

Evaluation of Bachelor of Science degree training in comprehensive ophthalmology and cataract surgery for clinical officers in Kenya with Focus on 2030 in Sight

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Abstract

Introduction: Adaptation of Universal Health Coverage signals the Kenyan government's commitment to ensure that Kenyans have access to quality, available and affordable health services. Cataract and uncorrected refractive error are the leading causes of blindness and vision impairment. Effective interventions exist for both eye challenges and capacity building by training more human resource is a step towards realization of vision 2030 in sight.

Objectives: To assess professional and academic growth, graduates contribution against reversible blindness and evaluating impact of BSc. Comprehensive ophthalmology and cataract surgery graduates in eye health with focus on vision 2030 in sight.

Methods: There was use of Descriptive cross sectional study design and data was collected via an online questionnaire. Study targeted clinical officers possessing qualification in BSc. comprehensive ophthalmology and cataract surgery. Census method was used on the 99 graduates of the program. Intention to use data for research was made aware to the participants. Data was analyzed using SPSS version 25 and presented using visualization techniques in frequencies, mean, mode and proportions.

Results: A response rate of 100% was attained; there were more males (52.5%) than females (47.5%), the modal age group was 31 to 40 years. Post-graduation, 17.2% of participants proceeded to undertake Master's degree and 20.8% reported promotion at work place. About 77.8% are competent cataract surgeons and Phacoemulsification (27.3%) was the most preferred ophthalmology sub specialization with 65.7% favoring Master degree as the most desired academic progression path against 26.3% preferring to undertake 3 to 6 months sub specialty trainings in ophthalmology. With availability of resources, 95% of the graduates were willing to work at primary health level but the graduates' distribution was more in urban centers. Majority (59.6%) were employed by the county governments, 42.4% were involved in some form of management. Small Incision cataract surgery (SICS) technique was the most practiced by 90.9% of surgeons. Poor resource allocation to eye departments was the commonest (51%) barrier to eye service delivery.

Conclusions: Open up academic avenues for BSc.COCS graduates by starting masters programs and short trainings in ophthalmology. Government to sponsor more clinical officers to the program for rural population. Organize workshop for BSc.COCS graduates to equip them on research skills.

Keywords: Clinical Officer Ophthalmology; Comprehensive ophthalmology and cataract surgery; Vision 2030 in sight; Universal Health Coverage; Primary eye health

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1. Introduction

Recognizing that at least 2.2 billion people are living with vision impairment or blindness, of which at least 1 billion have vision impairment that could have been prevented or is yet to be addressed is of great concern and calls for concerted efforts in addressing the matter. Vast majority of people with vision impairment live in low- and middle-income countries, which often have limited resources and may lack strategies to prevent or correct vision impairment; bearing in mind the higher prevalence of vision impairment in rural and remote areas¹. In Africa there are 4.8 million blind and 16.6 million visually impaired persons with an addition of 100 million others with near vision impairment². Good health is essential for sustainable development and the 2030 Agenda reflects on the complexity and interconnectedness of the two³. The global eye care needs are expected to increase substantially in the coming decades due to demographic, lifestyle trends and ageing populations¹.

The number of people living with blindness is projected to triple by 2050; this can be attributed to the substantial increase expected in cases of cataract, glaucoma, diabetic retinopathy, uncorrected refractive error, age-related macular degeneration and the fact that half of the global population is expected to be living with myopia. To reverse these trends we need to stress the importance of prevention, early detection and treatment to contain the increasing global eye health burden¹. World Health Organization's Thirteenth "General Programme of Work" aims to have 1 billion more people benefit from Universal Health Coverage (UHC) by the year 2025, while also contributing to the targets of 1 billion more people better protected from health emergencies and 1 billion more people enjoying better health and well-being³. Achieving UHC is one of the targets the nations of the world set when they adopted the 2030 Sustainable Development Goals (SDGs) in 2015. At the United Nations General Assembly High Level Meeting on UHC in 2019, countries reaffirmed that health is a precondition for and an outcome and indicator of the social, economic and environmental dimensions of sustainable development⁴.

Universal health coverage (UHC) means that all people have access to the full range of quality health services they need, when and where they need them, without financial hardship. It covers the full continuum of essential health services, from health promotion to prevention, treatment, rehabilitation, and palliative care across the life course⁴. In recognition of the growing evidence that improving eye health and preventing vision impairment can directly contribute to achievement of many other SDGs, including the goals on quality education (SDG4), gender equity (SDG5), work and economic growth (SDG8) and reduced inequities (SDG10), the first United Nations General Assembly (UNGA) resolution on vision was adopted by member states in July 2021. This resolution displays vision as a cross-cutting issue within the sustainable development framework and encourages greater coordination on vision with other global development priorities⁵.

Sustainable development goal 3.4 takes into account emerging challenges such as non-communicable diseases like eye conditions that cause 2.4% of the disability adjusted life years in the middle income countries. Quantification of disease burden indicates refractive errors affects 13.7 million people and it ranks among the top ten diseases in middle income countries⁶. Sustainable development goal 3.8 explore universal health coverage with an aim of financial risk protection and offering quality health to everyone³. This is aligned with the monitoring of eye health progress as outlined in the universal health coverage dimensions of access, quality, financial risk protection and equity⁷.

The Kenyan constitution of 2010 through the Bill of Rights recognizes health as a primary right and tasks the health sector with the responsibility to realize this right. The right to health is also captured in other policy documents such as Vision 2030 and the Kenya Health Policy 2015 – 2030, which aim to provide equitable and affordable health care of the highest standards to Kenyans. These legal and policy documents, among others, signal the government's commitment to ensure that Kenyans have access to quality, affordable health care⁸. Implementation of the bill of health as a primary health has been met with challenges like human resource shortages. According to the World Health Organization (WHO) report of 2013, sub-Saharan African countries, including Kenya, experience health workforce challenges. The shortage and inequitable distribution of the health workforce is a major barrier to the access of essential health care services⁹.

Advancing on eye health within universal health coverage (UHC) and strengthened health systems is essential to scaling-up eye health and reaching those most in need. Health system strengthening in eye health is built on pillars and one of the five pillars emphasize on human resource capacity building¹⁰. The delivery of these services requires healthcare workers with an optimal skills mix at all levels of the health system, who are equitably distributed, adequately supported with access to quality assured products, and enjoying decent work⁴. Bridging the health sector human resource gap and enhancing eye health delivery quality is what the undergraduate ophthalmology training for clinical officers offered at Jomo Kenyatta University of agriculture and technology aims to achieve in realization of vision 2030 targets on effective coverage of eye care.

1.1. Eye health care delivery in Kenya

As a foundation for Universal health care (UHC), World Health Organization recommends reorienting health systems towards primary health care (PHC). In countries with fragile health systems, WHO focuses on technical assistance to build national institutions and service delivery to fill critical gaps in emergencies. In more robust health system settings, WHO drives public health impact towards health coverage for all through policy dialogue for the systems of the future and strategic support to improve performance⁴. Aware that the majority of the causes of vision impairment can be prevented or their effects corrected through early detection and timely management, and that cost-effective interventions covering promotion of eye health and prevention, treatment and rehabilitation can be made available at primary health care level to respond to needs associated with eye conditions and vision impairment, but that there are significant variations in use of, and access to, eye care services between and within populations¹.

In Kenya, Eye care is provided as part of the national health system and can be found at all hospital levels, but not to the same extent in all counties. At the community level (Level 1) eye health services include primary eye care through eye health promotion, the services include treatment of minor eye conditions, disease prevention and identification referral and follow up of those found to have eye problems or are blind. This is done through Community Health Volunteers (CHVs) who have had prior training in Primary Eye Care. These referrals are channeled through Community Health Extension Workers (CHEWs) that are the immediate supervisors of these CHVs. At level 2 and 3 (Dispensaries and Health Centers), eye health services are provided by Primary Health Care Workers (PHCWs) trained in health disciplines such as Nursing and Clinical medicine. The services include treatment of minor eye conditions and appropriate referral of complicated cases to the next level of health care. Some of the PHCWs may have extra training in eye health such as the 3 months Ophthalmic Skills Up-grading Course (OSUC) in eye care, that improves their capacity².

At level 4 and 5 facilities (Sub-county, County referral hospitals and Regional hospitals), services are provided by eye specialists that include Ophthalmologists, Ophthalmic Clinical Officer/Cataract Surgeons, Ophthalmic Clinical Officers and Ophthalmic Nurses. Some level 5 hospitals also have Sub-specialty Ophthalmologists. The services include; medical and surgical treatment of eye conditions, refractive services, low vision services, laser treatment and rehabilitative services. More technical cases are handled at level 5 than level 4 based on the level of Human Resources and available equipment. All level 5 and some level 4 hospitals are expected to provide teaching services to students on elective term and practical attachment. At level 6 (National Teaching and referral hospitals), services are provided by Sub-specialty Ophthalmologists, Ophthalmologists, OCO/Cataract Surgeons, Ophthalmic Clinical Officers and Ophthalmic Nurses. Some level 6 hospitals have engaged the services of Optometrists. Services at this level include conditions to facilitate preventive, promotive, follow up and rehabilitative services, early identification and referral².

1.2. Clinical officer

Globally Clinical Officers are grouped as non-physician clinicians and are known as Physician associates /assistants (WHO, 2010). Training programs for physician assistants, started in the United States of America (USA) in the mid-1960's these grew to 75,000 providers in 2011 and has spread to Australia , Canada , Great Britain, Netherlands , Germany, India, Israel, Liberia, New Zealand, Saudi Arabia and in countries formerly comprising the Soviet Union. In Sub-Saharan Africa they are known as mid-level health workers. In 2010 this category of health care providers was identified in 47 out of 54 countries in sub-Saharan Africa although their roles varied widely within countries. They have different nomenclatures which include: Clinical Officers in Kenya and Uganda, Medical Licentiates in Zambia, Physician Assistant in Ghana, Clinical Associates in South Africa , Assistant Medical Officers in Malaysia, and Community Health Officers(CHO) in Nigeria among others⁸. In Kenya, Clinical Officers are middle-level healthcare workers providing preventive, promotive, curative and rehabilitative health care services at all levels of the Kenyan healthcare service delivery system under the Clinical Officer's Act No. 20 of 2017 of the laws of Kenya to the public since 1928⁸. Clinical Officers are responsible for the implementation of community and family health interventions aimed at promotive and preventive health, diagnosis and treatment of patients with personal contact of over 75% of the total number of patients attending hospitals on daily basis. They are also the managers and in-charges of the primary healthcare facilities across the country including over four thousand, nine hundred and twenty (4,920) dispensaries, over one thousand and forty three (1,043) health centers and about three hundred and forty nine (349) in Level 4 Hospitals⁸. Our national medical provider to patient ratio for clinical officers is slightly higher than that for medical officers at 26.8 and 14.7 per 100,000 respectively and markedly higher ratio for nurses at 82.6 per 100,000. The WHO health country workforce threshold requirement is a much higher ratio of 445 physicians, nurses and midwives per 100,000 people which Kenya as a country is far from attaining⁹.

1.2.1. BSc. Comprehensive ophthalmology and cataract surgery

In total compliance with the WHO Eye Care Competency Framework (eCCF) tool, JKUAT in the year 2015 initiated a five-year Bachelor's degree training programme for registered Clinical officers that best intervenes to meet the eye care needs in the community. The five year training period is distributed as; one year Credit entry, three years of training and one year of internship (Comprehensive Ophthalmology and Cataract Surgery) (WHO, 2022). While the entry Criteria is registered Clinical Officers, either with Diploma, Higher Diploma, or Bachelor's degree, those who had Higher Diploma in Ophthalmology and Cataract Surgery were waived 1 year ². A trained BSc. Comprehensive ophthalmology and cataract surgery graduate has spent a minimum of 9 cumulative years in medical training. Upgrading of clinical officers was advised by the need to meet the need of specialized eye health workers and at the same time open the career progression/path among the cadre of clinical officers⁹. This was supported by the Ministry of Health and the Clinical Officer's council, as the regulatory body. The first Class comprised of 29 among whom 9 had HND in Ophthalmology and Cataract Surgery, and were already in the Eye health workforce observatory while 20 had Diploma in Clinical Medicine and Surgery. Curriculum review in accordance to the standards of training is now due after completion of full cycle ².

The enrollment into the program was as displayed in table 1.

Table 1 Enrollment of BSc. comprehensive Ophthalmology and cataract surgery ²

Year	2016	2017	2018	2019
Number admitted	29	23	26	19

Surgical tasks are considered to be specialized service only performed by medical officers. However, in many instances, minor surgical procedures are performed by Clinical Officers. For clinical officers to perform more complicated surgical procedures, they must take upgrading skills training either in HND or enroll in the Bachelor of Science (BSc) in Clinical Medicine degree and surgery/Community Health program at an accredited institution for advanced training in basic science, surgical, clinical and community health, equipping them with skills to effectively integrate curative and preventive care services. Thereafter, clinical officers must receive licensure from the Clinical Officers Council (COC) to practice clinical medicine. The BSc degree for Clinical Officers is reported to take between 3 to 4 years, plus an additional year of medical internship⁹. The advancement in their training in response to the changing and emerging trends plus the amendment of the Kenyan constitution Act No. 20 of 2017; Vision 2030; Task sharing/shifting guidelines and Universal healthcare to all have increased the mandate and expanded the scope of practice for the Clinical Officer's personnel⁸.

1.3. Statement of the problem

The global pattern of the recent stagnating progress in service coverage while catastrophic health spending increases continuously is consistent across all regions, country income groups and most countries at all income levels. Inequalities continue to be a fundamental challenge for UHC. Even where there is national progress on health service coverage, the aggregate data mask inequalities within-countries ⁴. Vast majority of people with vision impairment live in low- and middle-income countries, which often have limited resources and may lack strategies to prevent or correct vision impairment, and bearing in mind the higher prevalence of vision impairment in rural and remote areas ¹. Noting that cataract and uncorrected refractive error are the leading causes of blindness and vision impairment and that effective interventions exist for both. Emphasizing the need to improve access to these interventions for everyone, everywhere can be achieved by eliminating the barriers to availability and accessibility of eye care services, such as cataract surgery, refraction services and provision of spectacles, including shortages of trained health personnel, access challenges for people in rural and remote areas, socioeconomic and cultural factors, inequities and costs of health services ¹. Kenya is one of 36 countries in Africa which has a critical shortage of health workforce ⁹. The health workforce shortage in Kenya negatively affects the quality of health service delivery, the attainment of universal health coverage, and the achievement of desirable health outcomes⁹. An estimated 15.5% of Kenyans are in need of quality eye care services, ranging from cataract surgery, diabetic and hypertensive retinopathy care, spectacle corrections and even basic ocular allergy treatment and care. Over 80% blindness in Kenya is due to curable and preventable causes. With increasing burden of NCDs diabetes is now an emerging cause of blindness. Despite the urgency required to avoid the same populations translating to blindness, and associated social impediments, it is regrettably noted that less than 1% of the global number of ophthalmologists practice in Africa². We can overcome these challenges by embracing new strategies like equipping middle level health workers like clinical officers with advanced skills in tackling patients' health challenges. This is in realization of the availability of the clinical officers within the low-income populations and among the rural populations where the irreversible blindness is at it highest.

1.4. Study justification

World Health Organization included the strengthening of health information systems (HIS) among its five global priority areas for action. It recognizes the critical role of health information system to provide information from population-based surveys, facility-based sources and administrative data to guide health policy, management and clinical care in middle and low income countries⁷. Baseline survey among the new unit of eye health providers (BSc. Comprehensive ophthalmology and cataract Surgery) is a step towards appreciating significant impact of vision impairment on development, educational achievement, quality of life, social well-being and economic independence of individuals, as well as on society, with disproportionate burdens imposed on underserved and vulnerable populations¹. WHO Eye Care Competency Framework envisions a situation whereby no gaps exist in service delivery to patients as various professionals interlink from one level to another in ensuring maximum care to needy patients.

The researcher aims at understanding the capacity and inputs of the eye professionals graduating with BSc. Comprehensive Ophthalmology and Cataract Surgery in the eye health industry landscape. This information will inform the stakeholders on new developments that require their action in improving eye health delivery. For example; With aging of the global population the number of people with vision-impairing cataract will increase unless cataract services improve in terms of access, output and quality¹¹. To provide yardsticks on the top most challenges in the eye sector, there are ambitious eye health targets for vision 2030 that were adopted at the 74th World Health Assembly. These targets included 40% increase in effective coverage of refractive error by 2030 and 30% increase in effective coverage of cataract surgery by the year 2030¹⁰. As data become more widely available in the future, the global reporting framework will monitor progress towards the achievement of the 2030 targets based on the 6/12 visual acuity threshold for both the “need for intervention” among the cataract cases and a “good quality visual outcome” among the refractive error patients¹².

In Kenya, the estimated cataract surgical rate (CSR) in 2019 was 800 per million per year, this is low compared to World Health Organization recommended Cataract surgical rate (CSR) target of 3000 per million per by year 2020. This is also backed by the considerable variation in eCSC by country, with estimates ranging from 3.8 % (95% CI 2.1-5.5) in Guinea Bissau, 2010, to 70.3% (95% CI 65.8-74.9) in Hungary, 2015. This reflects a gradient of available resources and subsequent cataract output when you compare high-income settings with highest eCSC and low-income countries with the lowest eCSC¹¹. With the increasing prevalence of cataract and number of cataract surgeries, there is need to promote high-quality surgery with a good visual outcome (visual acuity of 6/18 or better) from the current 65% to 70% by 2023 through routine cataract surgical outcome monitoring, and eCSC of 80% by 2025². One of the strategies of addressing low cataract surgical rate will be to training more cataract surgeons. Kenya will take several years to achieve the WHO recommended minimum human resources for health (HRH) levels. Another strategy to achieve the minimum human resource for health will be through task sharing concept. Task sharing is the rational distribution of tasks among trained and supervised health professionals and health workers; it will be employed to increase access to essential health services in Kenya. As a public health approach, task sharing can improve health outcomes and offer practical solutions amidst the health workforce shortage⁹.

Reorganizing health service delivery through formalized task sharing will support Kenya as it aims to achieve the intended health outcomes outlined in the Kenya Health Policy (KHP 2014 – 2030) and Vision 2030⁹. Use of health cadres like the clinical officers and equipping them with advanced skills in eye health maximizes use of the existing pool of health workforce in resource-constrained settings by using a standardized approach to extending appropriate clinical skills to less highly-trained health workers and non-professional cadres⁹. Training of more eye health care workers is a step towards realization of 2030 targets on effective coverage of eye care. It will help to increase the number of cataract surgeons which is the key mandate of BSc. Comprehensive Ophthalmology and Cataract surgery and in return work towards betterment on Kenya’s eCSC of 80% by 2025. This survey will enable the health sector to more effectively utilize health workforce so as to increase service provision as well as improve the quality of health services⁹.

1.5. Broad objective

To evaluate Bachelor of Science degree training in comprehensive ophthalmology and cataract surgery for clinical officers in Kenya: Focus on 2030 in sight.

1.6. Specific objectives

- To assess professional and academic growth of BSc. COCs graduates with focus on 2030 in sight.
- To assess BSc. COCs graduates contribution against reversible blindness with focus on 2030 in sight.
- To evaluate impact of BSc. COCs graduates in eye health workers capacity building process with focus on 2030 in sight.

- To evaluate graduates perception on BSc. comprehensive ophthalmology and cataract surgery training

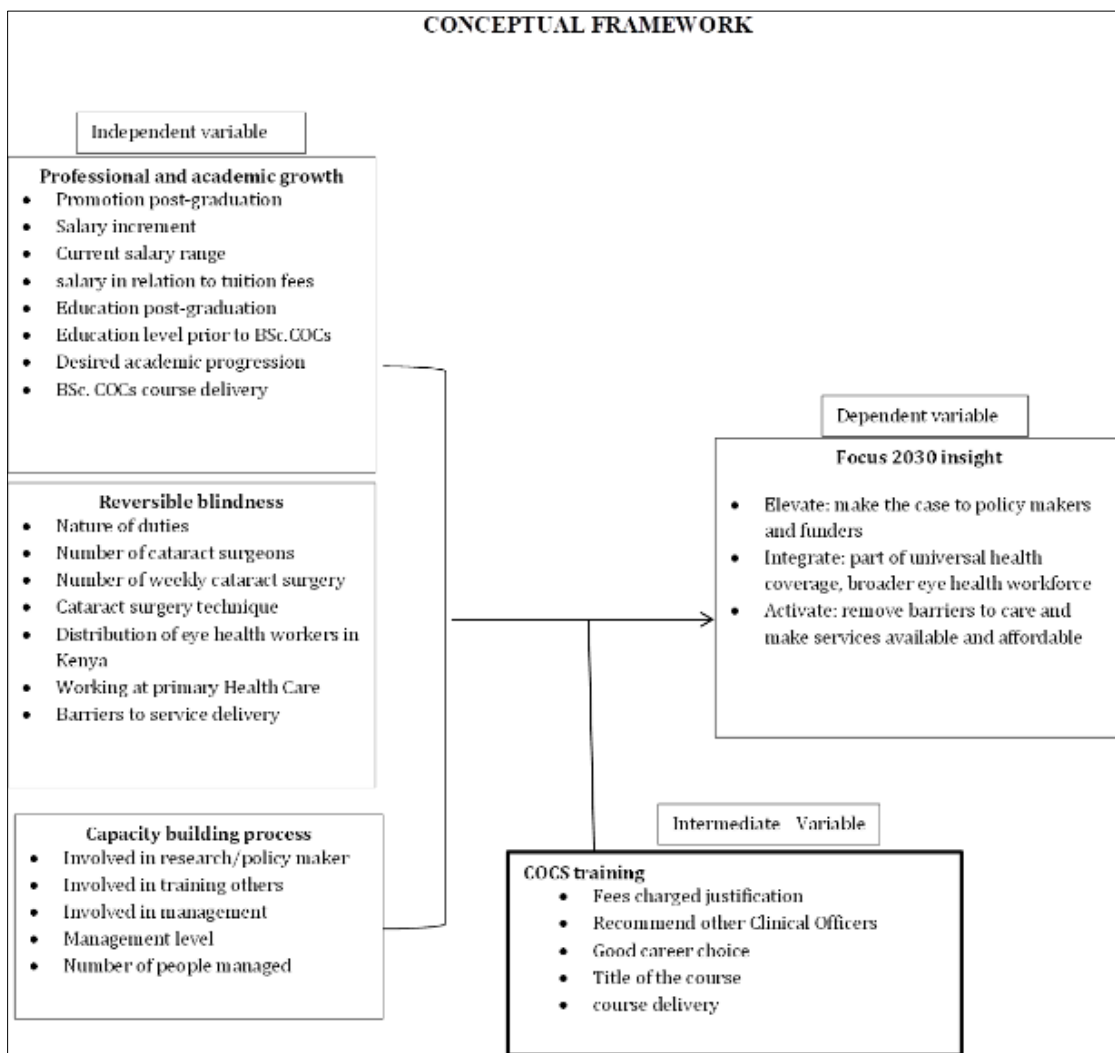


Figure 1 Conceptual framework

2. Methodology

A survey was carried out using a descriptive cross sectional study design. An online questionnaire was developed using Google forms and its formation was guided by literature and study specific objectives. A pretest was carried out 2 weeks prior to commencement of the study, five participants were involved in the process. Thereafter, data was collected over a period of 14 days from 30th October 2023 to 12th November 2022. Target group were clinical officers possessing Bachelor of Science degree in comprehensive ophthalmology and cataract surgery from Jomo Kenyatta University of Agriculture and Technology. We included all graduates from year 2018 to 2023 irrespective of internship completion status and excluded those who were still undertaking the program and are yet to graduated. Census method was used to involve the entire population of 99 graduates of the program. Intention to use data for research was made aware to the participants and they consented by affixing a digital signature on the consent form. Data was analyzed using excel 2016 and presented using visualization techniques in sum, mean and proportions.

3. Results

3.1. General description

The response rate was 100 percent, all the 99 Bachelor of Science in comprehensive ophthalmology and cataract surgery graduates participated in the survey. Gender distribution among the participants was uneven with slightly more males 52 participants (52.5%) than females 47 participants (47.5%).

3.2. Age in years

The modal age group of the participant was 31 to 40 years representing 73.1% of the total group. Those aged 41 to 50 years were the second most populous group with 16.2% representation. Age group of 20 to 30 years, 51 to 60 years were 7.1% and 3% respectively.

3.3. Graduation year

Jomo Kenyatta University of Agriculture and technology produced more Bachelor of Science in comprehensive ophthalmology and cataract surgery graduates in the year 2023 than other years accounting for 28.3% and year 2021 was second with 26.3% of the total graduates. Graduation of year 2018 recorded the least number of graduates at 5.1%.

3.4. Current salary

At their current work stations, the amount of remunerations in Kenya shillings earned by BSc.COCS graduates was descent with more than half of them (53.5%) earning a salary of between 51,000 and 100,000. A considerable number (34.3%) earned a salary ranging from 101,000 to 150,000 KES. About 7% of the participants had a salary of above 200,000KES while only 3% earned a salary range of 151,000 to 200,000KES.

Table 2 Socio-demographic characteristics BSc. COCS graduates

Demographic Characteristics of BSc COCS graduates		
	Frequency	percentage
Gender		
Female	47	47.5
Male	52	52.5
Total	99	100
Age		
20-30	7	7.1
31-40	73	73.7
41-50	16	16.2
51-60	3	3.0
Total	99	100.0
BSc COCs year of graduation		
2018	5	5.1
2019	17	17.2
2020	7	7.1
2021	26	26.3
2022	16	16.2
2023	28	28.3
Total	99	100.0
Salary Range		
less than 50,000	2	2
51,000 to 100,000	53	53.5
101,000 to 150,000	34	34.3
151,000 to 200,000	3	3
above 200,000	7	7.1
Total	99	100

3.5. Professional and academic growth of graduates

Highest education prior to BSc.COCS

Prior to joining BSc. Comprehensive ophthalmology and cataract surgery programme, majority of the survey participants possessed diploma qualification (54.5%). Those with various undergraduate and master's degrees were significant with 29.3% and 3% representation, respectively. There was a considerable number having higher diploma qualification at 13.1% of the total participants.

Education post-graduation

Participant who went on to pursue further training post-graduation lasting more than 6 weeks were 33 in number forming 32.3% of all the respondents. Majority of them went for Master's Degree comprising of 17.2%. Those with at least 6 weeks ophthalmology sub-specialty training were 8.1%, and 7.1% undertook other trainings not classified in our listing

Employment promotion post-graduation

It was 20.8% (20) of participants that reported promotion at work place post BSc.COCS graduation. Those who reported to have changed employers after graduation were 18.25 (18) while majority 61.6% (61) reported of no positional change post-graduation.

Salary increment post-graduation

There was a salary increment of more than 30,000 Kenya shillings among 19.2% of the graduates. Those who recorded a salary increment of 11,000 to 30,000 Kenya shillings were 18.2%. More than half of the participants (57.6%) did not report any salary increment in response to their academic progress.

Desired sub specialty training in ophthalmology

The most desired ophthalmology sub-specialty training was cataract surgery by phacoemulsification technique which was desired by 27.3% of the participants. Community and public eye health training came in second with 26.3% of the respondents wishing to take it up as a sub-specialty. Glaucoma management (14.1%), Low vision and refraction (9.1%), Investigative ophthalmology (6.1%), Neuro-ophthalmology (5.1%), Pediatric ophthalmology (4%), strabismus and squint management (4%), other unlisted ophthalmology trainings (3%) and diabetic retinopathy screening (1%) followed in that order as preferred trainings by the participants.

Table 3 Professional and academic growth

Professional and Academic growth		
	Frequency	Percent
Highest education level prior to BSc. COCs training		
Diploma	54	54.5
Higher diploma	13	13.1
Masters	3	3
Undergraduate degree	29	29.3
Total	99	100
Post-graduation training		
At least 6 weeks training	8	8.1
Masters	17	17.2
NONE	67	67.7
Others	7	7.1
Total	99	100

Employment promotion post-graduation		
Promoted	20	20.2
Not promoted	61	61.6
Change of employer	18	18.2
salary increment post BSc. COCs.		
No increment	57	57.6
less than 10,000	5	5.1
11,000 to 20,000	9	9.1
21,000 to 30,000	9	9.1
more than 30,000	19	19.2
Total	99	100
desired academic progression path		
3 to 6 months training in specific ophthalmology skills e.g. phaeco, diabetic retinopathy screening e.t.c	26	26.3
Master degree in ophthalmology	65	65.7
others	4	4
post graduate diploma in ophthalmology	4	4
Total	99	100

The most desired ophthalmology sub-specialty training was cataract surgery by phacoemulsification technique whereas diabetic retinopathy screening was the least preferred trainings by the participants.

3.5.1. Preferred sub-specialty

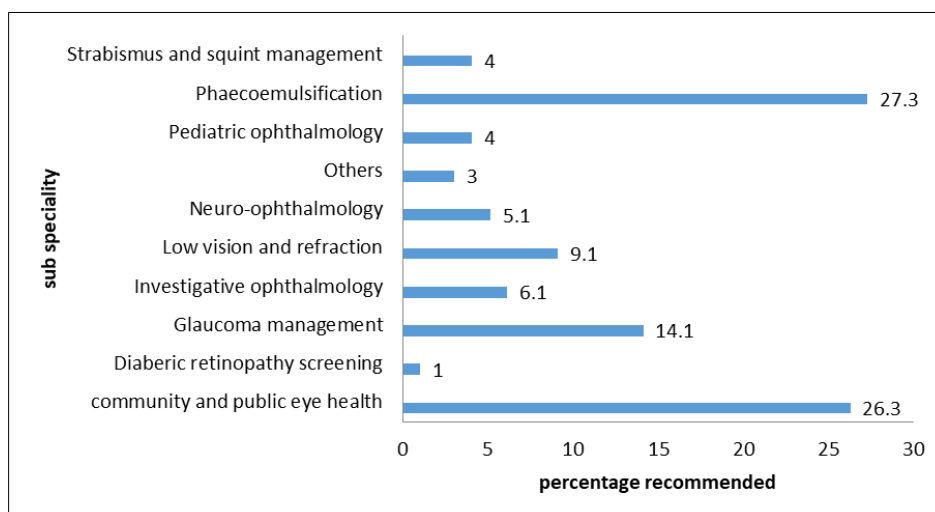


Figure 2 Preferred sub specialty

3.5.2. Graduates contribution against reversible blindness

Willingness to work at primary health care level

With availability of all the resources, 95% (frequency of 94) of Bachelor of Science in comprehensive ophthalmology and cataract surgery graduates are willing to work at the primary health level (as defined by the policy documents in Kenya). Only 5% of the respondents were not willing to take up primary health care duties

Distribution of BSc. Comprehensive ophthalmology and cataract surgery graduates in Kenya

The top three counties with the highest number of BSc. Comprehensive ophthalmology and cataract surgery graduates were Nairobi county (16.2%), Kiambu county (9.1%) and Makueni county (5.1%)

Employment of Bachelor of Science in comprehensive ophthalmology and cataract graduates

County governments are the top employers of BSc.COCS graduates taking up 59.6% , private hospitals (12.1%) and mission hospitals (11.1%) coming in second and third respectively. Non-governmental organizations (5.1%) and National government (4%) employ a considerable amount of the graduates too. There are those still undertaking their internships (3%), others in private practice (3%) and locums (1%). Only 1% of BSc. COCS graduates remain unemployed.

Nature of duties

Majority of BSc.COCS graduate are involved in managing eye patients only, 24% manage both eye and general patients while only 1% are not involved in any form of clinical works.

Cataract surgeons

The training programme has successfully injected 96 cataract surgeons into the eye care space, representing 96% of the total graduates. There are 77 competent surgeons representing 77.8% of the participants, 18.2% reports of not being competent enough to undertake the procedure. It was noted that only 4% of the graduates cannot perform cataract surgery.

Number of cataract surgery performed

Majority of cataract surgeons (63.6%) are attached to hospitals that allow them to perform less than 10 cataract surgeries per week. It was found that 18.2% of surgeons conducted between 10 to 20 cataract surgeries. Those carrying out more than 50 surgeries in a week were 5.1%. Centers allowing surgeries ranging from 31 to 40 per week and 41 to 50 per week were represented at 2% and 1% respectively

Cataract surgery technique

Small Incision cataract surgery (SICS) technique was the commonest practiced by 90.9% of the surgeons. A phacoemulsification technique was in use by 4% of the surgeons while only 1% reported to be using extra capsular cataract extraction (ECCE).

Barriers to eye service delivery among BSc.COCS graduates

More than half of the respondents identified poor resource allocation to the eye department as the most important barrier to service delivery to eye patients; this was represented by 51% of the respondents. Other significant barriers were Lack and poor maintenance of healthcare infrastructure (10%), high disease burden (7%), and lack of medicines (7%), Lack of ophthalmology training among staffs (6%), weak health system (5%), poor interdepartmental referral system (4%) and Non-use of evidence-based intervention (2%).

3.5.3. Impact of graduates in eye health

Involved in management

There are 42 participant involved in some form of management at their place of work. This represent 42.4% of the respondents while a majority 57 participants do not take part in management, this represented by 57.6% of the respondents.

Head of department

Being head of eye department is the commonest level of management BSc.COCS graduates are positioned at, those occupying those positions formed 23% of the respondents. There were 19% of the respondents involved in management at hospital level while 6% are involved in management at county level. Majority 48% were not involved in any form of management while 3% chose not to respond to the question.

Number of people managed

Those involved in managing less than 10 staffs were 24%, the output was replicated among those managing above 30 people representing 24% of the respondents too. It was 12% of the managers that managed staff number ranging between 11 and 20 and only 3% managed 21 to 30 staffs.

Eye related research

Only 13.1% of the graduates are involved in eye related research while a whopping 86.9% do not conduct any form of research.

Training of other health workers

A good number BSC.COCS graduates have been involved in health workers capacity building through training with 74.7% reporting to have trained other health workers against 25.3% who have not.

Table 4 Impacts of Graduates in eye health

	Frequency	percentage
Involved in management		
Yes	42	42.4
No	57	57.6
Highest management level		
County level	6	6
Hospital level	19	19
Head of department	23	23
Not applicable	48	48
No response	3	3
<i>Number of people managed</i>		
No response	1	1
None	35	35
Less than 10	24	24
11 to 20	12	12
21 to 30	3	3
Above 30	24	24
Eye related research		
Yes	13	13.1
No	86	86.9
training of health workers or students in eye health		
Yes	74	74.7
No	25	25.3

3.5.4. Graduates perception on BSc. comprehensive ophthalmology and cataract surgery training

On content delivery of BSc. Comprehensive ophthalmology and cataract surgery, 94% of the respondents were satisfied with how the programme content was delivered, none was in agreement, though 6% were not sure on whether the content delivery was perfectly executed. Only 5% were not in agreement that the title "BSc. Comprehensive ophthalmology and cataract surgery" was the most appropriate title. Majority, 95% were satisfied with the title. Almost

all, 99% of the respondents were certain they made a good career choice when they enrolled for training in comprehensive ophthalmology and 99% would recommend other clinical officers to join the program. In reference to their current remuneration and what they paid for tuition fees, 63% of the respondents were not convinced the fee was fairly priced.

Table 5 Perception on BSc. comprehensive ophthalmology and cataract surgery training

	Frequency	percentage
BSc.COCs course delivery was good		
Yes	93	94
No	0	0
Maybe	6	6
Total	99	100
you made a good career choice in doing COCS		
Yes	94	95
No	5	5
Maybe	0	
Total	99	100
Would recommend other Clinical Officers to undertake the program		
Yes	98	99
No	1	1
Maybe	0	0
Total	99	100
Fees charged for the program was justified in reference to your current remuneration status		
Yes	37	37
No	62	63
Maybe	0	0
Total	99	100

4. Discussion

There was a 100% study participation of all graduates, gender disparity was clear with more males (52.5%) than females (47.5%) graduating from the program. According to World Economic Forum, the situation of less women taking up STEM (Science, technology, engineering and mathematics) university programs has been conspicuous in Kenya with the disparity ranging from 30%-35%, though in this survey, there is evidence of positive changes, the gap on gender disparity is narrowing¹³.

The modal age was 31 to 40 years old, accounting for 73.1% of the population. This can be attributed to the fact that, graduates of the program must have completed a minimum of nine years in higher institution of learning and that length of training explains why it is almost impossible to get a graduate of the program aged less than 20 years old. A bachelor in comprehensive ophthalmology and cataract surgery takes 5 years of training⁹, pre enrollment requirement is that one has to be a clinical officer possessing a diploma that takes 3 years of training plus one year internship⁸. This totals to about nine years in training which can be more among those with higher national diploma or bachelor's degree qualification. The duration of training is a clear indication of the quality of eye professionals being produced to serve the Kenyan population.

The program has been growing in popularity as years advance, in the year 2016, there were 29 students who enrolled for the program, in the year 2018 a total of five graduated as the pioneer group and the number has been swelling ever since². On salary earned, all the graduates of BSc. ophthalmology earn descent salary that can allow them to afford all the basic need on offer. More than half (53.5%) earn a salary ranging from 51,000 to 100,000 Kenya shillings which is higher than the national minimum wage of 15,000 Kenya shillings¹⁴.

The pre entry requirement for admission into BSc. Ophthalmology was a diploma in clinical medicine and surgery and that explains the high number of diploma holders enrolling for the program². There was also a high number of new entrants into the program possessing undergraduate degrees (29.3%) and master's (17%) degree qualification which can be attributed to earlier struggles by clinical officer in search of academic progression along the clinical medicine path. Post-graduation, it was 32.3% of the graduates that progressed further in their academic journey, master's degree was the most preferred academic progression route favored by 17.2% of the response. When asked about their desired academic progression qualification, 65.7% chose masters while 26.3% preferred 3 to 6 months short training in ophthalmology. There is currently no master program in ophthalmology for clinical officers, meaning those advancing in post-graduate studies are pursuing other medical specialty away from clinical officer academic progression path.

Career growth can be termed as return of investment, Phillips's (1997) Five Level Return on Investment (ROI) Framework, labeled monetary gain as a metric to measure return of investment¹⁵. Graduates of this program, 20.2% are promoted upon graduation and 42.4% report some form of salary increment of between 11,000 Kenya shillings to more than 30,000 Kenya shillings. About 18.2% report of employer change which is the easiest and the fastest way of getting a salary increment. Graduates opinion on whether they consider the fees charged fair in relation to their current remuneration, 63% termed the fees charged in the training to be unfair. This contradicts Philip's return of investment framework on proportionality of investment to the returns inform of monetary profit¹⁵. On the preferred ophthalmology sub specialty, 27.3% chose to fortify their skills on phacoemulsification cataract surgery technique. Cataract surgery is the main mandate of the program and this is evident on the title of the training program that blatantly mentions "cataract surgery". Community and public eye health training was preferred among 26.3% of the respondents; this will enhance the key mandate of clinical officers who are the custodians of primary health⁸.

Majority of the graduates understands the role of clinical officers in universal health coverage with special focus in primary health⁸, 95% are willing to work at primary health care level providing eye care services. Nairobi County (16.2%) is the home of most of the BSc.COCS graduates; Kiambu (9.1%) and Makueni County (5.1%) were second and third respectively. Statistics on distribution of specialized health work force to be stationed within urban and non-arid areas² is still upheld in this survey with most of BSc. COCS graduates residing within Nairobi and Kiambu counties which are majorly urban areas. County governments are the most preferred employment destinations for BSc.COCS graduates with 59.6% working for the governments while private hospitals (12.1%) and mission hospitals (11.1%) coming in second and third respectively.

Three quarter of the graduates only handle eye patients in their daily work which enhances provider performance by concentrating on their specialty in service delivery. Cataract and refractive error have been picked as targets yardsticks to evaluate Kenya's progress towards vision 2030². To improve the cataract surgical rate (CSR) from 800 per million per year to WHO recommended rate of 3000 per million per year and also improve Ophthalmic Clinical Officers-(Cataract Surgeons) human resources ratio for eye health which is currently at 1:125,000 to the recommended of 1:190², concerted efforts are required to build capacity by training more cataract surgeons. Refresher trainings should be offered to boost the competency of 18.2% of those BSc.COCS surgeons who are sure but not confident that they can perform cataract surgery. Resources should be made available to boost the capacity of cataract surgery from less than ten per week (64%) to the recommended WHO of 3000 per million per year. The cataract surgery technique of choice practiced by more than 90% of the graduates is the small incision cataract surgery (SICS) technique against only 4% of the surgeons that carry out phacoemulsification cataract technique. Small incision cataract surgery (SICS) technique compared to other surgical technique has a shorter learning time, less complications, use simple technology and equipment; it takes shorter time to conduct hence good in high patient volume centers, this can be the reason why BSc.COCS graduates favor its use over other techniques¹⁶. Difference in resources allocation and economic strength of different countries has been blamed for variation of cataract surgery coverage (CSC) in countries (Guinea Bissau 3.8% compared to Hungary 70.3%) and regions within countries (Nakuru 80% and Kwale 75%)^{2,11}. From this survey, section on barriers to service delivery identified poor resource allocation (51%) as the main hurdle encountered by BSc.COCS graduates in line of duty.

The impact created by BSc.COCS graduate in the eye care spheres in Kenya is evident by 42% of them taking up managerial position at various levels in the sector. Majority (23%) head eye departments at their work places, 19% are hospital managers while 6% are policy makers in the eye care sector with managerial positions at the county levels.

About 64% of the graduates manage a huge number of employees ranging from less than 10 to over 30 employees at their work stations. Majority, 74.7% report to have been involved in capacity building through training other health care workers on eye related topic while 13% of the graduates are involved in conducting research which informs policy making. The impact of this program is explained better by Philip theory's third level framework on job applications that Measures change in behavior on the job application of the training materials and specific impact the behavior change causes in the industry¹⁵.

A considerable number of graduates (94%) were satisfied with BSc.COCS course content delivery, 95% are in agreement with the title of the program (Bachelor of Science in comprehensive ophthalmology and cataract surgery). Almost all (99%) were certain they made a good career choice with the same proportion of respondents willing to recommend other clinical officers to undertake the program. As stated in in the Eye health policy framework of 2020-2025, review of the program is due to evaluate the strength and weaknesses that need to be addressed for better quality and content delivery². The graduates' feedback on the program is in tandem with Philip theory's first level framework on reaction of planned action that measures participant's reaction to the program and outlines specific plans for implementation. In the review of curriculum, all stakeholders including former and current ophthalmology students should be involved for betterment of the program

Abbreviations

- BSc. COCS: Bachelor of Science Comprehensive ophthalmology and cataract Surgery
- CHEW: Community Health Extension Workers
- CHO: Community Health Officers
- CHV: Community Health Volunteers
- COC: Clinical Officers Council
- CSC: Cataract surgery coverage
- CSR: Cataract surgical rate
- eCCF: Eye Care Competency Framework
- HND: Higher National Diploma
- HRH: Human resources for health
- JKUAT: Jomo Kenyatta University of agriculture and Technology
- KHP : Kenya Health Policy
- NCDs: Non-Communicable diseases
- OCO: Ophthalmic clinical officer
- PHC: Primary health care
- SDG: Sustainable Development goal
- SPSS: Software package used for the analysis of statistical
- STEM: Science, technology, engineering and mathematics
- UHC: Universal Health Coverage
- USA: United States of America
- WHO: World Health Organization

5. Conclusion

- More than 20% of BSc.COCS graduates are promoted and 42.4% report of salary increment after graduation. Phacoemulsification technique (27.3%), community and public eye health (26.3%) are the most desired trainings among graduates and master's degree is the most preferred progression path.
- With availability of resources, 95% of graduates are willing to work at primary health level and most graduates are stationed in urban centers. County government employs 59.6% of the graduates and 75% are involved in managing eye patients only.
- The training programme has successfully injected 96 cataract surgeons into the eye care space, representing 96% of the total graduates. More than half of the respondents identified poor resource allocation to the eye department as the most important barrier to service delivery to eye patients; this was represented by 51% of the respondents.
- There are 42.4% participants involved in some form of management at their place of work. Only 13.1% of the graduates are involved in eye related research while a whopping 86.9% do not conduct any form of research. About 74.7% reporting to have trained other health workers against

- Training content delivery was supported by 94%, 95% were in agreement that the title “BSc. Comprehensive ophthalmology and cataract surgery” was the most appropriate title. Almost all, 99% of the respondents were certain they made a good career choice by enrolling for the training.
- About 99% of the graduate would recommend other clinical officers to join the program. In reference to their current remuneration and what they paid for tuition fees, 63% of the respondents were not convinced the fee was fairly priced.

Recommendation

- Institutions of higher learning should open up academic avenues for BSc.COCS graduates by starting masters programs and short trainings. Refresher trainings in cataract surgery to build confidence of those competent but not confident enough to perform the surgeries and also equipping learners with skills in phacoemulsification, community eye health and public eye health.
- County governments to sponsor more clinical officers into the BSc.COCS program to build human resource for the rural population where they can be involved in primary eye health and also provide necessary resources to increase cataract surgery coverage in realization of vision 2030 focus in sight targets of cataract reduction and correcting refractive errors.
- Local and international organizations and partners in eye health sector should organize workshop for BSc.COCS graduates to equip them with research skills and increase eye related capacity building among other health care workers by allowing BSc.COCS graduates to offer trainings.
- Training institution to review BSc.COCS curriculum to add more market driven units like management and policy formulation that will add value to the program so as to enable the graduates to see value for the tuition fee they pay while in training. The review should be consultative with inclusion of former students.

Compliance with ethical standards

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Foreword

In Kenya, the estimated cataract surgical rate (CSR) in 2019 was 800 per million per year, this is low compared to World Health Organization recommended Cataract surgical rate (CSR) target of 3000 per million per by year 2020. This is also backed by the considerable variation in eCSC by country, with estimates ranging from 3.8 % (95% CI 2.1-5.5) in Guinea Bissau, 2010, to 70.3% (95% CI 65.8-74.9) in Hungary, 2015. This reflects a gradient of available resources and subsequent cataract output when you compare high-income settings with highest eCSC and low-income countries with the lowest eCSC. (RAAB, 2021)

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

- [1] World Health Assembly. Integrated people-centred eye care, including preventable vision impairment and blindness. World Heal Assem [Internet]. 2020 [cited 2023 Nov 11];WHA 73.(4):1–3. Available from: <https://apps.who.int/iris/handle/10665/328717>,
- [2] Health M of. National Eye Health Strategic Plan. 2020;

- [3] United Nations Development Programme. Sustainable Development Goals | United Nations Development Programme [Internet]. United Nations Development Programme. 2021 [cited 2023 Nov 10]. Available from: https://www.undp.org/sustainable-development-goals/good-health?gclid=CjwKCAiAxreqBhAxEiwAfGfndAYuTRYC1yMOeDQUj99EEBBD0CdFXE4xipC2eq715p64tyn12mNWiBoCINYQAvD_BwE
- [4] Plianbangchang S. Universal health coverage (UHC). *J Heal Res* [Internet]. 2018 [cited 2023 Nov 10];32(4):322–4. Available from: [https://www.who.int/news-room/fact-sheets/detail/universal-health-coverage-\(uhc\)](https://www.who.int/news-room/fact-sheets/detail/universal-health-coverage-(uhc))
- [5] Keel S, Cieza A. Universal eye health coverage: from global policy to country action. *Int Health* [Internet]. 2022 Apr 6 [cited 2023 Nov 11];14(Supplement_1):i3–5. Available from: <https://dx.doi.org/10.1093/inthealth/ihab063>
- [6] Sandro Galea. Public Health and the Rise of Non-Communicable Diseases » SPH | Boston University [Internet]. 2016 [cited 2023 Nov 10]. Available from: <https://www.bu.edu/sph/news/articles/2016/public-health-and-the-rise-of-non-communicable-diseases/>
- [7] McCormick I, Mactaggart I, Resnikoff S, Muirhead D, Murthy G V., Silva JC, et al. Eye health indicators for universal health coverage: results of a global expert prioritisation process. *Br J Ophthalmol* [Internet]. 2022 Jul 1 [cited 2023 Nov 10];106(7):893–901. Available from: <https://bjo.bmj.com/content/106/7/893>
- [8] Kenya Ministry of Health. Role of Clinical Officers For Universal Health Coverage. 2023;
- [9] Kenya Ministry of Health. Task sharing policy guidelines 2017-2030. 2017;129.
- [10] IAPB. Eye Health and Universal Health Coverage - The International Agency for the Prevention of Blindness [Internet]. [cited 2023 Nov 10]. Available from: <https://www.iapb.org/advocate/eye-health-and-universal-health-coverage/>
- [11] Ramke J, Gilbert CE, Lee AC, Ackland P, Limburg H, Foster A. Effective cataract surgical coverage: An indicator for measuring quality-of-care in the context of Universal Health Coverage. *PLoS One* [Internet]. 2017 Mar 1 [cited 2023 Nov 10];12(3):e0172342. Available from: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0172342>
- [12] World Health Organization. Report of the 2030 targets on effective coverage of eye care [Internet]. 2022. Available from: <https://www.who.int/publications/i/item/9789240058002>
- [13] World Economic Forum. Why fewer Kenyan women are choosing degrees in STEM [Internet]. 2018 [cited 2023 Nov 19]. Available from: <https://www.weforum.org/agenda/2018/09/why-fewer-kenyan-women-are-choosing-degrees-in-stem/>
- [14] Kenya National Bureau of statistics. Kenya National Bureau of Statistics. Economic Survey 2017. 2017.
- [15] Phillips JJ. Level Four and Beyond: An ROI Model. In: *Evaluating Corporate Training: Models and Issues* [Internet]. Springer, Dordrecht; 1998 [cited 2023 Nov 20]. p. 113–40. Available from: https://link.springer.com/chapter/10.1007/978-94-011-4850-4_6
- [16] Patel AS, Feldman B, Tripathy K, DelMonte W D, Hossain K, Houser K, et al. Manual Small Incision Cataract Surgery [Internet]. 2023 [cited 2023 Nov 21]. Available from: https://eyewiki.aaopt.org/Manual_Small_Incision_Cataract_Surgery