Competency of graduates doing ECCE versus phacoemulsification between the graduation years 2002–2007 and 2008–2012.

## Discussion

Obtaining constructive feedback from trainees who completed residency-training program is pivotal as it facilitates implementing new modifications that intend to achieve competency-based curriculum. As limited information is available in the literature on the outcomes of residency training, in this study, we looked at the surgical experience that graduates acquired during their training in Riyadh's Ophthalmology Residency Program and the impact this training had on their clinical and surgical practice.

This survey indicated that Riyadh's residency program provided relatively sufficient training to ophthalmologists to practice comprehensive ophthalmology. Nevertheless, surgical training seemed to be underprovided in some areas as around two thirds thought that it should be augmented. This is in line with what McDonnell et al. published in which two thirds of the American ophthalmology programs' graduates perceived the need for additional surgical training predominantly in the fields of refractive surgery and oculoplasty.<sup>8</sup> Similarly, a recent study by Alsalim and colleagues conducted on Jordanian residency programs' graduates showed that 62% of the respondents were dissatisfied about their program, predominantly the surgical aspect as three quarters of graduates never did phacoemulsification, yet, 74% generally felt confident doing ECCE.<sup>9</sup> On the other hand, studies from India showed a prominent variation in the provided surgical training across the programs, and generally, students expressed the need to enhance their training.<sup>10,11</sup> Moreover, studies evaluating the satisfaction of graduates of the Canadian ophthalmology residency programs showed promising results where 85% were satisfied with their residency program training and stated that both clinical and surgical training prepared them efficiently for their future practice. Outstandingly, 85% of those respondents felt confident performing phacoemulsification and 27.5% completed 201–300 cataract cases. However, areas of insufficient exposure included ECCE, refractive surgery, and oculoplastics.<sup>12</sup> Another study surveying recent Canadian graduates revealed that approximately 90% achieved satisfactory practices after graduation and were still operating, which suggests that they were successfully prepared by their training program.<sup>13</sup> A

similar study evaluating the Iranian ophthalmology program showed that 71% of the ophthalmologists were content with their training in cataract surgeries.<sup>14</sup>

Rationally, achieving surgical competency is directly proportional to the rate of exposure. In the past, ECCE was more popular; thus, most graduates, especially the relatively older subgroup (2002–2007), felt competent doing it due to the high rate of exposure. With the advent of phacoemulsification, the frequency of performing ECCE decreased. However, we believe that each ophthalmologist must be able to do ECCE competently as intraoperative conversion may be essential in some cases. In our study cohort, lack of exposure was the main cause of incompetency which was more apparent in phacoemulsification. Meanwhile, the relatively recent graduates (2008–2012) felt more competent in performing phacoemulsification. This finding is in accordance with the increased exposure to phacoemulsification that took place after 2008 in our program. It is worth mentioning that the Accreditation Council for Graduate Medical Education (ACGME) in USA currently has a minimal requirement of 86 cataract surgeries to be completed by the resident as a main surgeon before graduating. In contrast, the minimum number of required procedures in different subspecialties (glaucoma, pediatrics, retina, cornea and oculoplastics) ranges between 3–10 surgeries as a main or assistant surgeon. The ACGME further emphasizes that the number of completed surgeries reflects experience but doesn't necessarily translate into skillfulness; therefore, the surgical skills of the resident should be monitored closely.<sup>15</sup> Focusing on the number of completed cases may not be sufficient to evaluate competency and we believe that both the quantity and quality of completed cases are equally important in surgical training. Therefore, we suggest recoding the number of completed cases along with the success rate and the rate of complications where this may act as an indirect surrogate for surgical proficiency.

The vast majority of our graduates are practicing their subspecialty in more than 91% of their practice time while only a minority of them (4.4%) practice comprehensive ophthalmology. In USA, 41% of graduates are practicing comprehensive ophthalmology full-time while 25% of them are almost exclusively practicing their subspecialty.<sup>8</sup> This reflects the fact that most of our graduates are practicing their subspecialty



chiefly; hence, fellowship training is certainly influencing the surgical skills and consequently the current practice of most graduates.

Due to the abundant availability of specialized ophthalmologists in KSA, these specialists frequently perform most of the oculoplastics, pediatrics and glaucoma procedures. This actually has led to an evident drop in the competency and rate of performance of such procedures (ex: laser procedures, filtering and strabismus surgeries) by ophthalmologists from other subspecialties. It is noteworthy to mention that specialized ophthalmologists were clustered mostly in the urban cities; therefore, encouraging comprehensive ophthalmology practice is important to serve the needs of the population in rural areas and to prevent overloading the tertiary centers in the main cities.

Dissatisfaction about surgical training in refractive and oculoplastics' surgeries in our program was quite similar to that reported by North American programs.<sup>8,12</sup> Refractive surgeries are among the most widespread surgeries worldwide and 50% of the American programs involve their residents in such procedures.<sup>16</sup> Some experts advocate expanding the surgical education to incorporate lens and corneal refractive surgeries.<sup>17</sup> Other studies had shown that residents could attain excellent outcomes implementing premium intraocular (IOL) lenses (ex: toric IOL).<sup>18,19</sup>

Our program graduates expressed adequate competency in several laser procedures and this is in agreement with the study of Scott et al. who concluded that graduates are expected to be able to perform panretinal photocoagulation, focal laser, vitreous taps and injections.<sup>20</sup> This is actually reassuring as retina specialists are not available in all cities of KSA. Residents in our program are only required to assist in major retinal surgeries as pars plana vitrectomy. Analogously, studies from the west showed that graduates are not expected to complete such advanced surgeries.<sup>20,21</sup>

Although the respondents were unreservedly asked to express their opinions on the assumed role that residency would play to facilitate transition to practice; surprisingly, none of the graduates proposed training in the fields of practice management and the administrative side of medicine. Our graduates are probably weak in this area due to the lack of training. Therefore, adding robust courses to the curriculum may help prepare our graduates to what comes after residency. The American programs' graduates reported limited teaching in this filed as well.<sup>22</sup>

This study included ophthalmologists graduating from a single training program over a 10-year period. These relatively recent graduates not only can recall the advantages and disadvantages of the program but can also recognize the needs of contemporary ophthalmology practice as some of them have been in practice for more than 5 years. Since this study adopts a self-reported survey, it can be subjected to recall bias, which might be a limiting factor. Additionally, correlating the level of reported competency to the number of completed surgical procedures would have been of some value as it may help in differentiating between competence and confidence. This is actually related to the Dunning-Kruger effect that is a cognitive bias representing the inverse relation between confidence and competence.<sup>23</sup> In simple words, incompetent individuals tend to overestimate their skills and vice versa. This might affect the results of this study; but unfortunately, studying this was not possible as this was

not included in our survey. We recommend recording the number and outcome of completed cases during residency in future studies to provide a more objective measure.

Identifying the root cause of a problem is the first step towards its resolution. This study brought to light multiple important factors that should be targeted to improve the graduates' competency and the provided eye care. The reported perception of lack of surgical competency is mainly due to the limited number of performed surgeries or lack of adequate supervision or both. We propose multiple solutions to tackle this problem efficiently: increasing the minimum required number of core surgeries (ex: cataract surgeries), continuously monitoring the surgical performance of the trainees starting from the early years of residency and compensating those who are lagging behind, providing the trainees with adequate intraoperative supervision and dedicating more of the resident's time for surgical training by achieving balance between training and service delivery.

The impact of trainers/supervisors on overall training and surgical exposure specifically varies between trainers and there are multiple influencing factors to study (surgical competition from the residents in the future, the ability to handle surgical stress when training others, increased complications rate which might affect the surgeon's reputation, limited surgical time which might not allow teaching). It would be feasible to thoroughly evaluate this in a separate study.

## Conclusions

To conclude, the lack of adequate surgical exposure during residency training was the main reason of surgical incompetency. Otherwise, it seems that Riyadh's ophthalmology residency program is preparing the graduates fairly-well in their pursuit of practice of excellence. Leadership authorities may utilize these findings to modify the surgical requirements so as to cope with the current practice demands and to ensure that the aspirations and educational needs of future young ophthalmologists are met.

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## Declaration of Competing Interest

The authors declared that there is no conflict of interest.

## Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.sjopt.2019.08.001>.

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