

Sub-Specialization Among Nigerian Ophthalmologists: Status, Disposition and Barriers.

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Research Article

Keywords: Sub-specialization, Nigerian, Ophthalmologists, Status, Disposition, Barriers

Posted Date: September 2nd, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-854936/v1>

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Abstract

Purpose: To determine the status of sub-specialization among Nigerian ophthalmologists as well as their dispositions and barriers against sub-specialization with a view to providing valuable information for the purpose of human resources for eye care planning thereby providing useful insight into the future of ophthalmic practice in Nigeria.

Methods: This was a web-based, cross-sectional study conducted among Ophthalmologists in Nigeria. An online questionnaire was distributed through e-mails using Qualtrics software (Qualtrics, Provo, UT, USA). Information concerning socio-demographic characteristics, type of practice, location of practice, years of practice, status and disposition to sub-specialization as well as barriers to sub-specialization were obtained through the questionnaire.

Results: two hundred and four Nigerian Ophthalmologists participated in the study out of which 118 (57.8%) were females. One hundred and ten (54.0%) respondents had undergone sub-specialty training. The sub-specialties with the highest number of patronage was Paediatric Ophthalmology and Strabismus (14.2%). Respondents older than 46 years were three times more likely to have undergone subspecialty training compared to respondents who were aged 46 years and below [odds ratio (OR) = 3.01, 95% Confidence interval (CI) = 1.33 – 6.83, p = 0.01]. The main barriers to the availability and uptake of sub-specialty services as well as the challenges of sub-specialty services at the centres with established sub-specialty practice were non-availability/inadequate trained specialist and inadequate equipment.

Conclusion: Nigerian Ophthalmologists are well disposed to sub-specialization although the extent of sub-specialization among them was a little above average. The main barriers to the availability and uptake of sub-specialty services as well as the challenges of sub-specialty services at the centres with established sub-specialty practice in this study were non-availability/inadequate trained specialist and inadequate equipment.

Introduction

Sub-specialization involves a focused and intellectual pursuit of a better understanding of a specific aspect of a specialty [1]. It is a necessary and logical phenomenon which results from a tremendous expansion of the knowledge base, technical skills and the technology of a specialty [2]. The main factor that is possibly driving sub-specialization is the advancing body of knowledge [3,4,5]. Research is continually presenting new procedures, advancing protocols and most importantly, a better understanding of the pathogenesis and management of surgical conditions [5].

Sub-specialization in ophthalmology, like other surgical specialty, is increasingly emerging as an inevitable phenomenon in ophthalmic practice in recent years [6]. In recent years, ophthalmology has rapidly expanded that it is almost impossible to maintain mastery of every bit of ophthalmic discipline [7]. Therefore, sub-specialization is needed to produce ophthalmologists who are well grounded with knowledge and practical skills in all areas of ophthalmic subspecialties [7]. Sub-specialization leads to

better quality of service to patients as well as better treatment outcome [5,8]. This is quite important due to the changing pattern of eye diseases in Africa and globally. Despite the appreciation of the benefits of sub-specialization, there are concerns, especially in sub-Saharan Africa, as to whether this region is ripe for sub-specialization going by the shortage of ophthalmologist relative to the burden of eye diseases [9]. Nonetheless, there might be a paradigm shift to sub-specialty practice in Nigeria as postgraduate training programs regulating body like West African College of Surgeons (WACS) has reviewed her curriculum to meet this demand.

Furthermore, sub-specialization in ophthalmology is evolving in Nigeria and there appears to be a trend towards this phenomenon. In fact, the annual conference of the Ophthalmological Society of Nigeria has well-established subspecialty meetings with formation of subspecialty groups as obtainable in developed countries. However, there is lack of information concerning the status of sub-specialization among Nigerian ophthalmologists. Therefore, this study sought to determine the status of sub-specialization among Nigerian ophthalmologists as well as their dispositions and barriers against sub-specialization. It is hoped that the findings in this study will provide valuable information on the status of sub-specialty practice coupled with useful insight into the future of ophthalmic practice in Nigeria.

Materials And Methods

This was a web-based, cross-sectional study conducted among Ophthalmologist in Nigeria. The participants were contacted through their e-mail addresses obtained from the e-mail correspondence of Ophthalmological Society of Nigeria (OSN) as well as the databases of the National Postgraduate Medical College of Nigeria (NPMCN) and West African College of Surgeons (WACS). This study was exempted from full review by the Health Research Ethics Committee of the Lagos University Teaching Hospital, Lagos, Nigeria (ADM/DSCST/HREC/APP/4628).

An online questionnaire was distributed through e-mails using Qualtrics software (Qualtrics, Provo, UT, USA) twice weekly for ten months (1st October, 2017 to 31st July, 2018) to optimize response rate. The objectives of the study and the procedures involved was explained to the respondents via email. before a semi-structured, web-based questionnaire is administered. Respondents were made to understand that consent would be implied by the completion of the questionnaire and the anonymity of their responses would be ensured with the use of the encrypted Qualtrics software. Respondents' identifiable information (emails) were kept in one file, and data in another and no arbitrary code number was used to link identifiable information and the data. The setting was such that the online questionnaire could only be submitted once by each participant. Information concerning socio-demographic characteristics, type of practice, location of practice, years of practice, status and disposition to sub-specialization as well as barriers to sub-specialization were obtained through the questionnaire.

Data obtained was analyzed using IBM Statistical Package for Social Sciences (IBM-SPSS) version 20 (IBM Corp., Armonk, NY, USA). Frequencies, means, median and standard deviations were generated to observe patterns of variable distribution among respondents. The association between categorical

variables was analyzed using chi-square test and Fishers exact where appropriate. A p-value was less than 0.05 was considered to be statistically significant.

Results

Two hundred and four respondents completed the online questionnaire out of the expected 382 responses accounting for a study completion rate of 53.4%. Table 1 shows the demographic characteristics and years of experience of the respondents. There were 118 (57.8%) females with a male to female ratio of 1:1.4. Their ages ranged from 29 to 70 years and the median age was 45 years with an interquartile range of 14 years (Kolmogorov Smirnov test < 0.001). Majority (92.1%) were between the ages of 30 and 59. The duration of practice post-qualification ranged from 3 months to 42 years with majority (62.7%) having practised for ten years and below. The median duration of practice post-qualification was 7 years with an interquartile range of 13 years (Kolmogorov Smirnov test < 0.001).

Almost all (99.5%) the respondents were in active ophthalmic practice. One hundred and forty-eight (72.5%) respondents practised in the Southern part of Nigeria with South-west geopolitical zone being the practice location of almost half (48.0%) of the respondents (Table 2). Majority (77.5%) of the respondents practised in the urban area and most (61.8%) worked in Government tertiary hospital. The availability of sub-specialty services in Nigeria was rated by the respondents as average (49.0%), poor (42.2%), good (6.4%) and terrible (2.5%) while the uptake of sub-specialty services was rated as average (51.5%), good (25.0%), poor (20.1%), terrible (2.0%) and excellent (1.5%). The barriers to the availability and uptake of sub-specialty services were as summarized in Table 3.

Concerning sub-specialization in ophthalmic practice, 199 (97.5%) respondents felt it was necessary, 4 (2.0%) respondents were unsure of its necessity while 1 (0.5%) respondent felt it was not necessary. One hundred and ten (54.0%) respondents had undergone sub-specialty training, 86 (42.1%) were yet to sub-specialize but planned to sub-specialize while 8 (3.9%) respondents were not interested in sub-specialization (Table 4). The sub-specialties with the highest number of patronage were Paediatric Ophthalmology and Strabismus (14.2%), Ophthalmic Plastic, Reconstructive, and Orbital Surgery (6.9%) and Vitreo-retinal Surgery (6.9%) while Low Vision and Rehabilitation, Uveitis and Immunology as well as Ocular Oncology were least patronized each having one sub-specialist (Table 4). The sub-specialties of interest to respondents planning to sub-specialize were as shown in Table 5.

Personal interest, acquisition of special skills and the need for sub-specialty at respondent's workplace were the most common reasons for sub-specialization among respondents who had sub-specialized as well as those who planned to sub-specialize (Table 6). Of the 86 respondents who planned to sub-specialize, the reasons for the delay were lack of sponsorship in 43 (50.0%) respondents, family consideration in 21 (24.4%), inability to get training centre in 10 (11.6%), unsure of subspecialty choice in 5 (5.8%) and other reasons were given in 7 (8.2%) respondents. Of the 8 respondents who were not interested in sub-specialization, family consideration was the reason in 4 (50.0%) respondents, lack of interest, no need for sub-specialty services at workplace and respondents not in active practice were each

given by one (12.5%) respondents while one (12.5%) respondent gave no reason concerning the decision not to undergo sub-specialty training.

Table 7 depicts logistic regression analysis to determine the predictors of sub-specialization among the respondents. Respondents older than 46 years were three times more likely to have undergone subspecialty training compared to respondents who were aged 46 years and below [odds ratio (OR) = 3.01, 95% Confidence interval (CI) = 1.33 – 6.83, $p = 0.01$]. Table 8 summarizes the duration of training of respondents who had undergone sub-specialty training. Training duration of at least 12 months was significantly more common among respondents who subspecialized in Vitreoretinal surgery and Public Eye Health/Community Ophthalmology while training duration of less than 12 months was significantly more common among respondents who subspecialized in Medical Retina and Ophthalmic Plastic, Reconstructive, and Orbital Surgery (Oculoplastics).

Concerning the nature of subspecialty training of the respondents, a larger proportion of respondents who subspecialized in Paediatric Ophthalmology and Strabismus (82.8%), Vitreo-retinal Surgery (85.7%), Anterior Segment (including Cataract and Refractive Surgery)(69.2%), Medical Retina (63.6%) and Glaucoma (53.8%) had predominantly hands-on training while the training of a larger percentage of respondents who subspecialized in Public Eye Health/ Community Ophthalmology (100.0%), Neuro-ophthalmology (66.7%) and Ophthalmic Plastic, Reconstructive, and Orbital Surgery (57.1%) were not predominantly hands-on (Table 9). These proportions were only statistically significant among respondents who subspecialized in Paediatric Ophthalmology and Strabismus as well as Public Eye Health/ Community Ophthalmology.

Of the 110 respondents who had undergone sub-specialization, 51 (46.3%) had their training in India, 15 (13.6%) were trained in the United Kingdom, and 13 (11.9%) were trained in Nigeria and 10 (9.1%) were trained in the United State of America. The remaining 21 (19.1%) respondents had their training in Egypt (4), Tanzania (3), Canada (2), Pakistan (2), Saudi Arabia (2), South Africa (2), Bangladesh (2), Dominican Republic (1), South Korea (1), Kenya (1) and Tunisia (1). Seventy-seven (70%) out of the 110 respondents who had undergone sub-specialization had their training sponsored. Of these 77, 24 (31.1%) were sponsored by Commonwealth Eye Health Consortium (CEHC), 21 (27.3%) were sponsored by their workplace, 15 (19.5%) had sponsorship from International Council of Ophthalmology (ICO), 3 (3.9%) had Federal/State Government's sponsorship while 14 (18.2%) were sponsored by other establishments.

One hundred and sixteen (56.9%) respondents reported established sub-specialty practice at their workplaces. The distribution of the established sub-specialties is as shown in Table 10. The challenges of sub-specialty services at the centres with established sub-specialty practice are as summarized in Table 11.

Discussion

Human resource development is one of the core strategies of Vision 2020 Global initiative launched in 1999. Sub-specialization is one of the ways through which human resource for eye health can be

developed to provide high quality specialised eye care services geared towards the prevention and management of blinding eye conditions. Sub-specialization is a growing phenomenon in Nigeria but there is lack of information on the status of sub-specialization among Nigerian Ophthalmologists as well as barriers towards sub-specialization. This study sought to fill this gap in knowledge and provide information that could be useful for human resource for eye health management and planning.

Almost half (48.0%) of the respondents in this study had their practice domiciled in the South-west geopolitical zone (GPZ). This finding mirrors the observation in previous studies conducted among the same population [10,11]. It could also be a reflection of the unequal distribution of Ophthalmologists in Nigeria which is skewed towards South-west GPZ as pointed out in a previous study conducted among the same population [11]. Also, the availability of more numbers of training institutions as well as practice opportunities in the South-west GPZ may be contributory as pointed out by Idowu et al [10]. The preponderance of Government tertiary institution's practice among respondents may not be unconnected with better remuneration, job security as well as better opportunities for career development in Government tertiary institution compared to other establishments.

Approximately 98% of the respondent felt sub-specialization was necessary. This is not surprising as 96.1% of the respondents have either undergone or planning to undergo sub-specialty training. This high level of disposition towards sub-specialization suggests a high level of awareness and acceptability among the respondents. This is a welcome development as the incidence of eye diseases requiring sub-specialist services in sub-Saharan Africa has been reported to have increased [12]. According to the Nigerian national blindness and visual impairment survey, glaucoma is the second leading cause of blindness in Nigeria [13]. The management of this condition especially when medical therapy fails would be laser or surgical intervention like trabeculectomy, minimally invasive glaucoma surgeries and glaucoma drainage devices which are better handled by glaucoma sub-specialist. However, concerns have been expressed with respect to whether sub-specialization is the way to go in sub-Saharan Africa going by the inadequacy of Ophthalmologists in the face of huge burden of eye diseases [14]. This concerns could be addressed by a model whereby subspecialist practice is combined with general ophthalmic practice (especially cataract surgical services) as suggested by Musa et al [15].

Fifty-four percent of the respondents in this study had undergone sub-specialized. This is higher than 32% reported by Kariuki et al in a study involving 65 ophthalmologists in three East African countries of Kenya, Uganda and Tanzania [12]. The higher percentage in this study may be linked to the near-perfect disposition of the respondents to the need for sub-specialization. Also, it could be due to a high level of awareness of sponsorship opportunities for subspecialty training among the respondents as 70% of those who had subspecialized had their training sponsored. Furthermore, Nigerian ophthalmologist were major beneficiaries of ophthalmic subspecialty sponsorships of Commonwealth Eye Health Consortium (CEHC) and the International Council of Ophthalmology (ICO) [16,17]. These two organizations accounted for 50% of the sponsorship of respondents who had subspecialized in this study. However, the willingness of majority of the respondents who had not subspecialized to undergo subspecialty training as observed in this study is in consonance with the observation of Kariuki et al [12].

In this study, the three most patronized subspecialties were Paediatric Ophthalmology and Strabismus, Ophthalmic Plastic, Reconstruction and Orbital Surgery (Oculoplastics) as well as Vitreo-retinal Surgery. This is contrary to the observation by Kariuki et al in East Africa where Glaucoma was the most patronized subspecialty followed by Paediatric Ophthalmology and Strabismus as well as Community Eye Health [12]. Given that glaucoma is the second leading cause of blindness in Nigeria according to the Nigeria national blindness and visual impairment survey, one would have expected glaucoma to be among the top three most patronized subspecialties among the respondents. However, this may not be surprising because the main reasons propelling sub-specialization among the respondents were not driven by national needs for subspecialties but personal interest, need for acquisition of special skills and the need for subspecialty at the work place of the respondents. It is instructive to note that glaucoma was also not one of the top three subspecialty preferences in a recent study conducted among ophthalmology resident doctors in Nigeria [15]. The less popularity of glaucoma as a specialty of choice among the respondents may be due to the fact that uncomplicated glaucoma, just like cataract, is managed by all ophthalmologist in Nigeria and therefore perceived to be in the realm of general ophthalmic practice. It is interesting to note that glaucoma subspecialty practice was reported to be well established by 70.7% of respondents who had established sub-specialty practice at their workplaces. This may suggest that such subspecialty clinics may not necessarily be manned by subspecialist. This explanation is similar to the observation of Idowu et al who reported that the provision of oculoplastic care in Nigeria was not limited to oculoplastic surgeons as 67.1% of general ophthalmologists render such care in their practice [10]. Overall, mal-distribution of sub-specialization is evident in this study as sub-specialties like low vision and rehabilitation, uveitis and immunology as well as ocular oncology had very low patronage. Therefore, there is need to ensure that all sub-specialties are covered in a manner that aligns with the national need for each subspecialty.

Despite the fact that Nigerian Ophthalmologists were major beneficiaries of the sponsorship opportunities provided by CEHC and ICO, it is interesting that lack of sponsorships was the reason given for delay in commencement of sub-specialty training by half of respondents who have not subspecialized but planning to undergo subspecialty training. This underscores the inadequacy of sponsorship opportunities for subspecialty training in Nigeria. Therefore, there is need for the Government to invest more in manpower development in this regard to improve the quality of eye care delivery taking into cognizance the fact that the general populace will be the ultimate beneficiary. Kariuki et al also reported lack of sponsorships to be the main pre-training challenges among the participants in their study [12].

The barriers to the availability and uptake of sub-specialty services as well as the challenges of sub-specialty services at the centres with established sub-specialty practice in this study revolved around non-availability/inadequate trained specialist, equipment and training centre as well as affordability of subspecialty services (cost). Similar barriers have been highlighted in previous studies from Nigeria[10] and other African countries [12,18]. This is not surprising especially in this study wherein majority of the respondent practice in Government establishment where Ophthalmology department compete with other departments for the limited Government's funding. Therefore, it is imperative for Government to invest

more in human resources development and infrastructure provision as well as creation of an enabling environment for private eye care establishment to flourish.

This study is not without its limitations. First, the average survey completion rate of 53.4% could limit the extent to which the findings could be generalized especially in under-represented geo-political zone like North-east. However, the study duration of 10 months coupled with twice weekly reminders could suggest that most of Ophthalmologist who were interested in the study would have been captured. Although average, it is higher than the completion rate of 44% reported by Idowu et al[10] in an online survey among same study population and for similar study period. Second, the extent of sub-specialization in this study could be an exaggeration when compared to the extent in climes where sub-specialty training of less than 12 months is not considered to be a full sub-specialty training.

In conclusion, Nigerian Ophthalmologist are well disposed to sub-specialization although the extent of sub-specialization among them was a little above average. The barriers to the availability and uptake of sub-specialty services as well as the challenges of sub-specialty services at the centres with established sub-specialty practice in this study revolved around non-availability/inadequate trained specialist, equipment and training centre as well as affordability of subspecialty services (cost).

Declaration

This work is original and have not been published elsewhere in any form or language (partially or in full).

Conflict of interest: Oluwatobi O Idowu is currently an employee of Allergan, an AbbVie Company, Chicago although the research work was completed when he was a Postdoctoral Fellow at Department of Ophthalmology, University of California, San Francisco. The remaining authors declare they have no financial interest.

Funding: The authors did not receive support from any organization for the submitted work.

Availability of data: Available on reasonable request

Code availability: Not applicable

Author's contribution: All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by (Kareem O Musa) and (Oluwatobi O Idowu). The first draft of the manuscript was written by (Kareem O Musa) and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Ethical approval: This study was exempted from full review by the Health Research Ethics Committee of the Lagos University Teaching Hospital, Lagos, Nigeria (ADM/DSCST/HREC/APP/4628).

Consent to participate: Respondents were aware that they would be giving informed consent by completing the online questionnaire

Consent for publication: Not applicable

Acknowledgements: Nil

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Tables

Table 1: Demographic characteristics and years of experience

	Frequency	Percentage (%)
Age group		
20-29	1	0.5
30-39	50	24.5
40-49	86	42.1
50-59	52	25.5
60-69	13	6.4
70-79	1	0.5
Undisclosed	1	0.5
Total	204	100.0
Gender		
Female	118	57.8
Male	86	42.2
Total	204	100.0
Number of years Post-qualification		
<1-10	128	62.7
11-20	48	23.5
21-30	22	10.8
31-40	5	2.5
41-50	1	0.5
Total	204	100.0

Table 2: Location and types of hospital

	Frequency	Percentage (%)
Geo-political zone		
North-Central	30	14.7
North -East	5	2.5
North-West	20	9.8
South-East	12	5.9
South-West	98	48.0
South-South	38	18.6
Undisclosed	1	0.5
Total	204	100.0
Location of hospital		
Rural	7	3.4
Semi-urban	38	18.6
Urban	158	77.5
Undisclosed	1	0.5
Total	204	100.0
Type of hospital		
Government-Tertiary	126	61.8
Government-Secondary	20	9.8
Individual private practice	26	12.7
Group private practice	15	7.3
Mission hospital/Clinic	14	6.9
Military hospital	2	1.0
Undisclosed	1	0.5
Total	204	100.0

Table 3: Barriers to availability and uptake of Ophthalmology subspecialty services

	Frequency*	Percentage (%)
Barriers to availability		
Non-availability/inadequate trained specialist	157	77.0
Non-availability/ training centres	148	72.5
Cost	111	54.4
Limited opportunity to practice	45	22.1
Not a priority	17	8.3
Less demand by patients	13	6.4
Not lucrative	3	1.5
Others	7	3.4
Barriers to uptake		
Non-availability/inadequate equipment	153	75.0
Non-availability/inadequate trained specialists	131	64.2
Affordability of services	124	60.8
Accessibility of services	115	56.4
Not a priority	25	12.3
Others	19	9.3

*Some respondents gave multiple responses

Table 4: Sub-specialization among respondents

Subspecialty	Frequency	Percentage (%)
Paediatric Ophthalmology and Strabismus	29	14.2
Ophthalmic Plastic, Reconstructive, and Orbital Surgery (Oculoplastics)	14	6.9
Vitreoretinal Surgery	14	6.9
Anterior Segment (including Cataract and Refractive Surgery)	13	6.4
Glaucoma	13	6.4
Medical Retina	11	5.3
Public Eye Health/ Community Ophthalmology)	8	3.9
Neuro-ophthalmology	3	1.5
Comprehensive/General Ophthalmology	2	1.0
Low Vision and Rehabilitation	1	0.5
Uveitis and Immunology	1	0.5
Ocular Oncology	1	0.5
Yet to sub-specialize but planning to do	86	42.1
Not interested in sub-specialization	8	3.9
Total	204	100.0

Table 5: Preferred subspecialty of respondents planning to subspecialize

Subspecialty	Frequency	Percentage (%)
Ophthalmic Plastic, Reconstructive, and Orbital Surgery (Oculoplastics)	18	20.9
Anterior Segment (including Cataract and Refractive Surgery)	14	16.3
Glaucoma	12	14.0
Paediatric Ophthalmology and Strabismus	9	10.5
Vitreoretinal Surgery	8	9.3
Medical Retina	7	8.1
Public Eye Health/ Community Ophthalmology)	7	8.1
Comprehensive/General Ophthalmology	3	3.5
Neuro-ophthalmology	2	2.3
Low Vision and Rehabilitation	2	2.3
Uveitis and Immunology	1	1.2
Not sure of subspecialty choice for now	3	3.5
Total	86	100.0

Table 6: Reasons for subspecialty choice

Reasons for subspecialty choice	Respondents who had subspecialized Frequency (%)	Respondents who planned to subspecialize Frequency (%)
Personal interest	58 (52.7)	42 (48.8)
Acquisition of special skill	25 (22.8)	22 (25.6)
Need for subspecialty at my work place	20 (18.2)	14 (16.3)
Availability of sponsorship	4 (3.6)	0 (0.0)
Potential for research opportunity	2 (1.8)	3 (3.5)
Less busy	0 (0.0)	2 (2.3)
Demand for sub-specialty	0 (0.0)	2 (2.3)
Lucrativeness	0 (0.0)	1 (1.2)
Prestige	1 (0.9)	0 (0.0)
Total	110 (100.0)	86 (100.0)

Table 7: Logistic regression for predictors of sub-specialization among participants

Predictors	B (regression coefficient)	Odds ratio	95% Confidence interval	p-value
Gender				
Male	0.19	1.21	0.65 - 2.27	0.55
Female†				
Age (years)				
> 46	0.62	1.86	0.81 - 4.29	0.14
≤ 46†				
Experience (years)				
> 7	1.10	3.01	1.33 - 6.83	0.01*
≤ 7†				
Geopolitical zone				
South	0.07	1.07	0.52 - 2.20	0.85
North†				
Type of hospital				
Government	0.13	1.14	0.57 - 2.30	0.71
Non-Government†				
Location of hospital				
Urban	0.69	1.99	0.94 - 4.20	0.07
Non-urban†				

*Statistically significant

† - Reference category

Table 8: Duration of sub-specialization

Subspecialty	Duration of training		Total	p-value
	< 12 months	≥ 12 months		
Paediatric Ophthalmology and Strabismus	12 (41.4%)	17 (58.6%)	29 (100.0%)	0.27
Ophthalmic Plastic, Reconstructive, and Orbital Surgery (Oculoplastics)	12 (85.7%)	2 (14.3%)	14 (100.0%)	0.01*†
Vitreo-retinal Surgery	1 (7.1%)	13 (92.9%)	14 (100.0%)	<0.001*†
Anterior Segment (including Cataract and Refractive Surgery)	8 (61.5%)	5 (38.5%)	13 (100.0%)	0.65
Glaucoma	8 (61.5%)	5 (38.5%)	13 (100.0%)	0.65
Medical Retina	10 (90.9%)	1 (9.1%)	11 (100.0%)	0.01*†
Public Eye Health/ Community Ophthalmology)	1 (12.5%)	7 (87.5%)	8 (100.0%)	0.03*†
Neuro-ophthalmology	2 (66.7%)	1 (33.3%)	3 (100.0%)	>0.999†
Comprehensive/General Ophthalmology	2 (100.0%)	0 (0.0%)	2 (100.0%)	0.50†
Low Vision and Rehabilitation	0 (0.0%)	1 (100.0%)	1 (100.0%)	0.48†
Uveitis and Immunology	0 (0.0%)	1 (100.0%)	1 (100.0%)	0.48†
Ocular Oncology	1 (100.0%)	0 (0.0%)	1 (100.0%)	>0.999†
Total	57 (51.8%)	53 (48.2%)	110 (100.0%)	

*statistically significant; † = Fisher exact

Table 9: Nature of sub-specialty training

Subspecialty	Nature of training		Total	p-value
	Predominantly hands-on	Not predominantly hands-on		
Paediatric Ophthalmology and Strabismus	24 (82.8%)	5 (17.2%)	29 (100.0%)	0.01*
Ophthalmic Plastic, Reconstructive, and Orbital Surgery (Oculoplastics)	6 (42.9%)	8 (57.1%)	14 (100.0%)	0.20
Vitreo-retinal Surgery	12 (85.7%)	2 (14.3%)	14 (100.0%)	0.08 [†]
Anterior Segment (including Cataract and Refractive Surgery)	9 (69.2%)	4 (30.8%)	13 (100.0%)	0.76 [†]
Glaucoma	7 (53.8%)	6 (46.2%)	13 (100.0%)	0.74
Medical Retina	7 (63.6%)	4 (36.4%)	11 (100.0%)	>0.999 [†]
Public Eye Health/ Community Ophthalmology)	0 (0.0%)	8 (100.0%)	8 (100.0%)	<0.001* [†]
Neuro-ophthalmology	1 (33.3%)	2 (66.7%)	3 (100.0%)	0.56 [†]
Comprehensive/General Ophthalmology	1 (50.0%)	1 (50.0%)	2 (100.0%)	>0.999 [†]
Low Vision and Rehabilitation	0 (0.0%)	1 (100.0%)	1 (100.0%)	0.38 [†]
Uveitis and Immunology	1 (100.0%)	0 (0.0%)	1 (100.0%)	>0.999 [†]
Ocular Oncology	0 (0.0%)	1 (100.0%)	1 (100.0%)	0.38 [†]
Total	68 (61.8%)	42 (38.2%)	110 (100.0%)	

*statistically significant; † = Fisher exact

Table 10: Established Sub-specialties at work place

Subspecialty	Frequency *N = 116	Percentage (%)
Glaucoma	82	70.7
Paediatric Ophthalmology and Strabismus	77	66.4
Medical Retina	65	56.0
Ophthalmic Plastic, Reconstructive, and Orbital Surgery (Oculoplastics)	48	41.4
Comprehensive/General Ophthalmology	48	41.4
Vitreo-retinal Surgery	47	40.5
Public Eye Health/ Community Ophthalmology)	47	40.5
Anterior Segment (including Cataract and Refractive Surgery)	35	30.2
Low Vision and Rehabilitation	32	27.6
Neuro-ophthalmology	17	14.7
Ocular Oncology	10	8.6
Uveitis and Immunology	3	2.6
Ophthalmic pathology	0	0.0

*some respondents gave more than one response

Table 11: Challenges of sub-specialty services at workplace

Challenges of sub-specialty services	Frequency	*N = 116	Percentage (%)
Non-availability/inadequate equipment to practice	93		80.2
Non-availability/Inadequate trained specialists	51		44.0
Inadequate in-service training	46		39.7
Reduced research activities	29		25.0
High patient burden	28		24.1
Low uptake of services	20		17.2
Inability to train others	18		15.5
Others	5		4.3

*some respondents gave more than one response