Commonwealth Eye Health Consortium

Final Evaluation

March 2019

Funded by
The Queen Elizabeth Diamond Jubilee Trust

Undertaken by
Lucy A Lee, Independent Consultant

Contents

A. List of acronyms used in this report

BCPB	British Council for the Prevention of Blindness
CEHC	Commonwealth Eye Health Consortium
COECSA	College of Ophthalmology of East, Central and Southern Africa
CPD	Continuous Professional Development
DR-NET	Diabetic Retinopathy Team Training Network
DRS	Diabetic Retinopathy Services
EPR	Electronic Patient Records
HMIS	Health Management Information System
ICEH	International Centre for Eye Health
ISH	International Student House
KAP	Knowledge, Attitude, Practice
KCMC	Kilimanjaro Christian Medical Centre
LINKS	Vision2020 LINKS Programme
LMIC	Low and Middle Income Countries
LSHTM	London School of Hygiene & Tropical Medicine
LUTH	Lagos University Teaching Hospital
MK	Microbial Keratitis
MoH	Ministry of Health
MOOC	Massive Open Online Courses
MPH	Masters in Public Health
mRAAB	mobile Rapid Assessment of Avoidable Blindness
MSc	Masters of Science
MUST	Mbarara University of Science and Technology
NCD's	Non-Communicable Diseases
NGO	Non-Governmental Organisation
OCT	Optical coherence tomography
OECD	Organization for Economic Cooperation and Development
OEEH	Open Education for Eye Health
OER	Open Educational Resources
PAEP	Princess Alexandra Eye Pavilion
PAHO	Pan American Health Organization
Peek	Portable Eye Examination Kit
PHEC	Public Health in Eye Care
PNG	Papua New Guinea
QEDJT	Queen Elizabeth Diamond Jubilee Trust
RANZCO	Royal Australian and New Zealand College of Ophthalmologists
RB-NET	Retinoblastoma Network
RCOphth	Royal College of Ophthalmologists
RCT	Randomised Control Trial
ROP-NET	Retinopathy of Prematurity Network
SSA	Sub-Saharan Africa
The Consortium	The Commonwealth Eye Health Consortium
The Trust	The Queen Elizabeth Diamond Jubilee Trust
ToC	Theory of Change
UCT	University of Cape Town
UNESCO	United Nations Educational, Scientific and Cultural Organization
VR	Vitreo-Retinal

B. Purpose and methodology

Purpose

This is the final evaluation report of the Queen Elizabeth Diamond Jubilee Trust-funded Commonwealth Eye Health Consortium (CEHC) programme. The purpose of the evaluation is to appraise the sustainability and legacy of the CEHC programme against targets set at its inception. This evaluation takes into account the findings of the mid-term evaluation, and incorporates the additional funding awarded to the Consortium in 2016.

Methodology

As laid out in the Commonwealth Eye Health Consortium Evaluation Inception Report, this report evaluates progress against the Trust's evaluation framework and targets devised by the CEHC programme at programme inception and revised at mid-term to incorporate additional funded programme elements. It appraises the progress and achievements of the entire Commonwealth Eye Health Consortium programme between the period of its inception in February 2014 and the end of data collection for this evaluation in March 2019. Progress and achievements of the CEHC programme beyond this date are not included in this report.

The data collection methods included a desk-based review of all available programme documents (see annexe III for full list) and semi-structured interviews with all Commonwealth Eye Health Consortium programme theme managers. In addition, many other collaborators, beneficiaries and committee members were interviewed in person or by Skype. These interviews included a focused sample of individuals attending the 2018 Congress of the College of Ophthalmology of Eastern, Central and Southern Africa in Addis Ababa, Ethiopia, and stakeholders from various programme streams within two Commonwealth countries: Uganda and Botswana. Wherever possible, interviews were audio-recorded and testimonials transcribed and used to illustrate findings of the report. All named individuals cited in this report provided written consent (annexe V) for their views to be included. Semi-structured interviews followed a discussion guide using the Trust's evaluation framework and the Theory of Change to guide question areas.

The report is structured into the following sections:

- An executive summary providing an overview of impact of each of the CEHC's themes, linkages and interactions between these themes, and an assessment of the combined impact and legacy of the of the Commonwealth Eye Health Consortium programme.

- For each funded theme:

    - *Analysis* of the theme's achievements and impact
    - *Legacy* of the theme's achievements
    - Recommendations on a *Pathway to Sustainability* for this theme

- A summary and appraisal of impact against the Commonwealth Eye Health Consortium programme logframe

C. Executive Summary

Background and purpose

Worldwide there are 285 million visually impaired people, of whom 39 million are blind. Most of this blindness is either curable or preventable, however, the large majority live in low-income settings, where access to services is limited. Being blind has profound effects on quality of life, can shorten life expectancy and results in increased poverty. It is a burden for both the affected individual and those who support them.

For much of the world, including many countries represented in the Commonwealth, good quality eye care is a very scarce resource. The situation is compounded further in many settings by an inverse relationship between the location of services and those who need them most. Doctors and other health workers, with eye care training and the equipment needed to diagnose and treat them, tend to be concentrated in major urban centres. Eye health systems are often relatively underdeveloped, with weak communication and referral structures. The recording and management of clinical information is frequently haphazard. Knowledge of the eye health needs of a given population and how to effectively meet these is often limited, leading to a lack of prioritisation and strategic leadership. In many low and middle-income countries (LMIC) there are limited opportunities for ophthalmologists to develop sub-specialty clinical skills, which are needed to deliver high quality eye care. In addition, it is difficult for personnel, particularly those working in isolated settings, to keep up to date with the ever-increasing body of evidence that underpins modern eye care.

In 2014 to address these challenges The Queen Elizabeth Diamond Jubilee Trust supported the establishment of The Commonwealth Eye Health Consortium (CEHC). The CEHC has sought to provide a coherent, integrated response that strengthens eye health systems in LMIC in three key areas: **People – Knowledge – Tools.**

The CEHC is a group of regional eye-health organisations and training / academic institutions from several Commonwealth countries, which brings together a range of complementary skills and capacity to deliver this programme.

The programme consists of several interrelated components, which have sought to strengthen eye health systems and improve quality of eye care for many people throughout the Commonwealth. These include training in public health for eye care, open online educational resources, sub-specialty clinical training, the development and training of networks (diabetic retinopathy, retinopathy of prematurity and retinoblastoma), clinical research fellowships and the development of high quality-low-cost tools for comprehensive eye care. Additional funding from the Trust was provided from late 2016 onwards to expand the CEHC programme both in terms of scope and size. A summary of the initial and additional (supplementary) funded components are outlined in panel 1.

CEHC funded components

Public Health Training Training in public health for eye care has been provided through Masters programmes at the International Centre for Eye Health (ICEH) at the London School of Hygiene & Tropical Medicine (LSHTM) in London and the University of Cape Town, South Africa.

Open Education Several freely-available online courses (MOOCs) have been developed. They are being used both for individual learning and in training programmes.

Clinical Fellowships The CEHC has worked through a Commonwealth-wide network of training institutions to deliver a programme of sub-specialty clinical training. There is a need for a variety of training opportunities to address different needs, which reflect different roles, programmes and stages of professional development. Most of these training opportunities have involved South-South collaborations. The CEHC has supported a number of multi-disciplinary teams to be trained.

Mentorship In 2016, supplementary funding was received to establish a programme of clinical mentorship for around 20 people. Senior consultant ophthalmologists from India and the UK supported recently trained sub-specialists, mostly from sub-Saharan African countries, following their one-year fellowship training.

Training the Trainers The Training of Trainers programme has been supported through supplementary funding. The model cascades skills development through six Commonwealth countries, to improve training of ophthalmologists, through the development of training skills among their teachers.

Development of Regional Clinical Fellowship Training The two main ophthalmology colleges (COECSA and WACS) in sub-Saharan Africa have been supported through supplementary funding to initiate the process of developing regional training for clinical fellowships.

Diabetic Retinopathy Network (DR-NET) The growing burden of diabetic retinopathy in Africa requires an integrated multidisciplinary team response. Since 2014, the CEHC established a network of 15 hospital-based links between multiple African and UK eye units to build teams. This has led to national frameworks for developing guidelines and systems for screening and management of diabetic retinopathy. The initial funding supported nine links. Supplementary funding has been supporting an additional 6 links since 2016.

Caribbean Diabetic Retinopathy Programme In March 2016 the Trust requested that their portfolio of work on Diabetic Retinopathy in several Caribbean nations (Belize, Jamaica, Dominica and St Lucia) be added to the work of the CEHC. This programme had a slightly different structure than the DR-NET, particularly as it included funding for equipment and salaries. Many of the tools previously developed for the DR-NET were used in this programme and the countries were linked to UK NHS units in a similar way to the DR-NET group.

Retinopathy of Prematurity Network In 2016 the CEHC formed a new network of partners from seven Commonwealth countries supported by experts from the UK and India through supplementary funding. The network is supporting, through training, the development of contextually appropriate systems for the improved care of neonates, awareness-raising, and capacities for the detection and treatment of ROP.

Retinoblastoma Network Retinoblastoma is a childhood eye cancer. Supplementary funding in 2016 allowed the CEHC to establish a network to strengthen the capacity to care for children with this problem; through training, shared learning about systems and mentorship.

Research Fellowships Several clinical research fellows (PhD and postdoctoral level) have been supported. The fellowships provide advanced research methods training, an opportunity to develop, conduct and analyse a study, and to communicate the findings. Research is focused on issues of ophthalmic public health importance in LMIC.

Peek Peek started as a programme to develop affordable technology for eye health programmes. It is developing tools and systems to connect people to eye health services. These are beginning to scale up to regional and national level programmes. Since 2016, the supplementary funding has supported scale up of these activities, enlargement of the core management and development team and catalysing the role out of a national school vision screening programme in Botswana.

Panel 1: *CEHC funded components*

Progress and Impact of the Programme: mid-term evaluation findings

By the mid-term point in its progress, the Commonwealth Eye Health Consortium had achieved numerous successes. Targets had been exceeded across its portfolio of activity. Many of the themes were ahead of schedule or had delivered more than agreed within original budgets. Successes across several themes emerged through evaluation:

Number of fellows trained: By the mid-term, the Commonwealth Eye Health Consortium had trained a very large number of fellows in clinical sub-specialties, public health for eye care and research skills, and broadly, fellows reported a high level of satisfaction with training received.

Engagement with decision makers: Across the network, examples of positive engagement with decision makers – crucially with Ministries of Health – were to be found, and held promise for formal uptake of Commonwealth Eye Health Consortium-funded activities into routine practice, notably within DR-NET and the Peek programme.

Development of a Network: A strong network actively supporting the development and proliferation of relationships for building research and training partnerships regionally and internationally was evidenced at the mid-term. This network had effectively capitalised on the reputation and established relationships of the lead/coordinating organization, International Centre for Eye Health (ICEH) at London School of Hygiene & Tropical Medicine (LSHTM), and the Trust's ability to influence and advocate within Commonwealth countries.

Integration: While the Consortium programme has been delivered as a series of sub-projects (or 'themes'), each managed by a dedicated team, linked programming and integration between specific themes was observed at the mid-term. For example, the research focus of a number of PhD fellows has actively contributed to the development of an evidence base to guide the Peek and DR-NET programmes. In addition, Peek technology has enabled the development of DR services and returned clinical fellows have the skills necessary to support these services, thereby advancing the development of the DR-NET.

Innovation of approach: Many examples exist within the portfolio of innovation of approach which have amplified successes. These include supporting team training for clinical sub-specialties, linking regional DR-NET teams to both maximize access to training and to jointly plan with Ministry partners for the development of national frameworks for the delivery of Diabetic Retinopathy services.

Multiplying investment: Already at the mid-term, match funding had been attracted to support and increase the programme's impact. These investments included support to expand Peek activities, to finance equipment required to deliver diabetic retinopathy services and to develop research capacity within East African Commonwealth countries.

Programme Legacy

As the five-year CEHC programme reaches its end, evaluation of progress and impact can be summarised through a number of themes, each demonstrating the achievements, integration and alignment of the programmes within the CEHC.

A Legacy of Networks of Knowledge Exchange Over the last five years, networks have developed and been strengthened across the CEHC. Relationships that were planned and established at the programme outset have evolved into sustainable knowledge sharing and capacity building partnerships and new relationships have been developed. Examples of this exist at the institutional level and also at the individual level. The efforts of members of the CEHC team have been instrumental in making this happen. Connections between individuals have been facilitated by the ICEH's alumni network, which

has supported both public health fellows supported by the CEHC to connect with each other, but also to link with other alumni.

Stakeholders of the three formal networks developed by the CEHC – DR-NET, Rb-NET and ROP-NET – recognise that they are part of a supportive structure and collaborate effectively towards common aims. Benefits exist not just for the recipients of training through these partnerships but also for the individuals and institutions that design and deliver this training. Training institutions in south Asia have strengthened their international training programmes through supporting a large number of trainees. Individuals coordinating training with DR-NET LINKS partners cite the experience of working with different health systems as providing perspective to improve service delivery within their own institutions.

A Legacy of a Productive Partnership The leadership of the CEHC enjoy an open, productive and collaborative relationship with the Trust. This positive relationship has ensured close communication between the Trust and CEHC. They have worked together in two important ways to ensure maximum impact of the Trust's investment.

First, the Trust has been responsive to proposed programme adaptations. For example, the Clinical Fellowship programme has expanded to include several additional models of training not originally conceived in the programme proposal. The decision to include these was made with the Trust, and based on close monitoring and feedback on fellows' progress. With the Trust's support, Peek has been able to develop in a responsive and flexible manner, building on learning through hardware and software development and deployment to adapt Peek's systems and now, successfully partner with a major NGO to roll these out across several countries. The DR-NET has been able to adapt original programme plans to front-load the programme with important network meetings designed to set common goals and strengthen collaboration within the DR-NET.

Second, the Trust has supported several major CEHC initiatives through providing platforms of influence and advocacy to programmes. Examples of these range from providing Peek with the opportunity to address heads of state at the 2018 London CHOGM meeting, to elevating the priority of establishing ROP services with institutional and political stakeholders in India's Maharashtra state.

A Legacy of Tools, Resources and Approaches Investment in the CEHC has allowed the development of important new tools to aid both training and planning for programmes to address avoidable blindness. Peek now offers a suite of apps to aid in developing school and community screening programmes and assess avoidable blindness at a population level. In addition, it has brought medical hardware to market in the form of Peek Retina, a smartphone-based ophthalmoscope and continues to develop an RoP camera. The OEEH programme has developed and launched four courses and a further two are in production. All these tools have been made available free or at low cost, and their reach is great: OEEH courses have been downloaded in almost 190 countries and Peek apps downloaded in over 170 countries.

Resources developed by the DR-NET and by individual research fellows are aiding the development of national action plans for Diabetic Retinopathy, facilitating the training of eye health workers in a range of specialisms, and improving awareness of communities to the importance of regular eye screening.
The Network approach developed for the DR-NET has informed the successful development of the Caribbean DR-NET, the ROP-NET and the Rb-NET, all of which are operational and achieving set targets. This learning is also feeding into the development of a new Network focused on paediatric ophthalmology.

A Legacy of Investment in Individuals The legacy of the Trust's investment to individuals is impressive both in terms of the numbers supported and also in the achievements and career development of many of these individuals. The CEHC programme has exceeded training targets for Clinical Fellows and Public Health fellows. Several Research Fellows have already secured funding to further their research careers. Examples exist in several Commonwealth countries of Public Health and Clinical Fellows having set up new services, secured funding for research, improved or expanded training programmes or achieved promotion to positions of planning service development for eye care.

Pathway to sustainability

The Commonwealth Eye Health Consortium has achieved impact through its targeted investment to people, knowledge and tools. Positive change is evidenced in the work of individuals and networks, and through strengthened institutional partnerships. What has been achieved is impressive given the ambitions of the programme and the relatively short timeframe since initiation.

This first phase of the CEHC allowed approaches to developing the capacity of individuals, institutions and networks to be tested and refined. As the CEHC moves forward, there are specific areas in which investment may be best focused to enhance sustainability.

Sub-specialty skill retention, utilisation and transfer While a very large number of clinical fellowships have been undertaken through the programme, there is still a significant variance in fellows' ability to fully utilise skills on returning to practice. Without adequate support to deliver sub-specialty training in practice, fellows risk losing these skills. Several approaches introduced through the Clinical Fellowships workstream have enhanced fellows' ability to practice sub-specialties. For example, mentorships are demonstrating that prolonged support post-training is an important step in reinforcing and retaining training in practice. In addition, establishing a framework of regional fellowships holds promise for skills transfer. However, this may require pump-priming to become well-established. It is only by having reasonable numbers of trainees going through the system, strengthening the skills of trainers and evaluating its quality, that the system will be refined and – if training is of high quality – become sustainable.

Regional focus of the DR-NET The DR-NET has identified and worked with members to address common challenges around Ministry of Health commitment, patient demand and equipment. Many of these challenges may be effectively addressed at a regional level. Most members agree that face to face meetings support progress, but with a very large network, these are logistically challenging, costly and infrequent. Concentrating effort regionally may reduce these barriers to bringing members together. Focusing the DR-NET on regional activity may also support ensuring local ownership and co-design, finding solutions to technical challenges such as equipment maintenance, delivering regional training and sharing expertise and lessons.

Achieving impact with OER's through integration into teaching and training institutions The University of Cape Town has successfully integrated OEEH-produced OER's into its MPH curriculum with positive results for faculty and scholars. In order to extend this impact to other institutions, the programme must find a sustainable way to support educators to best adapt and apply OEEH courses in their settings to bolster existing training. Achieving this may include offering assistance to institutions to utilize OER's through a hub of technical expertise. This would, however, require making the business case to institutions for investment in this support through a revenue-raising model. Exploring the viability of these models will be a crucial next step towards the OEEH programme's sustainability.

The funding leveraged through BCPB provides an excellent opportunity for CEHC research fellows to become directly involved in developing research capacity in the east African region.

Sustained investment to supporting capacity development for research The investment made into building capacity for research should be sustained to provide those with doctoral degrees to support others, and those who have embarked on research training through public health fellowships to progress further. CEHC research fellows recognize the need for further mentorship and support to develop their capabilities as mentors and supervisors themselves. In the short- to medium-term, novel PhD supervision models focused on local supervision with distance (ICEH) co-supervision may be considered, along with strategic funding to further post-docs. To have at least three institutions in the east African region equipped with local expertise in PhD supervision would be a remarkable step towards sustainability in the region in a relatively short timeframe and stands as a model that may be replicated in other regions.

Integrating Peek and OEEH into CEHC-supported Networks and institutions Despite the early intentions of the CEHC programme, the tools developed by Peek and OEEH have not fully been exploited through use in other CEHC work streams. Considering the strong Networks and partnerships established through the CEHC, maximising the impact these tools can have within the CEHC should be explored. For example, there may be opportunities to more effectively embed these tools into the Networks that have been established to enhance training and detection.

Commonwealth Eye Health Consortium: Conclusions

The Commonwealth Eye Health Consortium was designed to drive forward progress on addressing avoidable blindness within low and middle-income Commonwealth countries through an integrated approach focused on ***people***, ***knowledge*** and ***tools***.

Evidence from across the Consortium shows that this approach is having impact. Individuals have been equipped with research, planning and clinical skills to better design and deliver services in countries and regions in which they are desperately needed and in many cases, where there was previously no provision of specialised services nationally.

Tools have bolstered this through the provision of additional training opportunities – supporting both individuals and institutions – and powerful technology to aid planning, screening and referral. Much of this work has been further aided by the development and strengthening of networks, partnerships and collaborations.

Though strong foundations have been developed through the people, knowledge and tools approach and supported through the commonwealth-wide communities of practice that have facilitated it, the CEHC faces challenges to sustaining impact. It will be vital to provide further support to individuals and networks as they develop to ensure they can fully utilise the skills they have attained. In order to strengthen the Consortium structure, opportunities to maximise the application of the tools invested in through this first phase of activity must be fostered.

D. Evaluation of Progress and Achievements by Consortium Theme

Public Health Fellowships

Introduction

Training in public health for eye care has been provided through Masters programmes at the International Centre for Eye Health (ICEH) at London School of Hygiene & Tropical Medicine (LSHTM) in London and the University of Cape Town, South Africa.

Investing in the training of MSc and MPH students will expand the active network of leaders in eye care in Commonwealth countries, which will have a long lasting impact on the prevention of blindness activities in these countries. It is anticipated that graduates from these courses will strengthen district and national level programmes in the delivery of universal eye health coverage in priority Commonwealth countries. The close association between alumni of the LSHTM MSc in Public Health for Eye Care and the University of Cape Town MPH in Community Eye Health fosters a strong network for practical development of prevention and control of eye disease programmes in many regions.

By the mid- term, the Public Health for Eye Care Fellowships had attracted strong candidates for study, providing good representation of Commonwealth countries and regions. Completed fellows reported a high level of satisfaction with training and had made ambitious and relevant plans for improving their public health practice on returning to their posts.

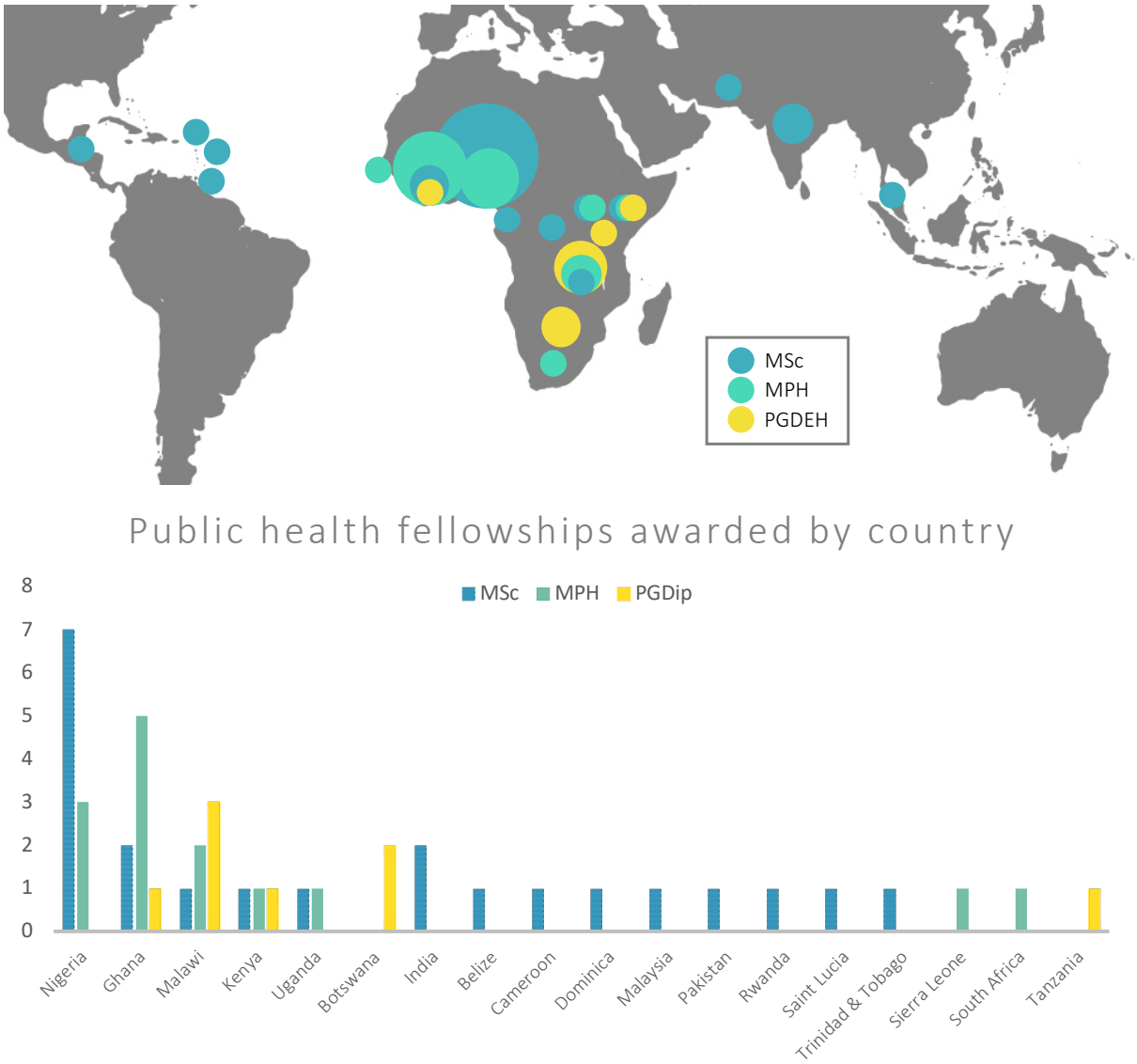
Supplementary funding awarded in 2016 has provided the programme with an additional 6 MSc PHEC scholarships, 6 MPH scholarships and 10 post graduate-diplomas in community eye health.

Findings and analysis

Impact, outcomes and output

Outcome 1	Output 1	Output 2
Strengthened eye health systems in Commonwealth LMICs in three key areas of people, knowledge and tools	Public Health for Eye Care Fellowships (LSHTM)	MPH in Community Eye Health (UCT) / Post-graduate Diploma in Community Eye Health
Outcome Indicator 1 Number of Fellows returning to their home institutions and using their new skills in eye care or planning	Output Indicator 1.1 Eleven ophthalmologists / programme managers from Commonwealth LMICs complete the one year MSc PHEC course; 6 additional fellowships from 2017	Output Indicator 2.1 Nine ophthalmologists / programme managers, from LMICs complete the two year MSc PHEC course; 6 additional fellowships from 2017; 10 new diploma fellowships from 2017.
Target 17 MSc scholars 15 MPH scholars 10 diploma scholars	Target 17 localities with a lead person, trained to initiate and implement eye care programmes	Target (MPH only) 15 localities with a lead person, trained to initiate and implement eye care programmes
On track for passes for: *21 MSc scholars* *12 MPH scholars* *10 diploma students*	*5 additional MSc's were funded through cofinancing from International Students House, London, through fee waiving for student accommodation.* *On track therefore for 22 localities with a lead person. Though 1 fellow did not pass, they are actively using skills from training in their locality.*	*On track for 12 localities with lead person, though 3 of these are experiencing delays in submitting year 2 dissertations. Two scholars have dropped out of the course.*

Selection and ability of candidates



Panel 1: *Public health fellowships awarded by country*

MSc ICEH: Within the ICEH, selection of candidates has been made on two criteria. The first is geographic spread *(see Panel 1)*, and the second, a candidate's suitability to have impact in one of three areas: planning and management, research or policy making. Efforts have been made to recruit candidates from the Pacific, but in a region with so few eye health professionals, it has not been possible to find a candidate with the necessary qualifications who is able to leave their post.

What the team has been able to do is increase the number of Caribbean fellows undertaking the MSc. Prior to the CEHC programme, there hadn't been candidates from this region. Current and returned Caribbean candidates are contributing actively to the Caribbean DR-NET.

Pass rate within the MSc has been high, considering the demands of the programme. One candidate was unable to pass the MSc, but remains closely involved with other Consortium activities.

Co-financing from the International Student's House (ISH) in London (the accommodation for scholarship students) has been used to fund an additional five scholarships, meaning that a total of 22 MSc scholars have been funded through the CEHC public health fellowships.

MPH and PGDCEH: There were concerns in the first round of applications to UCT's MPH of the low geographic spread, with only Malawi and Ghana represented. This has been resolved through active efforts on the part of both universities to increase advertising opportunities, and scholarships for the PGDCEH and MPH have since been offered to scholars from seven African countries (Panel 1). However, there is a lack in the range of occupational background applying for, and being awarded scholarships. Almost all scholars are optometrists, and for some, their training has not prepared them for the academic rigours of undertaking the MPH.

There have been challenges with completion for a large percentage of the MPH scholars, with two students dropping outs and a further three delayed in the submission of their year two dissertations. Colin Cook, director of the UCT MPH programme, is concerned that the structure of the two-year MPH – which provides a first year of taught courses in Cape Town, after which scholars return home and have a year to complete a dissertation by distance – has contributed to low completion rates. Responsibilities of work and distance supervision appear to contribute, but Colin also feels it's also possible that a lack of financial investment by scholars means they are less motivated to achieve the qualification.

It is important to remember that the MPH at UCT is still a very young course. The investment by the Trust has allowed the teaching staff to develop and refine the course, and learn more about the motivation, ability and career prospects of scholars. The PGDCEH has been offered since 2017 and pass rate has been much higher: 9 of the 10 CEHC funded scholars have completed the course.

> *"The postgraduate diploma (PGDCEH) is intended to train people as programme managers; the emphasis is management of eye care programmes. The experience with our PGDCEH is far more positive [than the MPH]. The academic standard is far lower so there aren't issues there, and they are finished in a year."*
>
> Colin Cook | Director, UCT MPH programme | South Africa

Involvement with the CEHC programme has also benefited the UCT MPH and PGDCEH courses through opportunities to integrate CEHC-funded OER courses into course modules. This development is described in detail elsewhere (*Case study: Using OER's in institutional training programmes,* p.24), but it has undoubtedly increased efficiency for the UCT team and provided valuable feedback to the OER team, helping them better understand how institutions may incorporate OERs into curricula.

Creating opportunities for alumni

All graduating MSc PHEC students are supported to return to the ICEH at the time of their graduation, to attend an alumni workshop. The MSc PHEC is the only MSc at LSHTM to offer this opportunity, and graduates spend time with alumni, teaching staff and donors reflecting on the impact of the course on their future ambitions, and discussing professional including research and funding prospects.

> *Being part of the Alumni meeting was very important. During the workshop we were able to interact with all faculty in a more informal way and we got good guidance on how to move ahead in our career. But more than that we were advised on developing strategies that will make a difference in the societies you live in. This was a huge motivator.*
>
> Sucheta Kulkarni | CEHC Public Health Fellowship and ROPNET member | India

Being based at the ICEH, MSc PHEC students and alumni have found opportunities to become more involved in other aspects of the CEHC's activities, for example by facilitating OER modules. Several fellows of both the MSc and the MPH have cited a desire to pursue further research training through PhD study. That the public fellowships have motivated such a large number of scholars from low and middle-income commonwealth countries is testament to its objective of equipping individuals with the training to further a career in public health research in these countries.

Impact of studies and future plans

Completed scholars have not been back in post for long, making it challenging to determine the impact of their studies, but there are a number of early indications of significant changes, advancements and improvements to practice *(see panel 2).* Particular areas of growth and change include: increased teaching responsibilities and confidence in teaching ability; lobbying efforts resulting in the provision of new services, assessment, improvement and scale up of existing services; positions on national decision-making bodies; and an increased commitment to research including several fellows expressing and intention to pursue PhDs.

Masters in Public Health for Eye Care | LSHTM			
Irfan Khattak	Pakistan	2014-15	• Lobbied hospital to open sub-specialty clinics of occuloplasty, paediatric ophthalmology and diabetic retinopathy services. • Motivated to improve DR services, has undertaken additional fellowship in retina. • Will shift focus to DR, developing awareness campaigns and advocating at government level for a comprehensive diabetic retinopathy screening and management programme.
Emmanuel Kobia-Acquah	Ghana	2014-15	• MSc research provided guidance on changing government practice to improve optometry services. Decision makers making steps to address this. • Promotion to lecturer and now sits on Ghana optometric association educational committee amongst others. • Teaching has changed: now includes community eye health in teaching. • Appointed as outreach coordinator in district: design and delivery of outreach has changed, focus on hard to reach areas.
Desirée Murray	Trinidad & Tobago	2014-15	• Regularly participates in media and public engagement initiatives. • Working with PAHO and also drafting a policy for vison and hearing services. • Improved ability to undertake research and award of research grant to use mobile technology to screen for glaucoma and DR. • Teaching style improved - emphasis on public health research, blindness prevention, uses blended learning.
Sucheta Kulkarni	India	2015-16	• Feels skills have greatly improved as a teacher: focuses on an interactive style. As a result, students are becoming more analytical. Now training others to teach with same approach. • Raised £100,000 in donations for institute over 2 years. Feels skills to approach donors came from course. • Publishing on ROP, RAAB survey results and DR. • Now has confidence in advocating with state health authorities to scale up ROP programme to other districts.
Simeoluwa Agbeleye	Nigeria	2016-17	• Has advocated for departmental evaluation of health services to improve efficiency and quality.
Egide Gisagara	Rwanda	2016-17	• Improved approach to teaching including addition of community ophthalmology module. • Developed a curriculum for mid-level eye workers. • Invited to sit on MoH technical working group for eye care. • Has been tasked with national responsibility for organising awareness raising events such as World Sight Day. • Launched DR programme in eastern province.

Effendy Bin Hashim	Malaysia	2017-18	• Now sits on Ministry of Health National Prevention of Blindness/Low Vision committee and Ministry of Health Optometry Service Technical committee. • Wishes to pursue further study for a PhD focused on developing DR screening services.
Mathew Njume Mbwogge Ngime	Cameroon	2017-18	• Has taken on responsibility for eye care outreach coordination for provincial hospital. • Assisting in the development of the National Eye Care Plan. • Undertaking ingoing research into quality improvement of service delivery. • Developing a diabetic retinopathy screening programme within the city of Yaoundé
Seslyn Maylor	St Lucia	2017-18	• Undertook a situation analysis of the diagnosis and management of diabetic patients in the public health sector in Saint Lucia which will support the work of the DR-NET Caribbean
Shaffi Yusuf Mdala	Malawi	2017-18	• Undertook a study into fidelity and acceptability of red reflex screening with primary care providers in Blantyre, Malawi. This formative research will feed directly into the red reflex trial involving members of the Rb-NET.
Stephanie Jean Jacques	Dominica	2017-18	• Contributed to the work of the DR-NET Caribbean through the development and pilot implementation of an electronic diabetes register in Dominica
MPH | UCT			
George Moyo	Malawi	2015	• Guiding all implementing partners in national programme of trachoma control in use of SAFE strategy. • Now responsible for collation of all data on trachoma for WHO validation of elimination.
Anderson Chimeziri	Nigeria	2016	• Feels more confident as a researcher. • Has aspiration to undertake PhD. • Intends to advocate for reorientation of eye care services to better serve secondary and tertiary units.
Michael Kyei	Ghana	2016	• Improved community eye screening through applying strategies from MPH resulting in improved awareness of services, subsidised care for most in need, increased attendance at district eye clinic and uptake of cataract surgery
Eric Ndaule	Malawi	2016	• Feels equipped in decision-making. • Has aspiration to undertake PhD.
Tagoh Selassie	Ghana	2016	• Improved emphasis on research in teaching role. • Assisting in set up of teaching eye health clinic and will support management of that and community services. • Currently putting together research proposals.
Hope Mackline	Uganda	2017	• Improving patient awareness through introducing health education to patients with diabetes at HIV clinic. • Focused on continuing research and capacity building health workers.
Grace Mwangi	Kenya	2017	• Focusing on research
Abraham Opare	Ghana	2017	• Has improved school screening programme using skills acquired through community eye health module. Programme is now more cost-effective and targeting those most in need.
PGDCEH | UCT			
Katlego Mbulawa	Botswana	2017	• Has intention to move towards planning and possibly Ministry role.

Panel 2: *Planned and implemented changes to practice of completed Public Health Fellows*

Alumni of the MSc PHEC at ICEH enjoy benefits of a strong and supportive alumni network. Former students hold prominent positions within health ministries and institutions in countries in which have been supported by the CEHC. The case study (panel 3) of one graduate of the MSc PHEC provides an example of the impact that the MSc has had on one fellow's career and professional influence.

'…a lot of alumni are now members of the wider consortium. There's a proven record that the network grows and continues through people that have trained in ICEH. It's not easy to show impact right now but we are confident looking at alumni that this will be a good investment.'

Cova Bascaran | Public Health Fellowships Programme Leader |ICEH

This network stands to support those who have recently graduated from the MSc, and based on the achievements and career trajectories of previous graduates, it is likely that many of the graduates will move into influential programme planning, research and policy making positions in their home countries.

'…when I returned to Rwanda I was tasked with developing a residents' programme. So I contacted [another MSc colleague from India] who helped me a lot, and other colleagues from elsewhere. It's a network – a rich network. I get resources from the American Academy of Ophthalmology through one classmate. I also have a UK connection. You don't stop the day you graduate, actually connections then move to another level.'

Egide Gisagara | ICEH Public Health MSc Fellow | Rwanda

There are several students we feel are on their way to doing good things and having good academic careers. A number of them have expressed interest in pursuing PhDs. I think many of them are intent on pursuing a research career.

Colin Cook | Director, UCT MPH programme | South Africa

Sucheta Kulkarni: Public Health Fellowship recipient 2015-16

Dr Sucheta Kulkarni is an Ophthalmologist, specialising in Diabetic Retinopathy (DR) and Retinopathy of Prematurity (ROP). She is Associate Medical Director of H V Desai Eye Hospital, Pune; a tertiary eye care centre and postgraduate institute. In addition to clinical care and teaching, she has substantial administrative responsibilities.

After 15 years of clinical care and management, Sucheta was beginning to feel stagnated in her role. Driven by the wealth of data collected by the institution but her lack of skills to use it in planning and improving care, she wanted to get formal training in research to extend her capabilities in pushing forward a public health research agenda in the institution.

Sucheta was funded through a CEHC Public Health Fellowship to study an MSc in Public Health and Eye Care at LSHTM in 2015. As so commonly reported by graduates of the MSc PHEC, Sucheta found both the content of the course and the diversity of student experience to be hugely influential:

"It improved my leadership skills and really brought out the best in me. So many skills developed; not least interpersonal and networking. It also helped me to be with a diverse group of scholars, to understand that diversity of experience."

Sucheta acknowledges the increased ability she has as a result of studying the MSc and cites the impact her studies have had on:

- Advocacy:
  "*My improved advocacy skills developed through the MSc I feel capable to engage with state health authorities to convince them to scale up this programme to other districts."*
- Fundraising:

"*The discussions about fundraising and proposal creation were very useful. I have since gone back to raise around £100,000 for my institute over the last couple of years.*"

- Research:
  "*My motivation and ability to publish has been entirely developed by the MSc and the collaborations that I have formed.*"

She has also drawn on the teaching style of the course faculty, and has changed both her own style of teaching and the approach she uses in training other teaching staff:

> *"Here in India things there is a strong framework of hierarchy, especially within the teaching field. We don't contradict and question teaching staff. But in London we were encouraged to challenge our teachers, and this helped me to develop my analytical mind and change my own approach to training and teaching. I am a much better teacher now. I encourage my students to contradict my points of view and question me. I want teaching to be more interactive."*

Sucheta has been involved in the Trust-funded RoP programme since its inception, and has seen the impact of the Trust's high level of engagement with the programme, and advocacy efforts made by the programme team, on institutional and political buy in the the programme in Maharashtra state:

> *"When the Trust came to Pune it had a great impact. Meeting with the Trust's representatives made the Director of Health Services and Director of the Hospital more committed to the programme. We also invited mothers of babies with RoP to share their experiences directly by video link to the Health Minister and State Health Authorities. The meeting had a huge impact in demonstrating how important the [Trust-funded] RoP programme is. Their presence made a huge difference."*

As mentor for Maharashtra state for the Trusts RoP programme in India, Sucheta has been instrumental in the programme's growth across the state. Now she is involved in the latest Trust-funded initiative, the Consortium's ROPNET, where her expertise stands to have a great impact on the development of ROP services in Tanzania:

> *"I was called to meet with other RoP specialists in Hyderabad last December. I was selected to mentor in Tanzania because there are currently no programmes there. We are planning to establish RoP programmes, a plan of action and a statement of objectives. I hope to share the model [we have used in Maharashtra] in Tanzania as well – it's the only way to have long term sustainability."*

Impact of investment to Sucheta Kulkarni's Public Health Fellowship

- Improved confidence in delivering teaching and transformed teaching and training methods focused on critical and analytical thinking and learning
- Publication of research on DR, ROP and assessments of avoidable blindness in high impact journals, adding to a literature base on developing DR and ROP services in low income settings, and epidemiological data on prevalence of visual impairment and blindness
- Fundraising of £100,000 over two years towards research, equipment and rehabilitative services
- The development and close engagement of a key member of the CEHC network; influential in pushing forward Trust and CEHC supported ROP programmes

Panel 3: *Case study on Sucheta Kulkarni, Public Health Fellowship recipient 2015-16 (MSc PHEC)*

Legacy

⇒ An expected total of 42 CEHC public health fellows (12 MScs, 3 MPHs and 9 PGDCEHs already awarded and a further 9 MScs and 9 MPHs expected) will have been awarded public health qualifications by the end of the CEHC programme.

⇒ There are numerous examples of CEHC Public Health fellows having impact in their institutions and countries on their return, ranging from influencing institutions to expand, improve or open new services; securing funding to implement research and service delivery; enhancing teaching and initiating public health-focused training; becoming involved in national avoidable blindness initiatives including sitting on avoidable blindness committees, rolling out national programmes and managing national activities for world sight day.

⇒ Alumni of the MSc PHEC at ICEH are linked into a strong and supportive alumni network, and are already finding ways to find support within this network. ICEH fellows are also contributing to the wider CEHC programme through facilitating OERs, and developing summer projects focused on topics of importance to enhancing the work of the DR-NET and Rb-NET.

⇒ The CEHC Public Health fellowships have seen a big increase in scholars from the Caribbean countries undertaking the MSc PHEC and returning to contribute to development of public eye health programmes within the region.

Path to sustainability

⇒ The MPH PEHDC at UCT is a very young Masters programme. Since 2014, fourteen fellows have been accepted onto the course through the CEHC programme fellowships, and although there have been two drop outs and difficulties in maintaining momentum for several students during implementation of their year two project, the injection of support has allowed the course leadership to develop and revise the course with much success, in particular through integration of CEHC-developed OER modules. Acknowledging the administrative and funding challenges presented by monitoring progress of year two MPH projects, it will be important for the achievements of the entire cohort of MPH students to be reviewed once all are completed, to consider whether future scholarship opportunities are better suited to the one-year diploma course.

⇒ Several completed public health fellows have expressed a desire to pursue a research career pathway. If there is an opportunity for both the public health fellowships and research fellowships to continue after the end of the current CEHC funding, there may be many strong candidates for these from within the CEHC public health fellowship alumni. Ensuring those public health fellows within the east African region with a desire to pursue a research career are well networked to the research capacity building programme that is underway there will also provide opportunities to pursue a research career pathway within the region.

Open Education for Eye Health

Introduction

Open education is a movement promoting collaboration in the development, sharing and building of knowledge. The Open Education for Eye Health (OEEH) programme develops Open Educational Resources (OER's) for eye health.

These e-learning courses are freely available for download, use, adaptation and redistribution. Based in part on key modules from the established International Centre for Eye Health MSc in Public Health for Eye Care programme at LSHTM, these courses aim to enable individual qualified and trainee ophthalmologists, nurses and optometrists to expand their understanding of public health for eye care. The programme builds on the learning from implementation of a Standard Chartered Seeing is Believing grant, the output of which was ICEH's first OER course, ***Global Blindness: Planning and managing eye care services***.

Initially funded to develop four courses, in 2016 the Trust awarded supplementary funding to the CEHC to develop two additional courses in glaucoma and retinopathy of prematurity.

Findings and analysis

Impact, outcomes and output

Output 3 Open Educational Resources for Eye Care development	Output 3 Open Educational Resources for Eye Care development
Output Indicator 3.1 Completed development of three modules. Completed pilot testing in Cape Town. Expert review report.	Output Indicator 3.2 Number of institutions and users accessing OER
Target 5 courses available and 2 in development	Target 20 Institutions
In use: *Eliminating Trachoma* *Ophthalmic epidemiology: basic principles* *Ophthalmic epidemiology: application to eye disease* *Global blindness (developed prior to CEHC, but facilitation continues under CEHC)* *Diabetic Retinopathy* *In development:* *Retinopathy of Prematurity* *Glaucoma*	*19,620 users joining courses, of which 11,429 are active learners* *188 countries and territories reached*

Development of online courses

The Open Education for Eye Health (OEEH) team has developed and launched four courses with two further in production, due for completion in 2019. The content of these courses is provided online through open access, and completely free of charge. Courses run several times per year, and the OEEH team has linked with past and current students and staff of the ICEH to support facilitation of these. Course content is kept current to reflect changes in research through periodic updates. Panel 1 shows the number of courses completed or in production and how many times they have run.

Course	Launch	Number of runs
Eliminating Trachoma	October 2016	6 runs
Ophthalmic Epidemiology 1: Epidemiology of Eye Health	January 2017	n/a: open continuously
Ophthalmic Epidemiology 2: Application to eye disease	January 2017	n/a: open continuously
Diabetic Eye Diseases: Managing the patient journey	October 2018	2 runs
Glaucoma	Planned for Dec 2019	n/a
Retinopathy of Prematurity	Planned for August 2019	n/a

Panel 1: *OEER courses produced and run between February 2014 and March 2019*

In developing the programme, the OEEH team have actively engaged with the wider field of open education, learning from experts, sharing their practice and contributing to the development of a field in which they recognise healthcare is not yet well represented. Being a part of these networks has allowed opportunities to surface that have scope to extend the reach and impact of the OEEH programme. For example, following a presentation at a global conference, initial discussions are underway with a French platform to form a partnership to create content for French speaking countries.

All four courses developed under the original funding have now been launched, though with some delays. In part, delays have been due to the demands of facilitating live courses. The team has addressed restraints caused by the need for facilitation with strategies that draw upon the network of staff, students and alumni of the ICEH.

> *"…we've now found a route through MSc alumni who have very generously helped us out and come on board as facilitators. We've also got the input from the steering groups for each of the courses who've come on board as experts and given up their time to be part of this. Perhaps the thing to note in this journey is how generous people have been to share their knowledge and expertise… that has been a surprise in a good way."*
>
> Daksha Patel | OEEH stream leader

While course production has experienced delays, the team have evolved their approach to learning design over the period of the grant. Following the course development cycle a number of times has led to a greater understanding of the range of learners who may benefit from the courses, and made the process more learner-centred. This has resulted in the development of tools and resources designed to help both learners and educators.

> *"The purpose of our programme has always been to support educators as well as health workers. …We really want to encourage mentorship and facilitation for the educators as well as the learners."*
>
> Sally Parsley | OEEH Technical Lead

Indeed, the team is putting increased emphasis on creating tools that support educators to engage with open practice and include digital resources in their practice. The team sees this as an important area of need and growth going forward.

Enrollment figures and diversity of applicant countries

Between February 2014 and March 2019, there have been close to 20,000 enrollments in OEER courses (see panel 2 for details on OEER participant enrollment). Over fifteen percent of those enrolling fully participate in the course with over ten percent completing the course. This is around double the average completion rate of online courses. Participants come from 188 countries with the highest representation from the UK and Nigeria. India, east Africa and southern Africa are also well-represented, suggesting that Commonwealth countries are engaging with the courses.

Course	Joiners	Learners	Fully participating (≥50% of course)	Completers (≥90% of course)	Certificates /upgrades sold	No. of countries & territories reached (max=248)
Eliminating Trachoma	5,859	3,072	773	526	113	155
Diabetic eye disease	2,178	1,522	381	223	52	136
Global Blindness (FL*)	10,198	6,216	1,864	1,215	449	174
Global Blindness French	206	148	35	15	13	34
Global Blindness (OS*)	319	143	49	38	12	65
Ophthalmic Epi1	587	224	78	45	19	71
Ophthalmic Epi2	273	104	26	13	9	56
TOTALS	19,620	11,429	3,206	2,075	667	188

*Key to course delivery platforms: OS - Open Study, FL - Future Learn

Panel 2: *OEER participant enrollment and geographic spread (data extracted December 2018)*

User experience

In designing and delivering online courses, understanding the user experience is essential to determining impact. The team engaged institutions and piloted courses to gather feedback and refine course design, have tracked course enrollment and drop out to determine demand and commitment to courses, and use post course surveys to assess user experience, and challenges.

The Ophthalmic Epidemiology course was piloted with participants in six institutions. Feedback from pre- and post-surveys has shaped the refinement and design of that course and all subsequent courses. As a result of survey feedback, OEEH courses now offer certificates of completion and peer discussion opportunities.

> *"…post course surveys [suggested that] main reasons for not completing include time, and the fact that people are working full time jobs and trying to fit it in."*
>
> Astrid Leck | OEEH programme team | ICEH

There are significant benefits to following a course which runs at a specified time and is facilitated. Learners are able to communicate with peers and benefit from having questions answered and challenges addressed. There is a tension though, between the benefits offered by facilitated courses, and the limitations set by courses which run at a specified pace and dates. These will not always work for learners – particularly when joining a course happens in addition to existing responsibilities and workload - and may make it harder for them to adhere and complete. Making all course materials available to download and use offline – as the OEEH team has - allows learners who cannot commit to a specific time period or pace to follow the course as well as addressing connectivity.

Feedback also suggests that course certification is important to a lot of learners and can be a motivator to undertake and complete OERs. Although payment for course certificates can be prohibitive, through LSHTM, the team has an agreement with the British Council that they will pay for certificates for people from non OECD countries The team is proactive in ensuring that students know when they are eligible for this.

The team is currently collecting data on the use of OEEH courses by individuals to understand how the courses are being received and course content utilised, through identifying the impact they are having on practice. Promising case studies are already emerging. For example, within one user's institution, the Eliminating Trachoma course is now being used as part of the induction of all new staff. A separate respondent has reoriented a trachoma programme following taking the course, placing greater emphasis on improving community engagement to address environmental factors in the spread of the disease. This has resulted in a reduction of cases of trichiasis and active trachoma since these changes were implemented.

Creating partnerships with institutions

The OEEH team have put emphasis on developing institutional partnerships to enhance impact of the courses. Two such partnerships created during the programme have had considerable success.

The first is with the division of ophthalmology at the University of Cape Town in South Africa described in the case study in Panel 3. The second is a partnership with COECSA, which has been championed by Kenyan CEHC research fellow Nyawira Mwangi, and Michael Gichangi, head of Ophthalmic Services at the Ministry of Health, Kenya. Together they reviewed and adapted Global Blindness: Planning and managing eye care services for use by members of COECSA. CPD accreditation of this course by the College has since been secured.

> *"The global blindness MOOC has been adapted and has CPD accreditation from COECSA so that's already setting an example of how one MOOC has been used on the local level."*
>
> Daksha Patel | OEEH stream leader

It has been the OEEH team's ambition to nurture more partnerships of this nature, which see stakeholders actively engaging with course materials, adapting them to ensure appropriateness in the context in which they are to be delivered, and then deploying them in a way which provides most benefit to the user. The work undertaken by Nyawira and Michael to adapt and share this course with the membership of COECSA both improves opportunities for COECSA's membership to undertake relevant CPD with minimal institutional support and strengthens COECSA's position as a promoter of Open Education in the region. In turn, this stands to expose a growing membership to flexible, quality public health training.

Using OERs in training: Dissemination versus adaptation and application

Mbarara University of Science and Technology (MUST) in Uganda and University of Cape Town

The availability of OEEH courses has been promoted through a number of channels, including at major eye health conferences and meetings, and through CEHC members. One way in which educators share these courses is illustrated by the example of CEHC research fellow Simon Arunga, recommending his third year ophthalmology residents at MUST to take both ***Ophthalmic Epidemiology*** and ***Diabetic Eye Diseases: Managing the patient journey***. Residents at MUST were not required to complete these courses as part of their training, but approached using the OERs enthusiastically. Here, they describe the benefits, but also frame some of the broader challenges learners have when approaching independent study of Open Education:

> *"The first two weeks were really wonderful for me. [The course] talks about general aspects of how you talk to patients, how to refer, link to other hospitals where the other patients can be treated, how to organise, clinics…. I know I would be the one doing this service so it really helped me."*
>
> Rachel | 3rd Year Ophthalmology Resident |Mbarara University | Uganda

> *"It's easier when we have a break between semesters – that would be a good time to go through some of the course."*
>
> Geoffrey | 3rd Year Ophthalmology Resident |Mbarara University | Uganda

> *"You do it on your own but there's not enough time to finish the second week. So by the second week I was left behind. I completed the third week in the fourth, and so on…"*
>
> Rachel | 3rd Year Ophthalmology Resident |Mbarara University | Uganda

The residents also illuminate some of the benefits of being involved in facilitated study, as well as pace and clarity of learning materials, which for residency programmes in sub-Saharan Africa, where many students for whom English is not their first language, is an important consideration:

> *"…the discussion in the group, it helps to understand some aspects... [As a Francophone student] the level is good, it's not so high, it's understandable. The English is good. The videos are clear. The speech is not too fast, not too slow."*
>
> Nana | 3rd Year Ophthalmology Resident |Mbarara University | Uganda

The use of OERs by MUST residents represents a light touch approach to augmenting training with online learning and students demonstrated varying degrees of commitment to studying the course.

In contrast is the enhanced application of OER to training by the division of Ophthalmology at UCT, which now uses adapted versions of ***Ophthalmic Epidemiology 1: Epidemiology of Eye Health*** and ***2: Application to eye disease*** as two of its modules on the MPH in Community Eye Health.

> *"[Students have] had online time on the course and then once a week a two-hour contact tutorial with me, and a manual to work through and assignment s to do. So there has been no classroom time with someone giving lectures and powerpoint presentation. It's been online, additional reading, assignments and contact tutorial.*

Professor Colin Cook | Director, MPH in Community Eye Health | University of Cape Town

In a department with limited teaching faculty, UCT has traditionally had to call upon partners like the ICEH, to bring in faculty from London annually to run modules on its MPH. Adapting to using OERs has enabled the team not only to remove this need, but to free up time of existing faculty.

> *"It's almost like having Daksha or Sally here as faculty and then creating additional exercises that complement it. It really enhances the learning experience for the students. There's direct learning from the OER, no faculty contact time other than two hours a week. Previously they would be in the classroom for 8 hours a day, 5 hours a week.*
>
> *The feedback we've had from the students has been positive. They like it and it works for them. [As for] assignments and exams, the performance has been as it always was if not better. So it seems to be a good and positive development for us to run it like this".*
>
> Professor Colin Cook | Director, MPH in Community Eye Health | University of Cape Town

These cases provide contrasting examples of applied support to the use of Open Education in learning environments. While students at MUST cited benefits of using the OER, none of the students interviewed had finished the course, and there was no clear strategy to link it to residents' learning objectives. The team at UCT has integrated OER as opposed to adding it to students' workload, making it a compulsory part of its training. It has been adapted to fit the curriculum and teaching and assessment has been developed around it. It has freed time for teaching staff, and has supported student performance.

Based on the impact of this integration, the OEEH team are motivated to find ways to better support institutions to adapt and integrate courses as UCT has.

Panel 3: *Case study: Using OER's in institutional training programmes*

Challenges and solutions to extending and growing partnership opportunities

The OEEH team recognize that the partnerships with UCT and COECSA hold promise for other institutions, and have worked in a number of ways to try to facilitate partnership opportunities, particularly within the CEHC network. In 2017, the team delivered a series of five webinars aimed at educators (see panel 4), providing guidance on what Open Education is and how to use Open courses for study, and how to both use and adapt courses in training others.

OER 2017 Webinar Programme

What is Open Education? Why is ICEH using it as part of our education strategy?	Using Open Education to support local training and capacity building
Open Education – does it work?	Where to find and how to use Open courses?
Creating and sharing your own Open Educational Resources	

Panel 4: *OER webinar programme*

Despite the success of these webinars, which engaged a range of subject experts and illustrated ways in which educators might use Open Education to support their efforts in training and capacity building,

the OEEH team are concerned that effective strategies to support educators and engage institutions have not yet been fully realised:

> *"I feel that we've not been able to develop [our support to educators] as much as we'd like… we've run some webinars to get educators involved but it would be fantastic to be more resourced or have a bigger team to get more involved with a network of educators."*
>
> Sally Parsley | OEEH Technical Lead

The OEEH team have had success when engaging with active, networked members of the CEHC with a keen interest in Open Education and an understanding of the potential that it has. Nyawira Mwangi and Michael Gichangi's positions within Kenya's leading health sciences training institution and Ministry of Health respectively, have been key to securing buy in from institutional partners in the COECSA region.

> *"Institutional support has come in handy. We have the support of the Minister of Health in the area of policy. We have the support of training institutions. We have support of professional institutions. We are able to accredit this course. We're able to give CPD points. We are able to give certificates. Institutional support is a very good opportunity that you can leverage on."*
>
> Nyawira Mwangi | CEHC Research Fellow | Kenya

The team's ambition to identify and work with more of these 'champions' within the CEHC network has not yet been realized. They recognize the importance of achieving this and are considering strategies for increased engagement.

> *"there would be huge value in getting members of the consortium involved in facilitating and mentoring on the open education platform because than they'd take a bit more ownership of the content and use it in their own setting."*
>
> *[Considering] the Consortium networks - RoP and DR for example – I feel that those are the people we'd really like to bring in to the picture because this content, particularly the subject specific content, is specifically designed for these networks and finding a better route and reaching out to the people in these network s would be a huge benefit.*
>
> Daksha Patel | OEEH stream leader

Taking this approach one step further and acknowledging the benefits of active support to institutions to find ways to adapt OEEH courses to enhance learning, the team sees the development of a technical support mechanism as a future goal.

> *"we're thinking of creating an educational hub with key educators invited to come on board and work actively – very much like Nyawira has – to strengthen and develop their use of open education in their setting. We think there would be a degree of handholding that may be required to get the momentum we want."*
>
> Daksha Patel | OEEH stream leader

Developing a sustainable OER programme

To maintain the level of support to facilitating and updating the existing OER courses, and provide technical support to institutions to adapt and integrate OER into their education, training or CPD curricula, the OEEH programme will require an ongoing revenue stream. This could be achieved in several ways including securing accreditation through LSHTM and providing institutions with subscriptions to updated and facilitated courses. LSHTM recognises that the OEEH programme has

already attracted applicants to the school's MSc in Public Health for Eye Care, and is discussing the possibility of accreditation with the OEEH team.

> *The school might [support us to] create an accredited programme around the content we've got. …there would be a fee attached for the assessments we'd attach to it. Anyone using it could get some form of certification that could be used to support their professional practice. In the long run we may have to consider this. That could generate sufficient revenue for us to keep a small team working on it.*
>
> Daksha Patel | OEEH stream leader

Legacy

⇒ The OEEH programme has developed five world class open educational resources, available for free to any learner, including one course available in English, Spanish, Portuguese and French. Two further courses are due for completion by end 2019. These are the first OERs available for public health and eye care, and contribute to a still emerging area of study in OER. The OEEH team has worked hard to respond to feedback from learners, including the importance of certification and flexibility of access to the content.

⇒ Close to 20,000 learners have engaged with OEEH courses since the CEHC programme began and over ten percent of these complete courses; around double the average completion rate for OER courses.

⇒ Successful institutional partnerships with UCT and COECSA demonstrate the potential of the application of OEEH courses within education and professional training environments and hold promise for applying learning about adaptation with more partners and institutions. In addition, examples of individual application of course learning are demonstrating impact through a number of case studies being collected by the team. These stand to serve as useful tools in demonstrating the quality of these courses to institutions which may benefit from integrating them into training.

⇒ The OEEH programme has made contributions to a global movement of Open Education through the development of innovative tools and approaches.

⇒ There is increasing recognition within LSHTM of the quality and potential of the OEEH courses and discussions are beginning on a possible route to financial sustainability through accreditation by the university as a Diploma.

Path to sustainability

⇒ The demands of coordinating content creation, facilitation ongoing courses and updating have been higher than expected, and have both delayed the development of courses and required the OEEH team to find facilitation solutions through involving members and alumni of the ICEH in facilitation. To ensure that the courses developed by this programme remain of a high quality, up to date and adequately resourced, ongoing resources will be required. It is therefore important to find ways to raise revenue to sustain the programme, ideally through the provision of technical support, or as currently being explored by the OEEH team, offering the courses as a diploma, accredited by LSHTM or similar.

⇒ The example of integration of OER's into academic training courses by UCT demonstrates the benefits that may be experienced by institutions able to adapt and integrate OER's into education or training curricula. In order to extend this impact to other institutions, the programme must find a sustainable way to support educators to best adapt and apply OEEH courses in their settings to bolster existing training. Offering this assistance through a hub of technical expertise could be explored. It will be important to determine whether this should be revenue-raising, in which case it must be done alongside making the business case for investment to institutions.

Clinical Fellowships

Introduction

The Clinical Fellowship programme was developed to provide opportunities for sub-specialisation to ophthalmologists across low and middle-income Commonwealth countries. Training has been provided by a network of training institutions, the majority of which are in Commonwealth countries in the global south.

Fellowship opportunities have been awarded based on an identification of priority needs within the applicant's country, and their potential to use training effectively on their return. This relies both on their own commitment to providing new or improved services, and the commitment and ability of the institution they work in to support the development of these services; both factors which are assessed through application.

The Clinical Fellowship programme has provided a combination of short- and long-term fellowships, and had already made remarkable progress in awarding and supporting these by the mid-term, with 61 of the 100 planned fellowships underway or complete and a further 69 awarded. Following an award of supplementary funding in 2016, fellowship training has been offered to multidisciplinary teams and to individuals seeking technical training in a range of skills including ocular prosthesis and microbiology.

The supplementary funding has also allowed the clinical fellowship programme to expand into two important areas: extended ***Mentorships*** to a small number of completed fellows to further develop their skills and provide support to setting up services; and the initiation of regional ***Capacity Building*** within sub-Saharan Africa, working through the two major regional colleges of ophthalmology, WACS and COECSA.

Findings and analysis

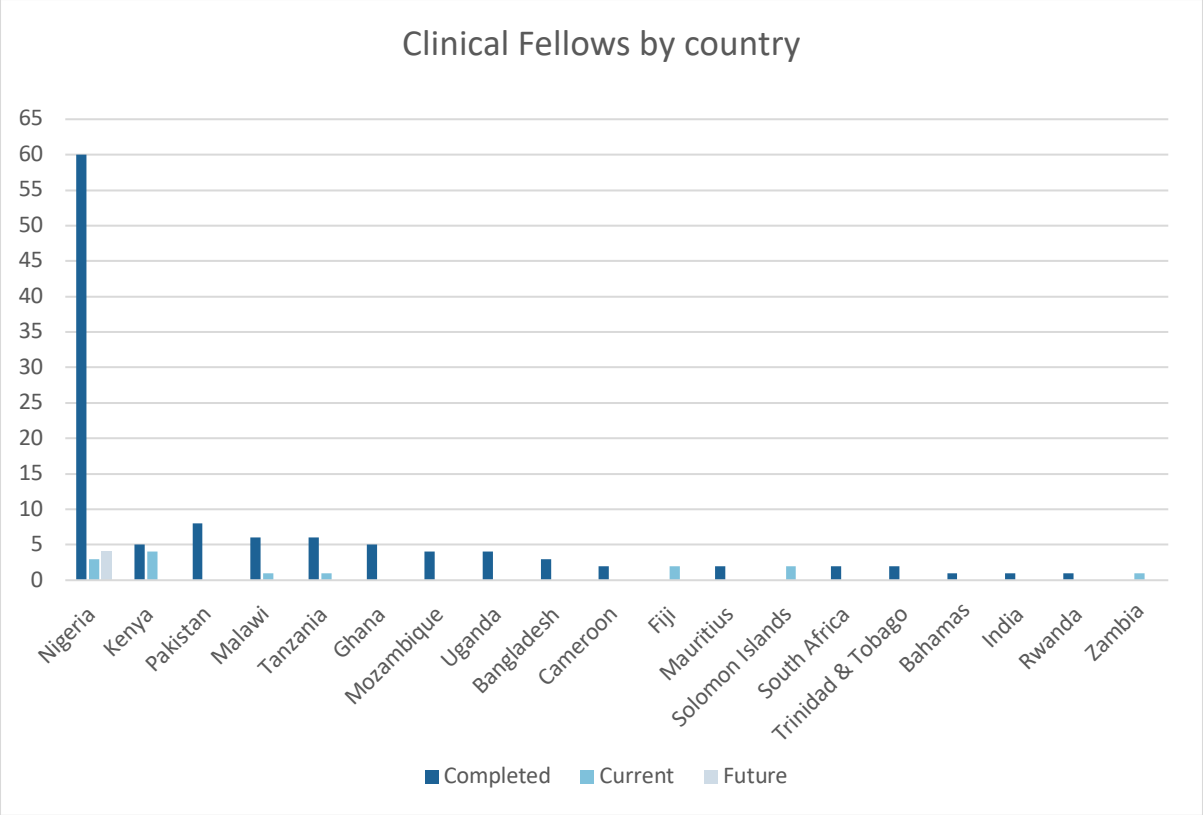
Impact, outcomes and output

Outcome	Output 4.1	Output 4.2
Strengthened eye health systems in Commonwealth LMICs in three key areas of people, knowledge and tools		
Outcome Indicator 1 PEOPLE: Number of Fellows returning to their home institutions and using their new skills in eye care or planning.	Indicator 4.1 Number of short-term Fellowships completed; Number of short-term team trainings completed	Indicator 4.2 Number of long-term Fellowships completed. Number of clinical mentorships established
Target 100 returned fellows using new skills in eye care or planning	Target 40 ophthalmologists in LMICs; 5 additional fellowships from 2017 5 new team-trainings from 2017	Target 60 ophthalmologists in LMICs; 5 additional fellowships from 2017. 20 clinical mentorships established from 2017
124 short- and long-term fellows appointed, training or returned home; 64 long-term, 60 short-term. 17 short-term team trainings completed (8 teams). 19 mentees receiving additional support. Total returned fellows: 141	58 short-term fellowships completed. 2 short-term fellowships appointed. 17 short-term team trainings completed (8 teams).	48 long-term fellowships completed. 14 long-term fellowships currently in progress. 2 long-term fellowships appointed 15 mentorships with 19 mentees in six African countries.

Number and distribution of Clinical Fellows

Panel 1 shows the number and distribution of all CEHC-funded Clinical Fellows by country. The Clinical Fellowship programme has exceeded targets in placing short-term, long-term and teams into fellowship programmes.

As was the case at mid-term, Nigerian fellows continue to dominate with over fifty percent of all fellows coming from this country. The team has worked hard to diversify this and has continued to advertise opportunities through an impressive number of channels. Since the mid-term there has been an increase in the number of fellowships being awarded to ophthalmologists from east, central and southern Africa, and with the support of RANZCO, fellows from the Pacific have been able to study.

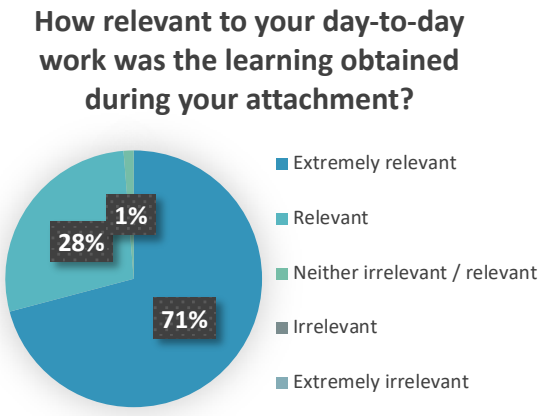


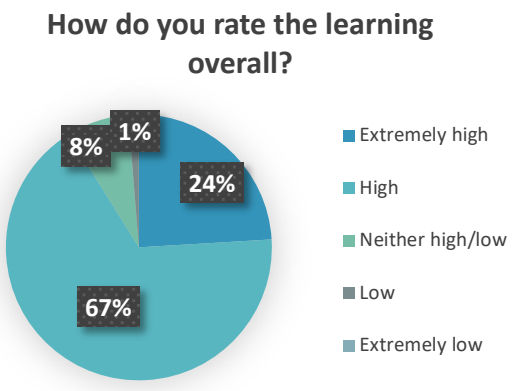
Panel 1: *Completed, current and future Clinical Fellows by country*

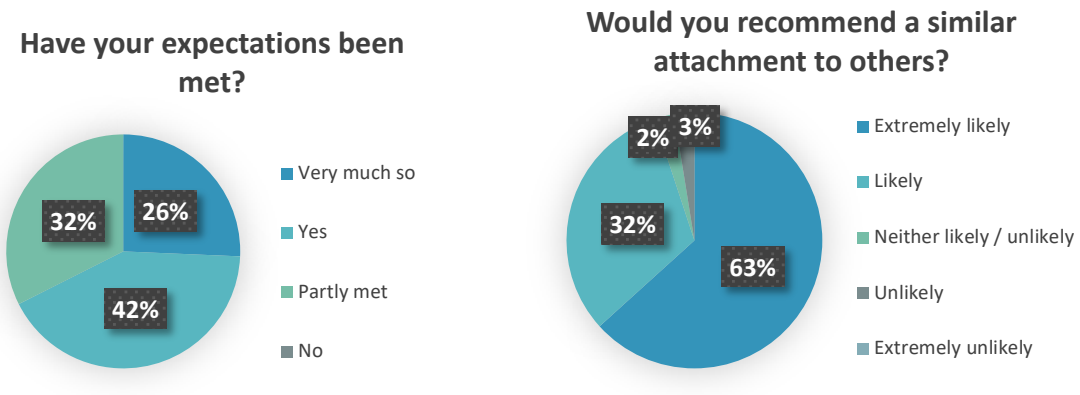
Fellows' assessment of training experience

The clinical fellowship programme team receives feedback from fellows at specific time points during and after their placement to determine whether the placement is meeting their learning needs, and what changes they have managed to implement on return to their institution.

Satisfaction with placements overall is high, with over ninety percent of those returned fellows who completed end of fellowship reports rating learning as 'extremely high' or 'high'. An overwhelming majority (ninety-five percent) would recommend their placement to others. Individual feedback from fellows, however, does cite challenges that have impacted on learning, and it is important to note that almost one-third of returned fellows felt their expectations only partially to be met (see panel 2 for details).





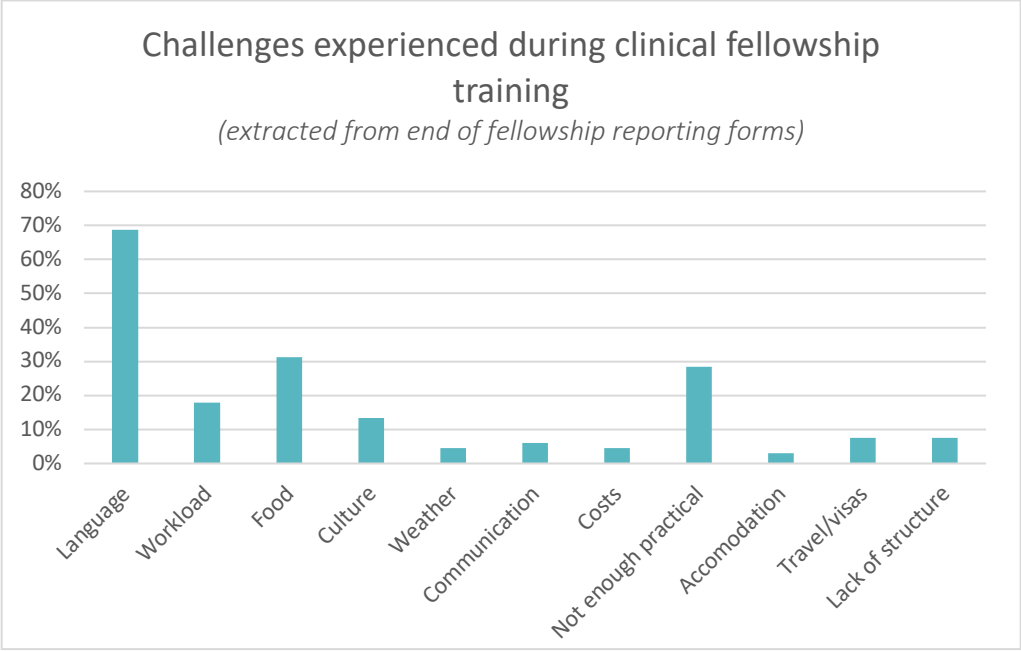


Panel 2: *Data extracted from end of fellowship reports by completed fellows (79 of 109 returned fellows).*

Panel 3 shows responses from returned long term and short term fellows who completed the section on challenges in the end of term reports. Of a total of 109 returned fellows to date, 79 have completed standardised end of fellowship reports, and 67 have provided information on challenges. Of these 67 fellows:

- Over two thirds experienced language problems
- Almost a third had problems with the local food
- Almost a third felt there was not enough exposure to 'hands on' practical training
- Around twenty percent struggled with the expected workload

Other issues experienced include cultural difference and culture shock, lack of structure, challenges with costs, communication home, travel and visas.



Panel 3: *Challenges experienced by fellows during clinical fellowship training*

Throughout the programme, the clinical fellowship team has paid close attention to the challenges faced by fellows during their placements. Themes that have emerged consistently are most common

for those from sub-Saharan Africa travelling to south Asian institutions for training. While it hasn't been possible to address these issues for all fellows during this phase of the programme, learnings like this must support the development of a next phase of the Clinical Fellowship program, particularly if the majority of fellows are based in Africa and travel to India for training.

Though it has been difficult to institute change within the current clinical fellowship programme, it is promising to see continued involvement of completed fellows in ongoing planning for the development of regional sub-specialty training with WACS and COECSA, and experiences from the fellowships programme being noted in considering appropriate design of regional fellowship programmes.

Potential for service development and change

The majority of placements are now complete and fellows have returned to their institutions. The clinical fellowship team has monitored returned fellows' progress both through regular correspondence during and on return to their posts, and through a formal report at training end (to assess quality and perceived benefit of training in relation to service development plans, discussed above), and six months' post-completion (to assess ability to provide new or improved specialist services within their institutions).

Forms received six months' post completion allow fellows an opportunity to reflect on what they have achieved since their return, and the challenges they still face. To date, sixty-one returned fellows have completed these assessments, and questions cover progress made in setting up and delivering services. Responses are narrative and content analysis provides an overview of common themes emerging in progress and challenges. Panels 4 and 5 summarise findings and provide examples.

Can you refer to the actions that you wanted to undertake on your return home? Have you been able to implement them?	
Area of progress	Quotes
Enhanced or increased service delivery over fifty percent have enhanced or increased service delivery	• *Increased referral to glaucoma clinic* • *Referral cases to my department have increased remarkably since my return* • *Number of paediatric patients have increased* • *I have seen a total of 52 new Occuloplasty patients* • *More pediatric cases seen in the past 9 months (170 per month) unlike previous (130 per month) approximately; More pediatric surgeries (15 per month) unlike previous (8per month) approximately* • *More squints, number has doubled approximately* • *Still doing one laser session but the number of patients has increased* • *Number of patients done Laser 171*

Set up of new subspecialty clinic or service over a third of respondents cite having set up a brand new service	• *Low vision department and vision rehabilitation department has also been started* • *Set up a standard Oculoplasty theatre* • *Oculoplasty Unit of the Department of Ophthalmology has been established* • *Vitreoretina Clinic Fully functional* • *Setting up a specialty eye unit started 1 year ago with construction and equipping with essential machines. Currently with functioning theatre which mainly cataract surgeries are conducted once a week* • *To start a retina clinic: Scleral buckling for rhegmatogenous RD is now being performed in the hospital*
Commencement of training and team development Several fellows have also begun to build and train a team to deliver new and enhanced services.	• *I will commence my first phase of in house training of the ophthalmic nurses in management of basic occuloplasty procedures* • *Residents in their 3 monthly rotations are being trained in the simple principles of early diagnosis and biopsy of possible eye tumours. Two residents have been taught how to place a frontalis sling for ptosis*

Panel 4: *Progress made: examples of responses from six-month post-fellowship forms*

What challenges have you faced in your home institution and how are you overcoming them?	
Identified challenge	**Quotes**
Lack of equipment and consumables By far the greatest challenge to returned clinical fellows is lack of equipment and consumables. Over seventy percent of returned fellows cite issues with equipment. Reports cite specific issues and the risk to service delivery where equipment is not available or breaks. There are also examples of efforts being made by fellows to address these challenges which suggest that lobbying for funds within institutions is challenging and some fellows are instead trying to identify external sources of funding.	*We depend entirely on donor support for all our activities. This limits what procedures that can be carried out as well. If the need to service, repair or replace a machine arises or when consumables run out, we are grounded.*
	I have written two different proposals to the Hospital management team justifying the need for this equipment plus the gains of having it, however there has been little progress on it.
	We are continuing dialogue with the management of our Teaching Hospital and University while also looking for external funding and grants that can fill these gaps.
	We are trying to reach out to corporate bodies and philanthropists to assist as Government is overwhelmed.
Institutional challenges Institutional challenges in the form of strikes, inability to reorient or acquire space for services, and delays due to bureaucracy are an issue for around a third of returned fellows.	*Bureaucratic bottle necks in the provision of space, manpower and equipment for establishment of a Vision Rehabilitation Center.*
	There is limited allocated theatre time for paediatric patients.

Other issues Other themes that emerged through the reports are poor patient awareness, lack of demand and inability to pay for services, and a lack of capacity within the institutions to deliver specialised services.	*Lack of dedicated team to support me in paediatric ophthalmology.*
	We have very limited support staff here. In routine OPD only one optometrist and she needs to be trained in orthoptics and squint evaluation.
	Awareness of general public on importance of vision in children is lacking. We are trying to create awareness through social media and print media.
	Patients' ability to pay for services limits the number of patients who will turn up for the service.

Panel 5: *Challenges met: examples of responses from six-month post-fellowship forms*

The level of support received by fellows through the clinical fellowships team has been very high. Multiple cases of support to adapting and enhancing fellowship opportunities exist. For example, a number of fellows have been supported to travel to relevant conferences during their fellowships.

This support, bolstered by close communication with the Trust and an openness to support changes to the original programme objectives, has allowed the clinical fellowships team to adapt its fellowship opportunities based on feedback and demand. Expanding opportunities to include team training and technical fellowships are a reflection of this. Panel 6 describes the experiences of an ophthalmologist and a counsellor from Nigeria, supported to undertake an observership of retinoblastoma management.

The impact of targeted sub-specialty training and team training on paediatric ophthalmology services in northern Nigeria

Aminatu Ali Abdul Rahman is a paediatric ophthalmologist, based at Nigeria's largest tertiary eye hospital, the National Eye Centre in Kaduna. In 2015 Aminatu travelled to Isphahani Islamia Eye Institute and Hospital in Bangladesh to undertake a one-year fellowship in paediatric ophthalmology and strabismus.

On her return to Kaduna, she quickly implemented changes and 18 months after completion of the fellowship she had established an orthoptic unit, started to undertake squint surgical services, developed protocols for retinoblastoma and squint and reoriented clinical and surgical services in her department to increase output.

> *The boss in my hospital is very supportive – he asked us as soon as we were finished training 'What are your plans, what do you need?'*
>
> *Actually we have almost everything we need in the hospital. The need was to bring everything into the right place to improve the service delivery.*

Aminatu continued to stay in close contact with the clinical fellowship team as her services developed. She identified retinoblastoma as an area requiring additional development; her training

in Isphahani having given her insight into the need to develop multidisciplinary teams to support patients and their families. As part of the clinical fellowships team training programme, Aminatu and her colleague – counsellor Abubakar Safinatu Bala - travelled to Aravind for a one-month observership of retinoblastoma management.

> *The impact of this training opportunity has been great. It has given me a new perspective on what we are doing, what others are doing, and how we can maximize our impact. I observed the way that retinoblastoma services are organized in Aravind. Seeing the way in which different teams and departments have to collaborate really broadened my thinking on how we may set up a similar service.*
>
> *Coming back, I've tried to institute something similar. I've developed a team, and having a counsellor is very helpful. We've created a support group of the parents of the patients who are undergoing treatment or in remission.*

The system set up by Aminatu and her team is working well and Aminatu is confident that it will sustain and grow. It is advantaged greatly by a supportive hospital director, but also by Aminatu's ability to apply learning from well-established services in major eye institutions and apply them effectively in her own hospital.

Her institution and the services she has set up, hold great promise in the longer term to become established as part of two networks being supported by the CEHC. Aminatu was involved in Nigeria's first RbNET meeting in December 2018, and her hospital and department stand to become part of a network of institutions capable of offering regional capacity building for sub-specialty training.

> *I am confident about sustainability, as the system is working well. We have adequate numbers trained and working in the system. Hopefully we will be able to start sub-specialty training for our residents. It's still in the planning stage but we would like to be able to offer this soon – even clinical observership. Nigeria has the patient volume, and enough skilled manpower to provide ophthalmic subspecialty services and training for our people.*

***Panel 6**: Case study of team training*

Aminatu and her team have tracked surgical output before and since training through the clinical fellowship training, and demonstrate a clear increase in patient's treated. While Aminatu's team has been able to show change, it is important to note that one of the biggest limitations of the broader clinical fellowships programme is the inability to measure impact against two important indicators: improvements in access to eye care in Commonwealth countries, and improvements in quality of eye care in Commonwealth countries.

Innovation to extend support to clinical fellowship training in the Pacific region

Promising progress has been made in offering subspecialty training in the Australasian region, thanks to close cooperation between the clinical fellowships team and RANZCO. Two major achievements stand out:

PNG RANZCO curriculum review: A close relationship between the Trust and CEHC, allowing for strategic revision of budget allocation to maximise impact has allowed funds from the clinical fellowships progamme to be used to support an ophthalmology curriculum review for the University of Papua New Guinea. This achievement, which is the culmination of a thorough staged review involving

local ophthalmologists, optometrists, RANZCO Fellows and staff members, now stands to inform training in the country.

In house training in RANZCO region: Due to the extreme scarcity of trained eye health professionals in the region, it has proven challenging for Pacific ophthalmologists to leave their posts to undertake fellowship training elsewhere. This has resulted in very few applications from Pacific Islanders to the clinical fellowship scholarships. To address this, an agreement has been reached with RANZCO for funds to be transferred for in-house training programmes for fellows from Fiji and the Solomon Islands.

Clinical Fellowships | Mentorships

Establishing a mentorship progamme

As evidenced by reports (panel 5), ability to use subspecialty training and set up services has been a challenge for a number of fellows. The Mentorship programme is an extension of the clinical fellowship programme, and aims to provide enhanced support to a small number of fellows by linking them with suitable mentors for continued dialogue, planning and direct training support to establish and enhance services intended following fellowship training. The programme provides support to 19 long term fellows, selected through a call for applications. The mentorship programme matches fellows with suitable mentors and – wherever possible - each mentee receives two visits to their institution to further enhance their skills and services.

As with so many aspects of the wider CEHC programme, the team at ICEH has drawn upon its impressive global network of partners to identify the majority of mentors. These come from three main sources: trainers from within training institutions participating in the clinical fellowships programme, UK institutions with links to the ICEH team; and in a small number of cases, previously established direct connections between the mentee and prospective mentor.

Progress

All mentors have undertaken one trip to visit their mentee. Feedback was gathered through standardised reporting forms. All mentees felt the mentor visit to be *'totally transformative; very significant changes will result'* or that *'some useful changes will result'*. All mentees would be *'extremely likely'* or *'likely'* to recommend the mentoring programme to others.

Narrative answers provide more description of some of the achievements that have been made, as well as some of the challenges experienced. Achievements include setting up of services, financial commitment towards equipment from hospitals and efforts by mentors to secure support from donors:

> *"The glaucoma unit is now established. Planning and organising this workshop brought us together as a formidable team. We have our plans to rise to great heights. I feel great that I am part of the global fight against glaucoma, the commonest cause of irreversible blindness."*
> Dr. Stella Ngozi Onwubiko (mentee), University of Nigeria Teaching Hospital Enugu

> *"the most important change that will result from the visit is that the hospital is more likely than ever to provide the equipment I need to practice medical retina in our hospital."*
> Dr Mbakigwe Chidi (mentee), Enugu State University of Science and Technology Teaching Hospital, Nigeria

> *"I will support Dr. Bore by asking for donation from pharmaceutical company in UK (at present I am awaiting confirmation from Bausch and Lomb if they could donate a refurbished phako*

machine and surgical packs) and also collecting instruments that could help to improve the surgical outcome as well as promoting the training of junior ophthalmologists in Kenya. Dr. Bore will meanwhile also continue to keep in touch with LV Prasad eye institute who will advise her on the logistics of setting up an eye bank."

Mr. Say Aun Quah (mentor), Macclesfield Hospital, East Cheshire NHS Trust, UK

High levels of satisfaction were clear on both the part of the mentees and mentors:

"I have undertaken numerous voluntary service visits to various countries over the past 20 years. I found the CEHC/LSHTM extremely efficient and helpful in arranging visas, tickets, travel planning and security briefings/pre-visit checks. This was, by far, the most hassle free trip, I have had!"

Dr Palimar Prasad (mentor): Warrington and Halton NHS Trust, UK

"I am grateful to the CEHC for the opportunity to benefit from the clinical fellowship and the mentorship program, I believe the benefits are unquantifiable."

Dr. Alice v. Ramyil (mentee), Jos University Teaching Hospital, Jos, Nigeria

However, concerns have been voiced on a number of issues including low opportunity to use surgical skills:

"As they do very few squint surgery, there is an apprehension that they might lose the surgical skills learned during the training. Both cost and uptake are barriers for squint surgeries."

Fredrick Mouttapa (mentor), senior consultant, Paediatric and Squint Services, Aravind Eye Care System

In the case of one mentor, concerns were also raised about the readiness of the mentee's institution to support specialty services. The same mentor found that two fellows had been trained within the same institution within a short space of time, and raised questions about appropriate assessment of needs within the institution. This has implications for the wider clinical fellowship programme, and it may be necessary to review the process by which fellows and institutions are selected:

"One of the main barriers I observed, was the profound ill-effect of repeated power supply breaks during clinical and surgical work. Having the entire operation room go dark for several minutes is unacceptable during the treatment of Oculoplasty cases. Funding agencies who support these candidates for overseas training should probably have a site-visit to ensure that working facilities at home country are conducive to specialty practice."

Dr Milind Naik (mentor), LV Prasad

Regional mentorship

Clear benefits to finding regional subspecialty training and mentorship opportunities have been identified through the clinical fellowship and mentorship programmes. When developing the mentorships programme, the team had to pay particular attention to security risks:

"There were some areas where travel was advised against by the FCO – particularly northern Nigeria. So we couldn't send mentors there. There were a few we had to say, we were sorry, [it wouldn't be possible]. But in some cases the mentee could travel."

Victor Hu | Programme lead | Mentorships

In 2018, Dr Olufemi Oderinlo, a vitreo-retinal surgery consultant at the Eye Foundation Hospital in Lagos, visited Dr Emmanuel Olu Megbelayin at the University of Uyo Teaching Hospital. This was an example of a mentor visiting the mentee in the same country, which has some clear advantages. The mentorship

team is planning to support further mentors from within Africa mentoring African mentees. Test cases like this help to inform the capacity building programme as more is learnt about impact, acceptability and efficiency of establishing regional training relationships of this nature.

Clinical Fellowships | Capacity Building

Great investment has been made into the clinical fellowship and mentorship programmes, and large numbers of ophthalmologists – primarily from across sub-Saharan Africa - have had an opportunity to train in a sub-specialty. Globally, ophthalmology training has moved towards sub-specialisation and these programmes are providing a basis of expertise in a large number of countries in Africa for the first time. While this is admirable and hugely important for the development of Africa's eye health system, it is also very expensive, requires significant coordination and administration across continents, removes ophthalmologists from post for sustained periods in a region with extremely low numbers of eye health professionals, and a large percentage of fellows have been hampered by challenges presented by training within very different cultures and contexts.

> *"…When [fellows] go back to Africa they move from a high equipment situation to a more constrained environment and I think if the training happens in Africa there's a bit more realism regarding the kind of environment you will return to after your training."*
>
> John Buchan | Programme lead | Capacity Building

In setting up the capacity building programme, the CEHC hopes to respond to these issues by supporting regional colleges of ophthalmology to develop a long-term self-replicating programme of skill sharing in the form of regional subspecialty training.

The process has been driven by close consultation with WACS and COECSA. It has placed the expertise within each institution at the centre of a planning process to develop a sub-specialist fellowship programme for the region, as evidenced by reports on preparations for a first workshop in May 2018:

> *Planning for the joint WACS and COECSA Sub-Specialist Fellowship Programme Development Workshop is progressing well. Each college is identifying both senior members of the ophthalmic establishment, and younger specialists who have themselves been the beneficiaries of CEHC supported international fellowship training to attend. Thus the experience they have had themselves of fellowship training, will inform the process of planning how to pass that knowledge on.*
>
> CEHC Narrative Report | January 2018

Both colleges are now working on situational analyses to determine key factors such as numbers and locations of potential trainers, level of need in each subspecialty field and potential mechanisms to promote long term financial stability for a regional training programme.

> *"So far we have been able to develop capacity and train faculty. Now we are evaluating centres to lift from the ground this new approach of in-situ training locally using the existing pool of faculty, specialists, and the centres which have the capacity to train locally. This is instead of having someone training in India for 18 months, which would mean service delivery being hampered for that whole time."*
>
> Josiah Onyango | Programme Manager | COECSA

The outcomes of these analyses will provide a roadmap towards initiating a regional programme. Much still has to be done to create these training opportunities, but the colleges seem engaged and

committed. A greater challenge may come when opportunities are made available, as asking African ophthalmologists to invest in new fellowship training, the quality of which is not yet known, may be too great a financial risk more many. In the same way that clinical fellowships were funded by the Trust, the initial wave of regional fellowships may require pump-priming to become well-established. It is only by having reasonable numbers of trainees going through the system, strengthening the skills of trainers and evaluating its quality, that the system will be refined and – if training is of high quality – become sustainable.

> *"We don't know yet if African institutions can provide this training – this is the risk. The answer will be that some can and some can't, but it will take a lot longer to determine this if we don't support it initially."*
>
> John Buchan | Programme lead | Capacity Building

The greatest risk to this programme then, will be lack of demand for regional fellowships if quality cannot be demonstrated. In mitigating this risk, the challenge will be to find a funder willing to invest in developing this system to refine it to that point.

Legacy

⇒ The Clinical Fellowships programme has seen remarkable numbers of ophthalmologists and other eye health professionals being afforded the opportunity to develop sub-speciality expertise, and has far exceeded targets set by the programme for this. Across the cohort of returned fellows, examples exist of the impact of this training in the development of new services and training of others in skills acquired. Clinical fellows are contributing to other CEHC-funded programmes including the Rb-NET, DR-NET and Research Fellowships. The expertise developed will enhance institutions, and within sub-Saharan Africa, provide the capacity and foundations on which to develop regional sub-specialty programmes.

⇒ A wealth of knowledge has been gleaned through the experience of administering the Clinical Fellowship and Mentorship programmes which is now feeding into the development of Regional Fellowships in sub-Saharan Africa. Returned fellows' appraisal of their training experience and more recently lessons coming from mentorships – particularly those operating regionally – are providing vital guidance to shape the situational analysis of existing capacity in the region.

⇒ The Clinical Fellowship programme has benefited from a high level of engagement from the CEHC programme team, who have used feedback on challenges and additional training needs to refine the programme – in close communication with the Trust – to provide specific training opportunities. This revision of the programme has added team and technical training opportunities as well as extended mentorship opportunities to individuals who have the ability and potential, but not necessarily the support or capacity to fully realise service change on returning from sub-specialty training.

Path to sustainability

⇒ While a very large number of clinical fellowships have been undertaken through the programme, there is still a significant variance in fellows' ability to fully utilise skills on returning to practice. Without adequate support to deliver sub-specialty training in practice, fellows risk losing these skills. Due to mentors' ability to spend time with mentees in their home institutions, the Mentorship programme has identified in a small number of cases, barriers that may significantly impede fellows' ability to deliver sub-specialty services. This indicates that more detailed appraisal of fellowship candidate's institutional support may be beneficial in advance of undertaking training, to ensure they will be able to use that training on their return in an enabling environment. In addition, prolonged support post-training is an important step in reinforcing and retaining training in practice. This higher level of planning and support would suggest that a future programme might only be able to support a smaller number of fellows, but may result in greater impact through their improved ability to deliver sub-specialty services.

Training The Trainers (TTT)

Introduction

COECSA and RCOphth are rolling out a Training The Trainers (TTT) programme across seven Commonwealth countries Kenya, Uganda, Tanzania, Malawi, Mozambique, Zambia and Rwanda) and and three non-Commonwealth countries (Ethiopia, Burundi, South Sudan).

The programme began in 2013 and since 2017 (Phase III) has been funded by QEDJT under the CEHC programme. The TTT programme aims to develop a skilled motivated workforce who can deliver high quality eye care and in this phase will extend the number of facilitators and faculty, develop on-line preparatory and teaching materials, and design training processes and tools for its assessment.

Findings and analysis

Programme development and leadership

In each of the ten countries, a lead, faculty member and facilitator will be identified and trained, who can then cascade the programme to local trainers. The programme continues until 2020, by which point it aims to ensure that more than 50 percent of trainers in COECSA have received at least basic level TTT training in supervision and implement the skills in their regular practice. Panel 1 shows current progress and aspiration for numbers trained in each country.

Country	Total trained	Predicted level/role	Current level/role
Burundi	4	2 faculty, 1 facilitator	1 facilitator, 3 delegates
Ethiopia	14	5 faculty	2 facilitators, 12 delegates
Kenya	26	10 faculty, 2 facilitator	4 faculty, 2 facilitators, 17 delegates
Malawi	9	2 faculty	1 facilitator, 6 delegates
Mozambique	2	1 faculty, 1 facilitator	2 delegates
Rwanda	8	1 national lead, 5 faculty, 1 facilitator	1 national lead, 2 facilitators, 4 delegates
Sudan	1	1 faculty	1 delegate
Tanzania	17	4 faculty	18 delegates
Uganda	19	7 faculty, 1 facilitator	2 facilitators, 15 delegates
Zambia	5	3 faculty, 1 facilitator	1 faculty, 1 facilitator, 3 delegates
TOTAL	**105**	**1 national lead, 40 faculty, 7 facilitators**	**1 national lead, 5 faculty, 11 facilitators, 81 delegates**

Panel 1: *TTT faculty training progress by country between February 2014 and March 2019*

In the two years since support from QEDJT commenced, the programme has worked closely with the COECSA lead; Ciku Mathenge, a Rwandan ophthalmologist. Ciku was inspired to take the training in 2013 when she relocated from a clinical post in Kenya to become head of department at a university in Rwanda. Encouraged after the training to take the post as COECSA lead, Ciku has been working in this capacity since 2014.

> *"I didn't know how to run a resident's programme, but I knew I wanted to run one. And probably part of the reason I was picked as the lead was because I was so engaged in the first one. I don't know how I would have [run the resident's programme] without the experience I have acquired. Honestly, we are doctors: we don't know how to teach and yet we have to teach. I didn't know how*

desperately I needed this and it has been completely transformative for me in terms of running my residency course."

Ciku Mathenge | TTT COECSA Lead | Rwanda

As TTT regional lead, Ciku has undertaken the important exercise of aligning each of the TTT training tools to the COECSA curriculum, thereby embedding the approach into the syllabus.

"I think that the curriculum offers an opportunity to put everything into practice and the tools have now been put into the curriculum and that will not change. That's there to stay."

Ciku Mathenge | TTT COECSA Lead | Rwanda

In addition, huge effort has been made by the lead team to adapt the existing TTT tools for the regional context. A thorough review of existing matierials has been made and revisions applied where differences in health system structure exist.

Progress in developing faculty

Following the first TTT course under the CEHC programme, an evaluation of the training programme was undertaken and published. This assessment focused on evaluation by the trainees on the delivery of the course, and retention and implementation of training skills at between 6 and 42 months following training. The evaluation also assessed impact using the number of eye-care workers that delegates had trained, and the number of patients seen by those workers each year. The figures suggested that approaching 1 million patients per year were treated by eye-care workers who had benefited from training delivered by those who had been on the courses.

To date, the TTT programme has trained a total of 106 delegates from ten COECSA countries. Feedback from delegates of the TTT programme suggests that while the approaches it champions are very new for some, the training has been well received and in some cases, considered transformative:

"This is one of the most mind-set changing trainings I have ever attended – I am leaving this place a different teacher"[1]

"The course was of great value and has opened my mind and created room for areas to improve at our training institutions"[2]

The course has been run most recently in November 2018 with 14 delegates from seven countries attending. Although the aim for this meeting had been to invite delegates who had previously attended the course, only two had previously attended. This required the team to reorient the course purpose towards a less experienced audience.

While this has had the result of delaying the progression to faculty of some of the more experienced trainers who the workshop was targeting, it had the unexpected and positive outcome of identifying a number of new delegates from a number of countries who show great promise and enthusiasm to become faculty.

Both because of this delay and in order to reach targets set to establish a sustainable model in the region, there is now a need to rapidly train up national TTT teams to a point where they are fully

[1] Anonymous feedback 2018 training course participant
[2] Anonymous feedback 2018 training course participant

resourced and trained, understand clearly their roles and feel confident to plan further training effectively.

Once fully resourced, these teams will require continued support or direction from the COECSA Lead on developing themselves and others. While COECSA provides endorsement to the programme: "*The development of the TTT has been good, especially since Ciku came on board. We are moving towards a pool of trainers who can deliver competency-based training. We'll have well rounded trainers who can share these skills with others involved in ophthalmic education"*[3], it has been suggested by TTT's RCOphth programme lead that in order to ensure the TTT programme is fully integrated into COECSA's education and scientific programme, TTT requires recognition within the COECSA committee structure, as a subcommittee of the Education Committee, and therefore with a seat on the Education Committee.

[3] Josiah Onyango | COECSA Programme Manager | Kenya

Legacy

⇒ In four years, the TTT programme's regional lead has made remarkable progress towards developing a sustainable regional training programme, particularly in terms of developing the systems and structures necessary to rolling this out. She has progressed from training as a delegate to leading the revision of training tools to make them appropriate to the COECSA context, integrating TTT tools into COECSA's training curriculum, and co-delivering training to delegates from ten COECSA countries through five workshops.

⇒ The TTT programme has trained 106 delegates from ten COECSA countries, of which seven are Commonwealth countries. Delegates have access to high-quality, locally relevant training tools mapped to a standardized curriculum for the region. Over half of the participating countries now have facilitators capable of delivering or supporting the delivery of future training, and by the end of the this funding period it is expected that every participating country will have trained faculty. This country structure, supported by COECSA and a strong regional lead shifts the TTT programme towards a self-sustaining model.

⇒ The TTT team are already receiving positive feedback from delegates of the training programme. Course satisfaction is high and delegates feel as though the skills learned are affecting their training approach positively. Trainees are also reporting positive changes in the way components like feedback are being implemented.

Pathway to sustainability

⇒ The programme has experienced some delays and challenges becoming embedded into COECSA's Education processes, particularly in relation to delivering training workshops. This needs to be addressed to ensure training can be rolled out as intended and that faculty can progress to the stage required to be self-sustaining in each country. In the longer term, if the TTT program is not seen as an integral and fully supported program within COECSA, the roll out of the programme stands at a significant risk to the sustainability of its goals in the region.

⇒ While it will be important to continue to deliver TTT training to delegates regionally and nationally, it may also be beneficial to explore undertaking workshops within institutions. The TTT regional lead recognizes that this targeted support may help to address institution-specific constraints in cascading training to others.

Research Fellowships

Introduction

Investment in research ('knowledge') is one of the cornerstones of the CEHC's approach. It recognises that in LMIC, the process of embedding research into health systems requires competent indigenous scientists and a supportive and enabling environment that will allow research communities to grow and deliver research that contributes to improving eye health services.

Strategic investment was made to eight PhDs and two post-doctoral fellowships, aiming to drive and expand research within the Commonwealth by furthering these individual's research capacity, output and ability to transfer research skills to others.

At the project mid-term, the research fellowships programme was considered to be on track, with a strong cohort of PhD and Post-Doctoral fellows, selected through a very-well subscribed call for applications. In addition to developing strong research proposals focused on issues of ophthalmic public health importance, they had already forged clear links to the Peek and DR-Net initiatives, supporting them through these programmes of research. At the mid-term it was also apparent that a network of support and collaboration had been established within the cohort, and particularly within the East African region. PhD and Post-Doctoral fellows were already engaged in planning to attract funding for joint programmes of research and develop research capacity further in the region.

Findings and analysis

Impact, outcomes and output

Outcome	Output 6
Strengthened eye health systems in Commonwealth LMICs in three key areas of people, knowledge and tools	Research Fellowships
Outcome Indicator 2 KNOWLEDGE: Number of research papers published, studies produced, conferences presented at (demonstrating the strengthened research capacity in Commonwealth LMIC).	Output Indicator 6.1 Five Phd Students recruited (including one within Peek testing) and one post doc recruited through open competition
Target Minimum of three published papers per fellow	Target 6 researchers recruited and completed PhDs/post-docs
By end 2018: - 16 publications accepted or in press - 11 publications submitted and in review - 9 manuscripts in preparation - 22 meetings held or attended to share findings - 11 public engagement opportunities undertaken - 7 resources produced (guidelines, toolkits, training materials)	- 8 PhD and 2 post-doctoral fellows recruited - 6 research fellows on track to complete PhDs by December 2019 - 1 research fellow failed to upgrade; on track to complete MPhil by May 2019 - 1 research fellow unable to undertake post doc; funds transferred to Peek budget for research - 1 research fellow delayed in completing post doc. Completion expected by end 2019

Progress through studies

Seven of the eight PhD candidates upgraded to work towards obtaining their qualification and all are on track to complete their studies in 2019. One scholar was unable to meet the LSHTM requirements to upgrade from MPhil to PhD student status and has continued studies as an MPhil student. The CEHC and fellows have worked through challenges in finalising sub-contracts, disbursing funds, public sector strikes and illness and students are largely on track to complete studies as planned.

One post-doctoral candidate has been unable to undertake studies due to illness. The funding for this post-doc comes from within the Peek budget and has been reassigned with the Trust's approval towards a trial in Hyderabad city, Telangana State, India in the use of Peek Retina. The trial aims to train in the technology's use, validate its capability in capturing images compared to standard intervention (fundus camera), and undertake a situational assessment of barriers and facilitators to DR screening in

the public sector to provide recommendations on whether/how Peek Retina could be integrated into NCD clinics that have been proposed to be established within the Community Health Centres.

At the mid-term, fellows reported feeling well-supported by their institutions to undertake studies alongside competing clinical, teaching and project management roles. They continue to be well-supported, particularly by their supervisors and the Trust, which has been supportive to allowing the team to make changes where fellow's studies have had to be adapted or extended, or funding increased.

Cascading research skills: building capacity through training and mentorship

The majority of the cohort of CEHC research fellows comes from sub-Saharan Africa, and half of the PhDs and post-doctoral scholarships were awarded to east African fellows. This reflects the weight of the applications coming from the sub-Saharan African region and the quality of these applications. A concentration of fellows within east Africa has led to unexpected yet positive outcomes for ophthalmic research in the region. The first is the organic development of a regional network of support, mentorship and collaboration. This operates informally, through relationships and contacts:

> *"I feel more close to Tanzania and Kenya, [and the CEHC fellows in those countries]. Perhaps the cultural context is the same. Maybe we have more to talk about beyond research. I know what's happening with the president of Kenya, they know…. We feel closer. Matthew [Burton: CEHC Programme Director] had already supervised researchers in the region who were an advanced level more than us. It was great because we could get advice from them."*
>
> Simon Arunga | CEHC Research Fellow | MUST | Uganda

This network evolved in the early stages of the fellows' study at the ICEH in London. Although most active within this region, communication and knowledge exchange does involve all fellows and those within and outside the east African region cite benefits of links to others in the group.

> *"The first year was a great time – great rapport both academically and socially. We shared ideas. We still keep in touch by email and ResearchGate."*
>
> Prabhath Piyasena | CEHC Research Fellow | National Eye Hospital of Colombo | Sri Lanka

The east African network has been nurtured and formalized through the leveraging of additional funding from BCPB to a programme to build research capacity in Kenya, Tanzania and Uganda. Now in its second year, it provides structure and opportunities to cascade research training to individuals through three east African institutions and COECSA and directly involves CEHC research fellows in delivering this training.

> *"…we have to find ways to get people interested in research. The research workshops we are holding with funding from BCPB helps people enjoy their research experience more. We are training people to supervise better. We're trying to help people to enjoy the process of finding a research question, of deciding on a study design, and carrying it through.*
>
> *But people also need to see there is a way that research is helping their careers. In one way, my post-doctoral work must help people to see that you do have a chance to continue to develop your research career after a PhD."*
>
> *Stephen Gichuhi | Post-doctoral fellow |University of Nairobi, Kenya*

Individuals are also investigating ways to develop research capacity within their own institutions. Prabhath Piyasena, for example, is already engaged in skills transfer with colleagues and plans to develop a research unit within Sri Lanka's largest public eye care institute.

Simon Arunga has been able to develop the capacity of a research team within his institution. He has achieved this both through supporting the team's skills development directly, but also through linking with the CEHC Clinical Fellowships programme. James Mwesigwe, a senior laboratory technician at Mbarara University and Teaching Hospital, undertook a clinical fellowship in microbiology to support Simon's research. He now intends to establish an ocular infection diagnostic facility. Simon leads a team of four who he has trained and developed through the PhD. They will stay with him to work with him on his post-doctoral research. They have developed skills in research implementation including data collection and input, and community engagement and sensitization. One member is showing a desire to train further to become an ophthalmologist and researcher, and all will be co-authors on papers published through Simon's post-doctoral grant.

Impact to the wider CEHC network

The Research Fellowships programme aimed to support ophthalmologists through a PhD on a topic of ophthalmic public health significance in LMIC, and more specifically, on the Trust's priority diseases. The activity of fellows demonstrates some of the CEHC's greatest impact in connecting its programmes. The work generated through a number of the PhD's contributes to an evidence base and drives forward activity in other CEHC's work streams and the Trust's other programmes. See panel 1 for details.

Impact of Research Fellowships on the wider CEHC programme

Nyawira Mwangi

Assessment of health system performance for Diabetes and Diabetic Retinopathy (DR) in Kenya in order to recommend and implement a package of interventions to strengthen DR services.

- OER: facilitation of courses, adaptation of DR course, successful certification of adapted OER course by COECSA for member CPD
- DRNET: contribution to development of Kenya's national clinical practice DR guidelines, input into development of guidelines for Ghana, development of OER for health workers in prevention and control of DR

Hillary Rono

The development, validation and implementation of Smart-phone guided (Peek) algorithms for use in eye care in Kenya

- Peek: capacity building of teams involved in Peek Botswana and Peek India programmes, Integration of Peek Acuity into School Eye Health and Community Eye Health solutions tested through RCT

Furahini Godfrey Mndeme

Validity of a new screening tool, assessment of risk factors and the effect of congenital cataract surgery on visual outcomes and nystagmus in Tanzania

- RBNET: PhD findings driving red reflex study supporting case finding in 3 countries

Rajan Shukla

Comparison of two approaches for screening for ST-ROP in two diverse states of India

- The Trust's Retinopathy of Prematurity Programme: Provided evidence to a national ROP taskforce in India to support scale up of ROP screening across all public sector SNCUs/neonatal care units in India

Panel 1: *Impact of Research Fellowships on wider CEHC programme*

Dissemination of research

Fellow's research output has been disseminated through publications, conference posters and presentations, public engagement events and dissemination meetings. Panel 2 summarises these outputs. For a full list of outputs by each Research Fellow, see annexe I.

Research Fellows (PhD): research output

16 publications accepted or in press to journals including The Lancet Global Health, BMC Endocrine Disorders, JAMA Ophthalmology, Journal of Glaucoma, Human Resources for Health, Tropical Medicine and Health and Implementation Science

11 publications submitted and in review

9 manuscripts in preparation

22 meetings held or attended to share findings including papers presented at 5 annual major ophthalmological conferences, 1 international donor meeting, 2 government or ministry meetings

11 public engagement opportunities including World Sight Day activities, presentations and awareness raising events with members of the public and community health workers

7 resources produced (guidelines, toolkits, training materials), including 4 training manuals, 1 health education campaign, 1 OER course

Panel 2: *Research Fellow research output summary*

Developing research career pathways

There is undoubtedly a thirst within the cohort of research fellows to continue in research and pursue post-doctoral study. Simon Arunga has already been awarded a post-doctoral fellowship as part of a Wellcome Trust-funded multi-country trial extending the research undertaken in his PhD. Furahini Mndeme continues his work as co-investigator in a three country trial assessing the effectiveness of primary care workers in red reflex screening of serious treatable eye conditions in children. Hillary Rono will continue his work as a member of Peek's research, design & development team, establishing a hub of knowledge and expertise in Kitale, Kenya. His focus will be delivering school and community screening programmes in Kenya, trialling and improving Peek systems, and training others – locally and globally - to deliver Peek programmes.

Legacy

⇒ The CEHC has supported the development and **award of 7 PhDs, 1 mPhil and one post-doctoral fellowship in eye health for LMIC Commonwealth countries.** In Uganda, Tanzania and Sri Lanka, these are the first ophthalmologists with doctoral degrees.

⇒ By the end of the CEHC programme, **research fellows will have published over 30 original academic papers, many in high impact publications**, creating an important contribution to the evidence base on priority issues relevant to their region.

⇒ Multiple CEHC programmes, including **Peek, DR-NET, ROP-NET and Rb-NET have benefited from the research of CEHC research fellows**.

⇒ **Funding has already been secured to continue and extend the work of at least three research fellows** in post-doctoral study, through co-investigator roles or as key members of global implementation teams.

⇒ **Research fellows are passing on research skills** directly to research implementation teams, through academic and resident programmes within their institutions, and through a formalised, funded east African research network. This network stands to build research capacity within specific institutions in the region, and offer a new generation of researchers local, relevant opportunities and supervisory structures to establish a research career.

Path to sustainability

⇒ The funding leveraged through BCPB provides an excellent opportunity for CEHC research fellows to become directly involved in developing research capacity in the east African region. To realise this as a sustainable model, CEHC research fellows recognize the need for further mentorship and support to develop their capabilities as mentors and supervisors themselves. In the short- to medium-term, novel PhD supervision models[4] focused on local supervision with distance (ICEH) co-supervision may be considered, along with strategic funding to further post-docs. To have at least three institutions in the region equipped with local expertise in PhD supervision would be a remarkable step towards sustainability in the region in a relatively short timeframe.

[4] For example, like those developed by the THRIVE consortium (http://thrive.or.ug/)

CEHC Research Fellow Case Studies

Furahini Godfrey Mndeme

Dr Furahini Godfrey Mndeme is a Paediatric Ophthalmologist, Lecturer in the Department of Ophthalmology at Kilimanjaro Christian Medical University College and Head of Community Ophthalmology Centre at Kilimanjaro Christian Medical Center. He has been focused on pursuing a research career for a number of years, and obtaining his PhD will have a significant impact on his ability to train others:

"I come from the teaching hospital. They have stopped taking ophthalmic residents because there isn't currently someone with a PhD who could teach them and regulations require at least one member of teaching staff in a faculty to have a PhD. Now the university knows I'm studying and that when I'm back they can receive an intake of residents."

Funding is already in place to extend and further the research into red reflex screening which formed a major component of Furahini's research. The trial will assess the effectiveness of primary care workers in red reflex screening of serious treatable eye conditions in children and compare the effectiveness of two screening devices through a cluster RCT in three east African countries. Furahini will be a co-investigator on this trial:

> *"The findings will allow me to move on to many further opportunities. One of the three objectives of my research was testing tools for screening. We now have a separate study that will build on the findings of this work. It's independently funded and being undertaken in three countries."*

During his time based at the ICEH, Furahini has become involved in developing new initiatives. Together with other members of the ICEH and CEHC, and drawing on the learnings and successes of the DRNet and other networks set up by the CEHC, he is driving forward an initiative to develop a paediatric ophthalmology network:

> *"One of the advantages of being here in the ICEH is exploring the possibility of setting up a paediatric eye health network with several of the CEHC programme. We hope this will help us to collectively think about how to improve child eye health regionally and more widely."*

Along with his peer east African CEHC research fellows, Furahini is working with this group to find ways to bolster research capacity and output in the region, and specifically through COECSA:

> *"We want to work as a catalyst within COECSA. We were together a couple of months ago, trying to think what we might do to help others in our region to raise up. How can we improve research in our region? Can we use COECSA to build a good research team in the region and how can we work together to supervise our colleagues?"*

Impact of investment to Furahini Mndeme's CEHC research scholarship

- Resumption of training to resident ophthalmologists within Kilimanjaro Christian Medical University College and increased capacity to drive and support research within the institution
- An important contribution to the evidence base on risk factors, detection and treatment of congenital cataract in east Africa
- Leveraging of new funding for a three country study into the effectiveness of primary care workers in red reflex screening of serious treatable eye conditions in children, the results of which will inform new standard of care pathways at primary level in LMIC

- Contributions to initial plans to set up a Network of Paediatric Ophthalmology, building on the experience gained through developing the DRNET
- The initiation – with other CEHC research scholars - of an east African group working with COECSA to strengthen ophthalmic research capacity in the region

Nyawira Mwangi

Nyawira Mwangi is a medical doctor, educator, administrator and eye health system specialist, and principal lecturer at the Kenya Medical Training College in Nairobi. The first goal of Nyawira's PhD was to complete a health systems assessment of DR services in Kenya, which identified a number of supply and demand side barriers to uptake and found gaps in screening services in particular. The findings of this assessment have shaped the second goal of the PhD; the design of a number of interventions to improve uptake of services. Nyawira explains the evolving nature of the project: *"As I implement, I plan, and the project expands".*

New components, including training of community health workers in health education, and development of guidelines for the detection and treatment of DR, were identified as priorities and added. In achieving these, Nyawira has leveraged successfully on available opportunities. For example, she identified a growing national interest in developing guidelines for DR, and drove this forward with members of the Ministry of Health as a national initiative, resulting in Kenya's first national guidelines for the detection and treatment of DR. This in turn has made an important contribution to the DR-NET programme as these guidelines have been used as a template for the development of similar frameworks in several other participating DR-NET countries, including Ghana.

Early in her research fellowship training at LSHTM, Nyawira undertook a MOOC developed by the consortium-funded Open Educational Resource programme. Inspired by this, she adapted the course specifically for the COECSA region of Africa. Understanding the potential application of online learning tools in her own research, she developed an online course in the control of DR for people with an interest in the prevention of visual impairment and blindness from DR (including health care workers targeted by her training and education intervention), with funding from UNESCO and support from the CEHC's Open Educational Resource team, and in particular, the guidance of her mentor, the OER programmes's technical lead, Sally Parsley.

Though developed as part of the training component of Nyawira's PhD, this online course holds promise to be used far more widely. Nyawira has developed successful partnerships with participating CEHC institutions including COECSA and the University of Cape Town to develop and improve access to this online training. Having the support of these partners is helping

> *"…to really meet the needs of the patients and the healthcare providers... That way the PhD can be meaningful and make a contribution. It has meant more work, but I now feel that it's reached the point it needed to reach."*

Nyawira feels a bond with her fellow CEHC research fellowship scholars and believes that the training received by the scholars at the beginning of their fellowship studies has had an impact on their long term ambitions. The leadership training undertaken at the beginning of their studies, for example, helped to inspire their ambitions in developing their capacity for leadership in research.

> *"We are a good group because we have quite different skills, so we have clinical, health systems, technology. It's a good mix of interventions we are thinking about. And we collaborate, we share what we are doing. We contribute to each other's work. My area is training so people come to me for this."*

Nyawira's future ambitions centre on research. As a member of Kenya's Ministry of Health involved in shaping medical training in the country, she stands to make an important contribution through the continued development of health system interventions to improve DR services in Kenya and beyond.

> *"My priorities for the future are working further on the gaps identified by my research. I'd love to undertake post-doctoral studies to address these. I would also like to continue north-south collaborations; for example, a UK – Kenya collaboration on NCDs."*

Impact of investment to Nyawira Mwangi's CEHC research scholarship

- **Publication of academic papers in high impact journals contributing to an evidence base on health system needs in relation to the prevention, detection and treatment of DR in LMIC and the development and effectiveness of interventions to address these needs**
- **Driver of the development of Kenya's first DR guidelines, and contributor to the DR-NET's support to the development of member institution and country DR guidelines.**
- **Adaptation, development and application of OERs to training and research within the COECSA region**
- **A key member and driver of a growing network of research leaders in eye health in the COECSA region, with specific expertise in the development of training for service development and research**

Simon Arunga

Many individuals supported by the CEHC – including the majority of the research fellows funded by the programme – had a relationship to the ICEH at LSHTM prior to the establishment of the CEHC. This is understandable: alumni of the Centre's MSc already have strong relationships with members of the team and a recognized academic record.

For Simon Arunga, learning about the PhD scholarship opportunity was his first connection to the ICEH. He felt supported through the application process, experiencing growth and mentorship while shaping and submitting his PhD proposal. This support is testament to the thoroughness and flexibility of the CEHC's selection process and the team's expertise in identifying potential and mentoring early stage career researchers.

Since joining the ICEH and its wider network, Simon has linked effectively with several CEHC initiatives, furthering his own and his research group's capacity and impact. Simon's efforts have provided two members of his home institution, Mbarara University of Science and Technology (MUST), with the opportunity to undertake clinical fellowships. In addition, two residents from MUST are currently enrolled in the MSc in Public Health for Eye Care:

> "…[finding an opportunity for James Musigwe to undertake a clinical fellowship] *has really been great – we grew a service that was not there before. These connections have helped us to do other things. Two of last year's residents are currently doing the MSc through CEHC. I played a role in encouraging them to do that.*"

Simon has also capitalised on the technological interventions supported by the CEHC, adopting Peek Acuity in his trials and quickly integrating the CEHC-funded OER courses into his ongoing teaching responsibilities at MUST, recognising their quality and practicality:

> *"As someone who is also supposed to teach I have really benefitted from OER. These are great lectures by knowledgeable people,* [and using them] *means I don't have to put in the time I used to."*

Simon is heavily involved in regional efforts to improve capacity for ophthalmic research. One catalyst for this has been the strong links developed with the other CEHC research fellows in East Africa.

> *"I feel great about the connections in East Africa. Already among ourselves we have spoken about how we can continue networking, having a strategic direction in this area. We want to do research. We want to mentor others and steer the direction of research in this region."*

Simon contributes to the development of regional research training through the Vision 2020 LINKS programme[5], edits the Journal of COECSA, led the 2018 COECSA Congress research plenary, and mentors a trainee involved in pan-DRNET research into barriers to accessing DR services.

The future of Simon's own research career is bright. Having almost completed his PhD, which makes an important contribution to the development of strategies to reduce blindness from microbial keratitis (MK) in East Africa, he moves on to post-doctoral study as part of a multi-country Wellcome Trust-funded trial aiming to make a major scientific contribution towards preventing blindness from microbial keratitis (MK), through addressing critical challenges in treatment, prevention and diagnosis. He is confident that involvement in this trial will propel him forward as an independent researcher winning grants and supporting others.

> "*At the end of the post-doc I see myself as strong, in terms of research in this area and recognised for my research output. And more devolved in terms of skills and ability to manage research. I see this cascading to further opportunities down the road. The journey is only just starting."*

Impact of investment to Simon Arunga's CEHC research scholarship

- The development of a promising long-term research partnership between the ICEH and Simon Arunga/MUST and the strengthening not only of a research team at MUST, but of clinical services and – on successful completion of the MSc – increased capacity to plan for and implement public health eye care programmes in the region
- An important contribution to the MK literature and to ongoing groundbreaking international research on MK through a research team positioned to take the role as country lead on a multi-country study funded by Wellcome Trust
- A greater understanding of how CEHC-developed OER modules may complement and bolster teaching on ophthalmic trainee (MMed) programmes in SSA
- Increased knowledge on application of Peek technology in clinical trials
- A future research leader in the region already engaged in strengthening the research agenda of COECSA and its journal, contributing to the DR-NET's research output and committed to developing a regional structure for sustainable research mentorship

Prabhath Piyasena

Dr Mapa Prabhath Piyasena is an ophthalmic medical officer and a volunteer community ophthalmologist from Sri Lanka, based at the country's largest public eye care institute, the National Eye Hospital of

[5] *Building research capacity through the VISION 2020 LINKS Programme*. Philip Burgess, Stephen Gichuhi, Simon Arunga, Mike Burdon, Marcia Zondervan and Allen Foster. EYE NEWS VOLUME 24 ISSUE 2 AUGUST/SEPTEMBER 2017

Colombo. His PhD assesses the technical feasibility of integrating DR screening services into public sector health care and builds on needs identified by a situational analysis conducted by Prabath in 2014.

Prabath is committed to working in the Sri Lankan public hospital system. His motivation to undertake research into DR screening services was driven by witnessing high patient numbers presenting late with advanced sight-threatening DR, in a health system with no public screening programme and poor awareness of treatments available. On starting the PhD, Prabhath's hope was that it would lead to the development of a comprehensive diabetic retinopathy screening program for Sri Lanka.

As with the other CEHC PhD scholars, Prabhath has benefited from the support of, and supports his peers. For example, he and Nyawira Mwangi communicate regularly on DR research, and he has guided Furahini Mndeme in identifying a source of corneal tissue:

> *"It will be a very strong foundation for the future – having all those people in the commonwealth – we want to be a resource for each other. We share our expertise. For example, because we have one of the best tissue banks I suggested that Furahini contacted our national eye bank to get corneal tissues."*

The support and recognition that Prabhath has received from his institution throughout his studies has been a significant factor in shaping the opportunities he is likely to have on completion, and the impact that his training and research output may have.

> *"There was a suggestion from my seniors that immediately after completing my PhD I might take on the role of the country V2020 coordinator. It would be under the Ministry and the national eye hospital. I have also been approached to teach public health eye care to medical students."*

During the PhD, Prabhath has taken up a number of opportunities to undertake clinical specialty training alongside the research training that is core to the PhD training. He is now able to provide colleagues – including seniors - with guidance and training in technical and research skills.

> *"I want to develop research capacity starting with the residents. The gap is the research knowledge. I really want to develop a small scale research unit for Sri Lanka."*

Prabhath recognizes the impact he could have if he is able to take on a national coordination role, and sees his training as vital in giving him greater respect and influence within highly bureaucratic and hierarchical public health system. He better recognizes what is needed to drive effective planning for public health eye care and feels confident he will be in a strong position to contribute to this on completion of his studies.

> *"Sri Lanka is a highly bureaucratic health system so seeing motivation from senior colleagues to consider me for these positions suggests that things are progressing. For example, I have already been asked to train optometrists in Sri Lanka using the modality developed through my PhD research as a pilot in DR screening."*

Impact of Prabhath Piyasena's CEHC research fellowship

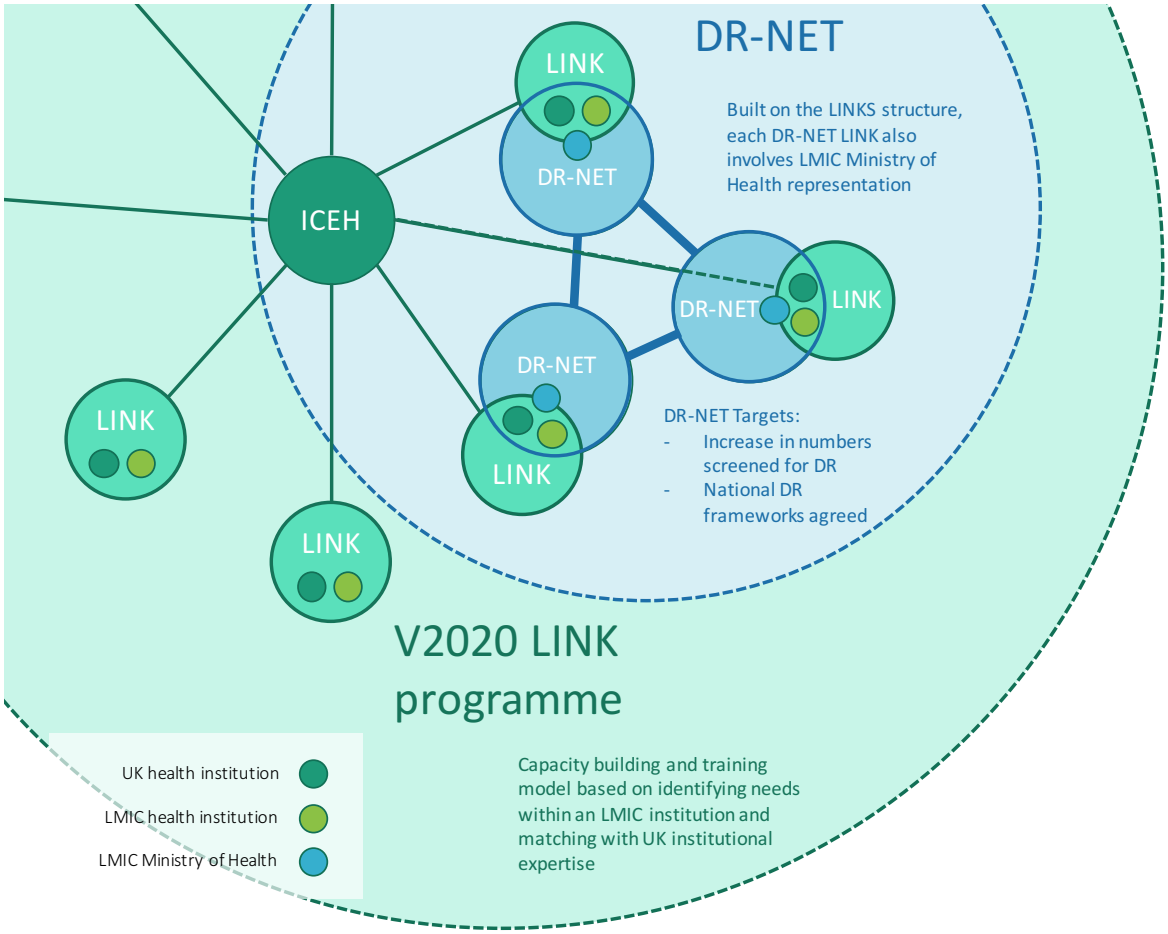
- A suite of systematic reviews, meta-analyses, formative research and feasibility studies providing an evidence base to shape pilot and scaled-up Diabetic retinopathy screening and treatment programmes in Sri Lanka
- An active member of the network of CEHC PhD scholars, providing mutual support and guidance in service development with specific expertise in diabetic retinopathy
- Opportunities to contribute in a high level coordination role to the development of avoidable blindness initiatives – in particular the development of DR services – across Sri Lanka

- Ongoing contribution to the training of residents and colleagues in skills such as digital retinal imaging and the teaching of research methods for public health eye care

Networks within the CEHC

As part of the funding to the CEHC, investment has been committed to three distinct networks: The Diabetic Retinopathy Network (DR-NET), the Retinoblastoma Network (RB-NET) and the Retinopathy of Prematurity Network (ROP-NET). These networks are structured in different ways with different modes of operation and objectives, but all utilise principles of knowledge exchange and communities of practice to achieve impact.

The growing burden of diabetic retinopathy in low- and middle-income Commonwealth countries requires an integrated multidisciplinary team response. The Commonwealth Eye Health Consortium is working through an established network of institution-based links (and in a small number of cases Ministry of Health links) between Commonwealth country and UK eye units to build teams that can address the needs of the populations they serve. This network of partnerships is collectively the Diabetic Retinopathy Network, or DR-NET. Panel 1 illustrates the DR-NET structure and its relationship to the wider V2020 LINK programme.



Panel 1: *DR-NET structure*

DR-NET activity has centred on direct support through UK LINKS to their counterparts, and a series of international meetings and workshops, bringing together all DR-NET stakeholders. The first of these meetings was held in 2014, and followed an initial detailed consultation and assessment process producing situational analyses for all LINKS. This supported the development of training action plans for each LINK, which have been updated and shared at three time points during programme implementation. The training programme is provided through regular visits from the UK based teams.

Each LINK has developed specific capacity building, service integration, health education and advocacy objectives as part of their action plans, and in addition to these targets, all are expected to have achieved the development of regional or national guidelines for screening and management of diabetic retinopathy by programme end.

At the beginning of the programme, the DR-NET had nine links from within sub-Saharan Africa and the Caribbean. In 2016 four additional links joined the programme. In addition, three Pacific countries established links with RANZCO, following the same structure as the existing DR-NET and joining the global DR-NET meeting in Durban, South Africa.

In 2016, the CEHC were invited by the Trust to take over management of a Caribbean DR-NET, which had been operational since 2014. This programme was brought under the same implementation structure as the wider DR-NET; each country programme being formally linked with a UK partner for capacity building in planning and expanding DR services.

The Retinoblastoma-Network (RB-NET) is a consortium of Retinoblastoma centres in the UK, India and sub-Saharan Africa. Funded through the Trust's supplementary funding in 2016, the programme began the following year. Initial plans for the structure of the RB-NET were based on lessons from the successes of the DR-NET's formation and focused in part on mentorship from UK institutions to institutions in Africa. During planning, this was expanded to include mentor partners in India.

The RB-NET's goal is to improve the outcomes of children with Retinoblastoma in the African countries by linking them with four institutions in India and the UK (LV Prasad, Sankara Nethralaya, London, and Birmingham) who currently provide retinoblastoma services. These LINKS provide support to service development with significant technical expertise, and in the case of the Indian institutions, invaluable and highly relevant experience in developing services to address the late presentation of Retinoblastoma.

Tanzania, Uganda, and Kenya are core sub-Saharan African members and a further three non-funded African partners are also participating: Malawi, Zimbabwe and Indonesia. LINKS relationships already exist in all these centres and these partnerships have clearly facilitated these additional members to join the Network. For example, the team in Zimbabwe, along with their LINKS partners, have been successful in obtaining $50,000 towards establishing Retinoblastoma services in partnership with the Network.

More recently, Nigerian centres have become involved in the Network, and while efforts have centred on Lagos and Calabar, their progress has also been bolstered by the ambition and effort of CEHC clinical fellow Aminatu Abdul Rahman and her team in Kaduna (also trained through the Clinical Fellows programme). In addition, preliminary efforts to develop Retinoblastoma services, linking with the RB-NET are also underway in Ghana.
The ROP-NET was funded through the Trust's supplementary funding in 2016, and the programme began the following year. It draws on the experience and successes of the DR-NET and the Trust-funded RoP programme in India, where a national RoP programme is currently in development. The ROP-NET's structure connects mentee institutions in Africa and South Asia with mentors in India, South Africa and the UK. The goal of the ROP-NET is to provide training on how to plan and implement a national ROP programme using expertise from within the Commonwealth and the Trust's India model programme in particular.

DR-NET | Findings and analysis

Impact, outcomes and output

Impact Indicator 1	Output Indicator 5.1	Output Indicator 5.2
Number of patients per year screened for DR in eight Commonwealth LMICs	Network partners and National Prevention of Blindness Committees agreeing national framework for DR screening and treatment	National DR frameworks in place in eight Commonwealth LMICs
Target By year 5, 15,000 patients screened annually; 37,500 screened in total	Target All 8 national DR frameworks agreed by 2016; plus one additional from Oct 2016.	Target All partners in eight LMICs have national DR frameworks in place 2019; plus one additional from Oct 2016
By the end of 2018, DR-NET partners reported a total of 107,389 patients screened	Agreement in nine Commonwealth LMICs – Kenya, Tanzania, Zambia, Botswana, Uganda, Nigeria, Ghana, Malawi, Jamaica.	National DR frameworks in place in Zambia, Botswana, Uganda, Tanzania and Kenya; work underway in Nigeria, Ghana, Malawi and Jamaica.

Network structure

DR-NET LINKS are based on existing institutional partnerships between UK partner and counterparts in low and middle income commonwealth countries. Each UK partner is a hospital, and counterparts are either health ministries or hospitals. Panel 4 outlines the DR-NET partnerships.

DR-NET LINKS since 2014	
Ministry of Health, Botswana	Addenbrooke's Hospital, Cambridge, UK
Kitwe, Zambia	Frimley Park Hospital, Surrey, UK
Muhimbili University, Tanzania	St Thomas' Hospital, London, UK
KCMC, Moshi, Tanzania	University Hospitals Birmingham, UK
Mbeya Referral Hospital, Tanzania	Altnagelvin, Londonderry, N Ireland
Makerere University, Uganda	Royal Free Hospital, London, UK
Lilongwe, Malawi	PAEP/ Fife, UK
LUTH, Lagos, Nigeria	Royal Bolton Hospital / N W Deanery, UK
MoH Kenyatta National Hospital and University of Nairobi, Kenya	University Hospital Coventry
University of the West Indies, Jamaica	Homerton University Hospital, London

DR-NET LINKS since 2016	
Mbarara and Ruharo Hospitals, Uganda	Bristol University Hospitals
Calabar, Nigeria	Wolverhampton University Hospital
Korle-Bu, Accra, Ghana	Homerton and Moorfields Eye Hospital
Blantyre, Malawi	Liverpool University Hospital

RANZCO DR-NET LINKS	
Pacific Eye Institute, Fiji	RANZCO, Sydney, Australia
Solomon Islands	RANZCO, Sydney, Australia
Vanuatu	RANZCO, Sydney, Australia

Panel 4: *DR-NET LINKS since 2014*

In the majority of these LINKS, partnerships had already been established for several years, and all are based on a process of matching, devising shared objectives and agreeing an MoU to guide action. There is little evidence appraising the impact of this type of institutional partnership on health in LMIC, but members of the DR-NET and a large number of individuals interviewed within the wider CEHC programme, recognise these partnerships as important for sharing of experience and knowledge.

The DR-NET has benefitted from the expertise of individuals directly involved in the challenging process of setting up the UK's DR screening and treatment programme, providing experience through lessons learned and setting realistic targets for impact.

> *"I knew where we made mistakes [with the UK screening programme] and how important it was that right from the beginning we set really realistic targets. They might be challenging but they should remain realistic because otherwise you end up with people giving up far too early if they can't reach them."*
>
> Tunde Peto |Technical Advisor to DR-NET | UK

While technical assistance and experience from UK partners to LMIC partners is an expected benefit, cross-fertilisation of ideas has proven an unexpected benefit for UK partners on developing appropriate services:

> *We need to go out and see how people work in different places, to see how we might do 'reverse innovation'… Come back and say 'we don't need to do that, that's a waste of money. We're not doing that'. You see what you really need to do and what you don't need to do.*
>
> Caroline Styles | Lilongwe-Fife DR-NET LINK lead | Fife

DR-NET LINKS are highly heterogeneous, with significantly varying baseline service and capacity needs, health system structures and limitations, and alignment with Ministries of Health. According to the original proposal, the impact of the DR-NET was to be measured through a cumulative increase and target in screening numbers across the network. The core output for each LINK was having a national DR framework in place.

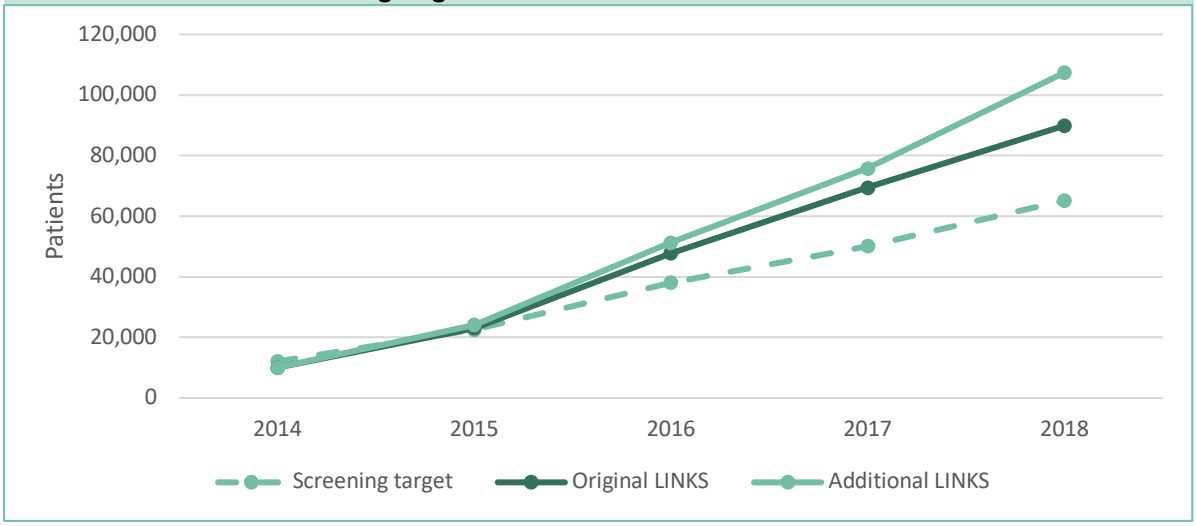
The key target agreed by the 15 participating LINKS at the initial DR-NET workshop in 2014 was 'to treat one extra person per week per centre for the five years of the grant'. If this target was reached, 3,750 extra people would have kept their sight; if we estimate that they live for on average another ten years

after treatment, then DR-NET would have saved 37,500 'blind years'. Screening and treatment data were collected from the initial 15 centres and from all those joining DR-NET during the five years. Baseline data was collected on numbers treated prior to 2014, so that the number of extra patients treated was clear.

The DR-NET has overachieved significantly on screening and treatment targets set at the programme's initiation in 2014. The table and graph in panel 5 show this.

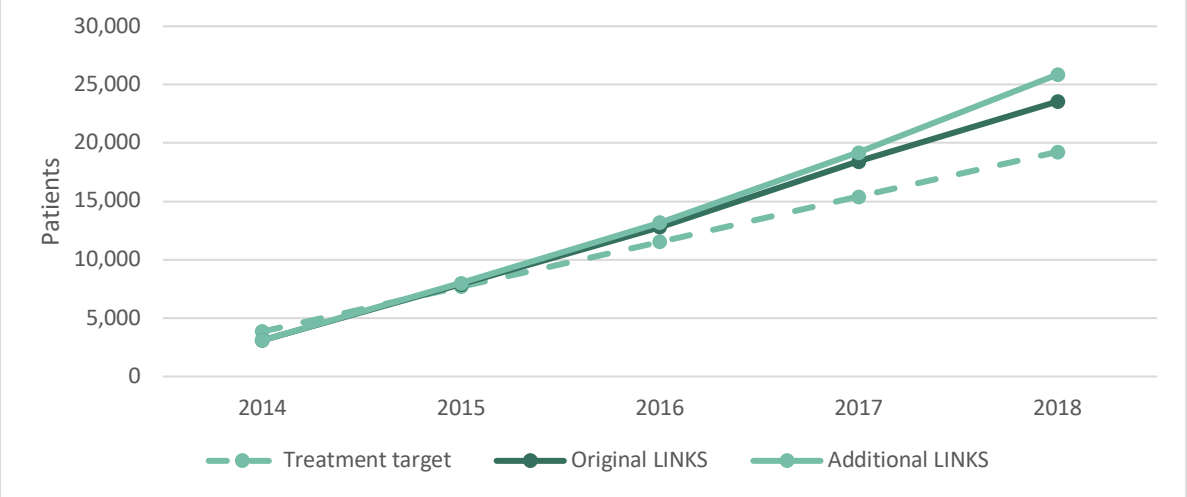
DR-NET : Cumulative screening numbers across all DR-NET sites

	2014	2015	2016	2017	2018
Screened	10,042	24,124	51,288	75,755	107,389
Screening baseline	10,042	20,084	30,126	40,168	50,210
Screening target	12,042	22,584	38,126	50,168	65,210



DR-NET : Cumulative treatment numbers across all DR-NET sites

	2014	2015	2016	2017	2018
Treated	2,878	7,992	13,188	19,181	25,867
Treatment baseline	3,098	6,196	9,294	12,392	15,490
Treatment target	3,848	7,696	11,544	15,392	19,240



Panel 5: *Cumulative Screening and treatment numbers across DR-NET between February 2014 and March 2019*

These figures are impressive and illustrate the level to which the DR-NET has exceeded initial targets set. For both treatment and screening, targets have exceeded those originally set; by two thirds for screening, and a third for treatment. These statistics do not, however, elucidate the pathway each LINK is following to achieve its goal nor the relationships that have been built between institutions. Within each LINK, and increasingly between LINKS, a range of methods have been utilised to build pathways to these targets. These are discussed below.

Global meetings

> *"I was impressed by the scale, by how many people were called together. It was impressive to showcase what we were doing and also listen and learn from others. It gave me a sense of our responsibility – that we all have and the role we have to play as a team together. We all made commitments – numbers – I think it was good to make that commitment. I think today we are still doing just that. Working together, bit by bit."*
>
> Aderonke Oyewo | Physician and Head of Block 6 Diabetes Clinic, Gabarone | Botswana

The DR-NET has held three major meetings involving all LINKS, to plan, assess progress and share lessons, successes and strategies. The first meeting, held in London in 2014, brought together health ministry, eye health and diabetes care stakeholders from each funded LINK, their UK counterparts, and technical experts in treatment, guideline development and capacity building. The meeting established the DR-NET's approach as involving government and recognizing the necessity of interdisciplinary action.

> *"The great part of the DR-NET is meeting with people from other countries. Understanding how they do things, and appreciating that others have similar challenges. We don't feel isolated in what we're facing. We are all saying that we will try to do better by involving more stakeholders in our countries."*
>
> Pearl Mbulawa | Eye Care Nurse and DR-NET member | Botswana

Despite an overwhelmingly positive response to the first and subsequent meetings, some members have raised concerns that there was not greater involvement of Southern partners in the planning of the first meeting, and the subsequent design of the DR-NET structure and priorities.

> *"Somehow some level of ownership lacks when all coordination is external. It may be more accepted if locally coordinated."*
>
> Josiah Onyango | COECSA Programme Manager | Kenya

> *"I get the impression that with the first grant, none of us were very involved, none of us had any input into designing it. If we involve the beneficiaries, I think it will be a better programme than people sitting elsewhere and designing what they should do for us"*
>
> DR-NET member | Zambia

The primary importance of ownership for effective development co-operation is well known and clearly stated in the Paris Declaration on Aid Effectiveness and Accra Agenda for Action. Involving all partners in structuring a network of practice and knowledge exchange stands to foster a sense of shared goals and responsibilities and good communication. Concerns around ownership, communication and transparency within the DR-NET have been raised through this evaluation. As the DR-NET considers its priorities moving into the future and seeks funding for further implementation, ensuring the

involvement of its members in this process, and fostering local or regional leadership will be essential to supporting sustainability of the network.

The DR-NET quickly acknowledged the importance of bringing stakeholders together, reconceiving its second meeting as a mid-term review of progress and a chance to plan for the next phase. The 2016 meeting in Durban addressed the DR-NET's objective of developing national frameworks. Its focus on bringing together Ministry representatives, agreeing a network-wide communique on shared goals and equipping LINKS with a toolkit to guide framework development resulted in significant traction in advancing achievement of these in several countries.

> *"I feel that we've progressed enormously in these meetings since November 2014. The whole tone of the meeting has become very specific in focusing on particular problems. We've learned so much about how our partners are progressing."*
>
> Denise Mabey | ICEH LINK Volunteer

The most recent meeting, in August 2018, demonstrated a network growing in its understanding and confidence of how to work together on its common goals. Two major, network-wide priorities were discussed in depth during the meeting. The first was the introduction of a laser training programme to be rolled out across the DR-NET by the end of this phase of funding, and the second a presentation and network-wide discussion on developing national plans for DR services, bringing to light the experiences of several countries who have already developed, are in the process of developing, or have provided support to other programmes based on their experience of developing guidelines. In addition, as with all DR-NET meetings, each LINK presented progress against action plans. A summary of these presentations (panel 5) describes the main achievements and challenges experienced by each.

> *"I think people left this meeting motivated because we don't feel isolated and we don't feel behind. We've reached a good stage. Although there is a lot to be done, we have made progress, and these meetings have real benefit. Each time we meet, we move forward on lessons learned."*
>
> DR-NET stakeholder| Tanzania

Summary of presentations by 16 LINK partnerships	
Achievements of DR-NET to date	Challenges of DR-NET to date
15/16 recognised equipment improvement 14/16 recognised training achievements 9/16 policy and guidelines developed 7/16 DRS services placed in DM clinics 4/16 databases established 3/16 research and publications 2/16 funding obtained	14/16 remaining training needs (VR; laser staff; screener attrition) 7/16 faulty equipment interrupting services 4/16 data difficult to obtain 3/16 problems in anti-VEGF (Avastin) procurement 2/16 slow progress on policy or negotiations with MoH 2/16 Lack of funding for programme

Panel 5*: Summary of achievements and challenges across DR-NET LINKS August 2018 DR-NET meeting (compiled by DR-NET team)*

Although achievements have been made across areas of concern (equipment improvements, training, service integration), almost half the LINKS are still without formal Ministry approved DR service plans and guidelines, almost half experience issues with faulty equipment and data collection is a challenge for around a quarter. The DR-NET has supported development of guidelines centrally, prioritizing this as a goal since the programme started in 2014, and further emphasizing during the 2016 DR-NET

meeting. There seems to be clear understanding across the network that there exist tools and resources to help teams to move forward with this.

What has been less discussed is the DR-NET's role or ability to address issues around equipment shortages and failures. As this is so critical to providing treatment, and so many of the LINKS still struggle with this, the DR-NET must determine if it can play a role in developing strategies that improve technical support or maintenance at least at a regional level.

Knowledge exchange and shared best practice

> *"…at the very beginning, [being a part of the DR-NET] helped us in sparking off the process of developing the guidelines, and then giving support along the way. They have really been there for discussion and to give us momentum to move along."*
>
> Nyawira Mwangi | CEHC research fellow and DR-NET stakeholder | Kenya

Each LINK is expected by the end of the programme to have a national DR framework in place. This process was initially challenging for the majority of the LINKS and progress was slow, in part due to varying degrees of alignment and influence of LINKS to their Ministry counterparts. In year two of the programme, funding was provided to a small number of LINKS to allow stakeholders to meet to develop frameworks.

In advance of the 2016 DR-NET meeting, the DR-NET developed a toolkit to support the process of developing national frameworks. During the meeting LINK teams used the toolkit to work through steps needed to develop a framework. Some traction followed, and the Tanzanian Ministry of Health invited Muhimbili National Hospital in Dar Es Salaam to put forward a proposal for enhancing DR services. This process culminated in the agreement of national guidelines in June 2018.

In 2017, both Uganda and Kenya developed national guidelines and frameworks. The Kenyan DR framework was developed with support from CEHC research fellow Nyawira Mwangi as part of her PhD studies (case study p 53), and subsequently shared through the DR-NET as a model framework for other countries to follow.

The DR-NET brought together the team that had developed Kenya's guidelines with stakeholders in Ghana and Nigeria to input into development of guidelines in these two countries. This is one example of the role played by the DR-NET in facilitating cross-country knowledge exchange.

> *"…the DR-NET brought the Kenyan experience to [the Ghanaian guideline development] forum and shared what they had gone through with their guideline development. This cross-fertilisation between the centres and across the continent; I don't think that could have happened if it was done centre to centre – if there was not a 'NET' bringing the centres together."*
>
> Hannah Faal | CEHC advisory committee member and DR-NET stakeholder | Nigeria

These guidelines now provide a template to other countries to ensure they do not 'reinvent the wheel'. There are now five DR-NET LINKS with national guidelines in place (having gone through approval from the national prevention of blindness committee or equivalent) either as standalone frameworks or as part of the national eye care plan. The development of a further four is underway.

In setting up the DR-NET, it was hoped to generate momentum around knowledge exchange through not only face to face meetings and workshops – as these are time and resource intensive – but also

through linking members to a repository of tools and resources. In principle, this makes a lot of sense. The DR-NET has developed several extremely valuable and high quality tools and resources which are in use by LINKS members. Making these easily accessible across the DR-NET and further afield supports standardized approaches, and benefits others working towards similar goals. Packaging and effectively disseminating these resources also lends weight to sustainability and demonstrates the quality, utility and impact of the DR-NET to potential future funders.

All DR-NET members have been expected to contribute data on their LINK institution's screening and treatment figures on a three monthly basis. This data is currently managed by one of the DR-NET members Heiko Philippin, an ophthalmologist and educator based in Moshi, Tanzania. He is impressed by the consistency of data collection:

> *For four years the platform has been running and for most of the projects we have consecutive data. Not all the way but at least until the end of last year. So because we're dealing with a chronic problem it's very important for it to keep going.*
>
> Heiko Philippin | DR-NET member | Moshi, Tanzania

It is important to remember that the chronic nature of the disease and stage at which most DR-NET members began this programme – with services in their infancy – means that tracking change must be a long-term process. In the settings in which the DR-NET is being implemented, where many of the LINKS have historically not had high levels of ministry involvement and influence and have only begun to focus on getting DR onto national agendas over the last four years, it can be expected that to demonstrate impact on treatment in particular, will be a much longer process. When compared to the UK, for example, collective DR-NET progress seems acceptable for this timeframe, as Tunde Peto, technical advisor to the DR-NET and involved in developing the UK DR screening and treatment programme acknowledges:

> "*It took us 11 years to be able to produce national data with everyone working to the same level since 2003 and with the government pouring lots of money into it".*

Both the DR-NET's knowledge repository and data repository have huge potential value. Fostering a culture of sharing tools and best practice and working collaboratively to demonstrate progress against screening and treatment targets stand to motivate DR-NET members, accelerate progress and have value as tools for advocacy.

Training across the network

Each LINK has developed an action plan addressing training needs in country. LINKS teams travel to partner institutions regularly – in most cases at least once a year – and deliver a combination of service review, planning and training activities.

Action plans, progress and adaptation are highly context specific. It is therefore very difficult to appraise the collective progress of the DR-NET in achieving training goals. Examples of significant successes both in terms of achievement of training targets, and of development of effective training packages and approaches exist. In some cases, however, ongoing structural and system challenges have affected LINKS abilities to achieve training targets to address needs in country. The most significant achievements and challenges are summarized below.

Malawi Over four years the Lilongwe-Fife LINK have trained almost 150 health professionals in an annual screening and grading programme attended by multidisciplinary practitioners from all over the

country. The training programme is standardized as a package, repeated annually and former trainees become involved in the training.

Uganda Trainers from the Makerere-Royal Free LINK have delivered annual training visits to multi-disciplinary teams in Kampala and nationally. In 2018, the team delivered workshops in three centres across the country, to a total of 94 consultant ophthalmologists, trainee ophthalmologists, ophthalmic clinical officers and ophthalmic nurses.

UK Teams from eleven LINKS have travelled to their UK partner institutions for training, examinations, observerships and planning meetings.
These trips have:

- supported ophthalmic nurses to complete international diplomas in screening and grading;
- provided exposure to LMIC Ministry of Health staff of the UK health system to aid in service planning;
- allowed national teams to develop frameworks for DR services and
- trained individuals in management, financing, treatment modalities and service planning

Botswana In 2013, a Seeing is Believing grant award supported a national programme to develop eye care services across Botswana ('Pono Letlotlo'), focusing on three areas including establishing DR services. Despite this investment and a number of effective system changes that came from it, including the training of a large number of eye care nurses and integration of DR screening into diabetic services in Gabarone, the DR-NET LINK in Botswana has not been able to undertake any in-country training of eye health professionals. A restructure within the Ministry of Health and Wellness, coupled with a severe shortage of ophthalmologists in country, has significantly restricted the Botswana LINKS team's ability to train eye health workers. Low capacity and influence of the National Eye Care Programme within the MoHW has been identified as an additional issue by an independent evaluation of the Pono Letlotlo programme and recent review visits by the DR-NET LINK Addenbrooke's Abroad.

The team has made headway within areas where progress is possible. For example, between 2016 and 2018 the Botswana DR-NET team has worked to integrate DR services into the national Integrated Patient Management System (IPMS). Some foundations to build an effective DR service exist in the country; an operational IPMS, functional fundus cameras in sites across the country, trained eye health nurses and a highly experienced lead nurse for national DR screening. But without urgent recruitment of ophthalmologists to improve provision of treatment and support to the National Eye Care Programme to develop capacity, the programme cannot fully utilize these resources.

Zambia Progress in Zambia through the LINK with Frimley Park has expanded from the partnership with Kitwe hospital, to five centres across Zambia and the team have successfully lobbied the Ministry of Health in Zambia to provide essential equipment (laser and digital fundus camera) for each. The Kitwe-Frimley Park LINK team has developed a competency based training programme for the DR service, using a multidisciplinary team approach with a mix of hands-on classroom and clinical teaching. Since the initiation of the DR-NET, the team has delivered three multi-day workshops in screening and grading nationally (with all ten provinces attending) and specialized training to DR specialists from across the region (two workshops have taken place and Malawi, Tanzania and Kenya have benefited). In 2017, a representative from each of Tanzania's three LINKs joined the training programme in Zambia to support plans for scale up of services across Tanzania.

Opportunities to undertake clinical fellowships Benefiting from its position within the CEHC, the DR-NET has been able to link with the Clinical Fellowships programme to support individuals from LINKS to undertake sub-specialty training, providing potential for a much enhanced service in countries where

these skills were severely lacking. Amongst completed clinical fellows are members of the Tanzania, Nigeria, Kenya, Uganda and Malawi DR-NET teams.

The experience of Ugandan Ophthalmologist Moses Kasadakawaho, who undertook a VR observership in Canada in 2015, speaks to the impact of these fellowships on the DR-NET:

> *"During the observership I was exposed to many disciplines and more detail about DR services. I was exposed to how clinics are run, screening, available treatment and surgical intervention and also trained how to be a trainer. I learned how to pass on the skills I've learned to the students back home.*
>
> *I have managed to use the training. I'm seeing an impact. When I came from upcountry to start working in Kampala, there was no hand over so I had to start from scratch. The training enabled me to keep retinal services going and improve – take it to a higher level.*
>
> *What the team from Royal Free [Hospital, Mulago Hospital's LINK] is doing is consolidating that training. We managed to build a team which we didn't have and now we're seeing a multiplier effect. We have expanded, we are bringing more senior house officers and they are also getting involved in managing patients."*

University of Gloucester screener grader diploma

> *"We've managed to enrol quite a number of our screener graders into that qualification, that made a real difference in people understanding the basics of diabetic retinopathy screening and grading."*
>
> Tunde Peto | DR-NET technical advisor | Queen's University, Belfast

Since 2016, the DR-NET has been able to roll out the University of Gloucester's screener grader diploma across the network, enrolling at least 2 people from each LINK in the programme. This provides screener graders with an internationally recognized, highly credible qualification and links them to a network of individuals studying for and graduating from the same diploma. DR-NET training trips to the UK have involved direct coaching on taking the qualification and the DR-NET has built an informal team of senior UK screener graders to provide ongoing support. This is an example of the DR-NET's ability to coordinate technical expertise, leverage opportunities and develop quality standards across a global platform. To date, close to 40 people within the DR-NET have achieved the qualification.

Expanding treatment through laser training The initial training focus of the DR-NET was on developing capacity in identification through screening and integration of DR services into diabetic services. As services develop, the focus has moved increasingly to strengthening treatment. To support this, a manual for laser training has been developed and a plan made for roll out across DR-NET LINKS. DR-NET's strength as a platform was leveraged to launch this initiative during the 2018 DR-NET meeting in Addis Ababa.

The roll out of laser training in Uganda (panel 6) provides an example of the application of the manual and programme.

Development of laser treatment services in Uganda

Background

There are currently two DR-NET LINKS in Uganda; London's Royal Free Hospital with Mulago Referral Hospital in Kampala, and Bristol University Hospital with two centres in the country's south west: Ruharo Hospital and Mbarara University and Referral Hospital Eye Centre. LINKS partners have supported the development of multidisciplinary teams to deliver DR services in both centres through several large scale training visits. In addition, the team in Mbarara have leveraged funding to develop DR service infrastructure both within the Eye Hospital and through outreach screening services. Ophthalmologists in both centres have been recipients of clinical fellowships (through the CEHC and COECSA), equipping them to deliver laser treatment for DR.

In November 2018 a cascade model of laser training was delivered in both DR-NET centres. The approach trains local trainers (in this case ophthalmologists who had undertaken sub-specialty training) to teach residents in the use of laser. In total seven residents were trained in Mbarara and five in Kampala. The trainers are now equipped with a manual and simulation eye to continue and cascade training. This will be vital as challenges in finding patient numbers during training mean that residents have not all undertaken laser on patients. They report satisfaction in the course, though most feel they require further training under supervision.

Reflections and future considerations

Although laser training was well received in Uganda and the cascade model for training shows potential for sustainability, the Ugandan DR-NET programme highlights ongoing human resource concerns and limitations common in the region:

- most residents are bonded to other countries and will return to these centres following training, taking specialist training experience with them
- ensuring adequate experience in training and ongoing retention of skills for treatment delivery is challenging due to low patient numbers and demand for services
- one of the country's two retina specialists will spend a year on fellowship in Tanzania during 2019

There is a need to address low demand for service: this is recognised and Uganda's DR-NET action plans prioritise improving health education. The team in Mbarara are undertaking research into health seeking behaviours and data from this should inform future health promotion interventions in the country and may have impact within the region and wider DR-NET. Concerted effort to scale up screening through outreach is also a focus.

Sam Ruvuma, the retina specialist undertaking a fellowship during 2019, is making plans to address the risks to continued service delivery created by his absence:

> *"There is one second year resident from Uganda who is bonded to Ruharo. She will train further in laser and will take over from me when I am in Tanzania. One of the reasons I chose Tanzania for my fellowship is to stay near, come back, see patients and monitor her or other resident's work."*

Panel 6: *Development of laser treatment services in Uganda*

Research

The need to package and disseminate widely the tools developed by the DR-NET has already been discussed. The programme team has documented a number of the processes and findings of the programmes to date through publications in the widely read and popular eye health publication Eye News, and several of these are authored or co-authored by members of African and Caribbean DR-NET LINKS. These serve as useful resources and tools to communicate programme aims, but there is also a need to develop a portfolio of peer-reviewed articles leveraging members to undertake original research connected to, assessing and ultimately providing the evidence of need for the development of DR services and the role that a network mechanism like the DR-NET can play in achieving this in LMIC.

Members of the DR-NET are beginning to collaborate on research. For example, driven by concerns in both locations about low demand for eye services, a team in Uganda and Tanzania are working together on the implementation of a Knowledge, Attitudes and Practice (KAP) study at two sites. Their hope is that this will provide insights to help with education campaigns in both countries. This collaboration was initiated by the DR-NET's programme director, Marcia Zondervan.

> *In the [2018] DR-NET meeting we felt that one of the priorities [for the DR-NET] is sensitisation. The KAP will be very useful in considering the need that exists for this. Marcia [had already] suggested we collaborate on a KAP study in the two countries Marcia is great at leveraging collaborations. That's her strength; trying to connect people who can work together and learn from each other.*
>
> Simon Arunga | CEHC Research Fellow and DR-NET stakeholder | Uganda

Further collaborations are likely through a partnership with the Royal College of Ophthalmologist's journal, Eye. A supplement focused on the DR-NET LINKS is planned and this represents a huge opportunity for members of the DR-NET to be published in a high impact journal. A new working group has been established to expand DR-NET research and to develop the DR LINKS supplement in Eye. The DR-NET clearly benefits from having CEHC research fellows such as Nyawira Mwangi and Simon Arunga in its membership, and these individuals will likely drive much future DR-NET research output from within the COECSA region.

DR-NET Caribbean

In 2017 the DR-NET team agreed to take on the management of Phase 2 of the Caribbean DR Project which includes four countries: Jamaica, Belize, Dominica and St Lucia. This programme has now been modelled on the wider DR-NET's structure and each country has been paired with a LINK institution in the UK (Panel 7). The team moved quickly from undertaking situational analyses in each country to partnering them with a UK institution, and a launch workshop took place in September 2017, bringing together policy makers, ophthalmologists, diabetologists, optometrists, screener/graders and information management systems personnel from Jamaica, Belize and St Lucia along with UK LINKS members. The hurricane in Dominica meant they could not join. The output from that meeting was an action plan for each country to move towards a national screening service for diabetic retinopathy.

DR-NET Caribbean LINKS	
Jamaica	Moorfields Eye Hospital, London/Homerton University Hospital, London
Belize	Brighton and Sussex University Hospitals NHS Trust
Dominica	Brighton and Sussex University Hospitals NHS Trust
St. Lucia	Frimley Park Hospital, Surrey, UK

Panel 7: *DR-NET Caribbean LINKS*

Although the hurricane in Dominica delayed programme start up, all four countries have now made remarkable progress in both training of screener graders and in achieving buy in from government. The LINKS partnerships are proving fruitful in accelerating progress.

> *"…because the VISION 2020 LINKS are expanding in the four countries and within Jamaica, it's increased our collaboration with the Ministry of Health. Things have taken off, starting at the university and moving island wide, and with the help of Moorfields and Homerton we're getting everyone trained up and getting the work done."*
>
> Lisette Mowatt | Ophthalmologist and DR-NET member | Jamaica

Much of the training has utilised the Certificate in Higher Education from the University of Gloucester, ensuring a universal level of quality across the region. Government involvement and endorsement in all four countries has been impressive. Particular achievements are:

- re-establishing an MoH role in eye care in Belize which has for many years relied on a non-governmental agency to deliver eye care, hampering integration of eye care services with other sectors. During the November 2018 LINKS visit to Belize, the Ministry of Health funded DR training and sensitization of all primary care workers.

- transitioning St Lucia's DR programme to the Ministry of Health. Recognising interest in the programme from the Medical Officer of Health at St. Lucia's Ministry of Health, the DR-NET team worked closely with her to achieve buy in. She is now a champion of the programme within the MoH, and less than six months after the first DR-NET workshop St Lucia officially launched their National Diabetic Retinopathy Screening Service. Less than a year prior to this, the situational analysis undertaken by the DR-NET team had described St Lucia's DRS programme as '*at a standstill.*'

The Caribbean DR-NET has also been able to leverage support from within the CEHC public health fellowships cohort. The CEHC has funded students from Belize, Dominica and St. Lucia to undertake ICEH's MSc PHEC. Two of these focused their research projects on current DR services in their countries. The DR-NET Caribbean programme team member and Public Health Fellowships programme manager Cova Bascaran explains the benefit of their training and involvement:

> "*We've had [students from] St Lucia, Belize and Dominica since we started the DR-NET Caribbean. Their studies have helped to develop country resources for public health. It's also allowed us to have someone who understands what we do to talk to the government there."*

Retinoblastoma Network| Findings and analysis

Impact, outcomes and outputs

Output Indicator 5.3	Output Indicator 5.4
Network workshop in June 2017. Network partners agreeing an action plan for each centre including data collection and development of local multidisciplinary Retinoblastoma protocols.	Specialist training for the multidisciplinary team in each of the seven centres
Target All centres have an action plan	Target Functioning multidisciplinary team treating Retinoblastoma in seven centres
Action plans have been developed and are ongoing. Data collection is being done. Local multidisciplinary protocols are integral to the exchange visits.	Training has taken place in 5 of the seven centres. Plans are underway for training to take place in Kenya.

Planning meetings and exchange visits

On initiation, the RB-NET held two planning meetings in quick succession. The first, in May 2017 brought key stakeholders to London to work together to develop the approach to partnership to be used by the Network. The second followed in June and brought together all members of the RB-NET in a planning meeting at LV Prasad in Hyderabad, India. Meeting outputs included a resource manual for the management of retinoblastoma in low and middle resource settings, agreement to multidisciplinary Retinoblastoma management protocol by all partners; agreed action plans for each centre and an agreed data collection form for recording core indicators.

Training visits started soon after, and most sites have now had one or two visits (see panel 8) to receive training and observe Indian partners' practice and for Indian or UK partners to assess current service delivery in African partner sites and offer training. These trips have been very well received by partners, although concerns have been raised by RB-NET members on the lack of interaction between African sites. There is a sense that following the DR-NET model more closely could support greater knowledge exchange and – where there is significant regional expertise – provide regional, highly contextually relevant capacity building support:

> *"There are so many practical issues we learn on the DR-NET about how teams are developing services - for example how the screening has moved from the eye clinics to the diabetic clinics. That is an enormous change. In the RB-NET we don't know if there are similar things that can be shifted. If we got together to discuss it, that would be helpful."*
>
> Denise Mabey | ICEH LINK Volunteer and RB-NET stakeholder

> *"We had one meeting – the planning meeting, but we don't know what the others are doing. We don't know about challenges and successes. That would be good."*
>
> Bernadetha Shillio | RB-NET stakeholder | Tanzania Ministry of Health

RB-NET LINK Visits		
Team	Visit date	Travelling to
Malawi team	September 2017	London
A team of 4 for 5 days		
Royal London/Barts team	November 2017	Malawi
A team of 4 for 4 days		
Sankara Nethralaya	March 2018	Kampala and Mbarara, Uganda
Sankara Nethralaya's Dr Vikas and Dr Krishnakumar spent five days visiting participating centres in Uganda, pledging to support the service through teaching materials, sharing protocols, clinical advice, fellowship training and moral support.		
Birmingham	May 2018	Dar Es Salaam, Tanzania
A team of 3 including an ophthalmologist, pathologist and a Retinoblastoma nurse visited for four days. They were paired with their counterparts and other members of the team in Dar. The Hyderabad actions were reviewed and plans made to develop the service in Tanzania.		
Birmingham	February 2019	Muhimbili University, Dar Es Salaam, Tanzania
A team from Birmingham - a paediatric oncologist, oncology nurse and a pharmacist - visited Muhimbili for a country-wide training including all Tanzanian partners.		
Uganda	November 2018	Sankara Nethralaya
Four RB-NET members (ophthalmic nurse, ophthalmology resident, pathologist and paediatric ophthalmologist/team head) from Mulago Hospital in Uganda visited Sankara Nethralaya, India to observe and review the management of patients with retinal diseases, especially children with Rb, with Dr Vikas (Vitreoretinal Surgeon/Ocular Oncologist).		
Moorfields London	Decmber 2018	Ilorin, Nigeria
Dr Ashwin Reddy, Consultant Paediatric Ophthalmologist at Moorfields Eye Hospital, visited Nigeria for a Retinoblastoma workshop, together with Charlotte Clifton, Clinical Nurse Specialist at Bart's Hospital and Caroline Thaung, Consultant Ophthalmologist at Moorfields Eye Hospital. They were also joined by one of the Lagos LINKS team, Dr Musa Kareem. The workshop was locally led by Dupe Ademola-Popoola, Associate Professor & Consultant Paediatric Ophthalmologist.		
LVPEI	December 2018	Nairobi, Kenya
Dr Mishra and Dr Swathi Kaliki from LV Prasad Eye Institute in India, visited Kenya for a Retinoblastoma training visit to Dr Kahaki Kimani and others from Nairobi, Mombasa and Eldoret, as well as residents from various parts of Africa who are training in Nairobi.		
Other training activities		
RB-NET Workshop	June 2017	Hyderabad
64 participants over 3 days		
Retinoblastoma session	August 2017	COECSA Congress Kampala
50 participants to a half day workshop		

Panel 8: *RB-NET LINK visits*

Research

From its initiation, the RB-NET has focused on two key research outputs, requested by African partners during the RB-NET planning meeting in Hyderabad. The first - Global Retinoblastoma Presentation 2017 - is a study on Retinoblastoma presentation, aiming to investigate and analyse the presentation mode of treatment-naïve Retinoblastoma cases diagnosed across the world during 2017. Results of this study will be published in a high impact journal, involving two authors from each RB-NET centre. These findings will be used to influence funding and policies in respect of global Retinoblastoma management.

The RB-NET has also incorporated a cluster RCT in three RB-NET countries assessing the effectiveness of primary care workers in red reflex screening of serious treatable eye conditions (including Retinoblastoma) in children and comparing the effectiveness of two screening devices. If this study provides evidence to support improved Retinoblastoma case finding and the development of standardised care pathways at primary level in LMIC, it stands to make an important impact across the RB-NET.

RB-NET in Uganda

Until recently, all cases of Retinoblastoma in Uganda were managed at Ruharo Mission Hospital, Mbarara under the care of a small team led by British ophthalmologist, Dr Keith Waddell. Presentation of Retinoblastoma in the late stages of the disease is typical across sub-Saharan Africa; the lack of treatment centres and low education about the disease are both factors in delayed presentation and treatment. The majority of treatment provided by Dr Waddell's team is chemotherapy and surgery. The significant expense of these treatments, along with travel and accommodation costs for families, is reliant on raising private funds through charitable donors. Dr Waddell is in his mid-eighties, and close to retirement. Developing a succession plan is essential to continuing services in Ruharo.

In order to address the historical dominance of the Ruharo Retinoblastoma services in Uganda, the RB-NET supports both Ruharo and a team at Mulago Hospital in Kampala, with support from an Indian Retinoblastoma treatment centre, Sankara Nethralaya. The national service will be led from Mulago; a strategic decision that was made during the Hyderabad planning meeting with both Ruharo and Mulago teams.

Two training exchange visits have taken place since the RB-NET began. The first - in May 2018 - brought a team from Sankara to review existing services and potential in both sites and begin the process of developing teams through training, paying particular attention to ensuring the involvement of pathologists and oncologists.

A team of four from Mulago (pathologist, paediatric ophthalmologist, ophthalmic nurse and ophthalmology resident) travelled in November 2018 to Sankara to observe and review the management of patients with retinal diseases, especially children with Retinoblastoma.

> *"The most significant change since the start of the RB-NET is the teamwork. We've built a team and for me that's crucial. Even if I'm not here they can continue, they know what to do. Before the RB-NET we were not handling retinoblastoma in Kampala. We were sending it to Mbarara."*
>
> Grace Ssali | Paediatric Ophthalmologist and RB-NET member | Mulago Hospital, Kampala

It is hoped that this work will be bolstered by the implementation of the red reflex trial testing screening tools and the capability of non-specialist screeners in identifying children with leukocoria i.e. the appearance of a white opacity through the pupil. As well as identification of cataract, such screening also has the potential to save life by picking up Retinoblastoma early.

Late presentation of the majority of cases in Uganda means a low survival rate of around thirty percent. Since the initiation of the RB-NET, coverage of treatment centres has now doubled, providing greater access to patients, improving timely access to treatment. In addition, if the trial is successful, the red reflex study currently underway holds promise in offering a model of outreach screening capable of identifying more children at an early stage of the disease, where survival rates are increased.

The Ugandan RB-NET programme is also seeing evidence of improved team work. RB-NET members in Ruharo and Mulago report enhanced team work as an important advancement to their ability to treat Retinoblastoma. Mulago's coordination with the Uganda Cancer Institute is a significant advancement in improving treatment and developing specialized multidisciplinary teams.

Retinopathy of Prematurity Network | Findings and analysis

Impact, outcomes and outputs

Output Indicator 5.5	Output Indicator 5.6
Network partners agreeing local protocols for ROP screening and treatment.	**Team strengthening in the five centres.**
Kenya, Ghana, Nigeria, Sri Lanka have these in place now. Tanzania is still to develop its local protocol but has started its baseline survey as it currently has no ROP programme in place therefore is at the earliest stage of all the mentees. Pakistan has a screening protocol and is updating its treatment protocol.	This has started in all countries with the help of ROP NET. It began with teams coming to the workshop and all countries have subsequently had team meetings and decided on new team members for training in ROP screening and treatment at the training institutions. Therefore team building is actively taking place.

Leveraging experience to develop the programme

Early planning to identify mentee institutions to include in the ROP-NET was not able to utilise existing networks or LINKS programmes to create a network. Two workshops were undertaken to devise the partnerships and structure for the ROP-NET; the first brought together ophthalmologists from Kenya, Nigeria, Ghana, Tanzania, Sri Lanka, Pakistan and Bangladesh to build on situational analyses. The second brought together multidisciplinary teams to outline needs and create partnerships to address these.

Despite uncertainty in early stages of planning, the ROP-NET has adopted a network model that has successfully created partnerships, and remains dynamic and flexible to evolution in the future.

> *A lot of learning has come from each meeting. We shared feedback from each: reflections on what each country needed and could offer, who we felt would work best together and that was fed back and the whole network could input. That's the idea of having a network, that the ideas can be swapped and shared between different mentors and partnerships. Depending on the next stage for each of the countries we can look at the most appropriate partnerships. I'm also keen to see the number of countries grow. Because it's a brand new thing, there's a lot of work, a lot to learn and set up. Now that we are working well as a team within ICEH and the ROP-NET we'd like to expand.*
>
> Aeesha Malik | ROP-NET programme leader

The ROP-NET has done a remarkable job of leveraging existing expertise both in the form of networks of mentors created through the Trust's Indian RoP programme, but also through taking guidelines developed by that programme as a template to support mentee programmes in developing their own. This – along with the learning the CEHC has developed through the development of the DR-NET - has allowed the ROP-NET to leapfrog much development already invested in by the Trust.

Motivated leadership drawn from across the CEHC

> *"Because they're already linked to the Consortium, we've been able to identify them to be part of the network – and because of their training they're often people who will be good leaders as well."*
>
> Aeesha Malik | ROP-NET programme leader

> *The primary benefit of being involved in the CEHC network is the satisfaction I get by being able to contribute to something good, because without this, establishing RoP programmes in countries where there are no facilities is a huge thing. This is one of the biggest advantages of being part of this network.*
>
> Sucheta Kulkarni | ROP-NET mentor institution lead and CEHC MSc alumni | Pune

A repeated finding of this evaluation is of the involvement of ICEH alumni and previously supported CEHC clinical fellows in leadership roles amplifying impact of activities. The ROP-NET has involved several individuals with long-standing relationships to the ICEH as well as past clinical fellows. Alumni and fellows are well trained, highly motivated and often responsible for managing or setting up new services in the countries in which they work. Because of the dedication of the ICEH team and its training partners, they tend to have ongoing access to mentorship and support. This has helped greatly in developing momentum within the ROP-NET, and mentee countries are in most cases exceeding the expectations of the programme team in initiating and expanding RoP services. For example, the Nigerian team has managed in a very short space of time to begin to roll out RoP screening services to peripheral centres. Dupe Poopola – Nigeria ROP-NET lead and ICEH MSc alumni – has been instrumental in achieving this:

> *"They have taken this leadership role very well. In Nigeria for example, when the Indian partners came for a meeting, Dupe used that as an opportunity to raise awareness in the whole country. She involved all the key people: neonatal societies, ministry reps… The meeting was intended to develop the ROP-NET programme in one institution but she used it to raise awareness of the topic across the country."*
>
> Aeesha Malik | ROP-NET programme leader

CEHC Networks: Legacy

⇒ Across all networks, there has been high commitment to training which has seen direct training visits from UK and south Asian institutions to their partners, observerships to UK and south Asian institutions from LINK members, large scale regional training visits within east and southern Africa, the development of packaged and repeated national training programmes to high numbers of recipients in southern Africa, and an internationally renowned screener/grader qualification leveraged to be made accessible to a high number of trainees within Africa and the Caribbean, supporting quality and consistency within the DR-NET.

⇒ The DR-NET has identified common aims and developed pathways to these, through close interaction of members at the three planning meetings held since the CEHC started. Centrally, the DR-NET team has developed training programmes and toolkits and facilitated meetings to support achieving these aims. Close relationships and reciprocal support have begun to emerge within continents and regions, and examples of knowledge exchange in training, service planning and policy making exist across the DR-NET.

⇒ All three networks have research agendas. RB-NET and DR-NET have integrated multi-country studies into their programmes to provide evidence on two important areas: task shifting for patient identification and understanding barriers to health-seeking behaviour. All networks are engaged in collaborations with high impact journals which will disseminate research from across these networks and provide researchers and implementers from within the regions this activity is focused with opportunities to publish.

⇒ The DR-NET has made an impressive start to involving policy makers in developing DR services in participating LINKS countries. Across the DR-NET, LINKS are experiencing increased political engagement and support to developing DR services. The DR-NET programme has seen agreement to national DRS guidelines from over half of the Ministries of Health involved in the programme. Supportive mechanisms including the creation of a toolkit to guide development of plans, and facilitated information sharing between DR countries has accelerated this and set a foundation to support other members to move towards governmental support for DR services. DR-NET Caribbean has been particularly successful in achieving government support within countries in a short space of time.

⇒ Screening and treatment figures achieved by the DR-NET are impressive and for both diabetic retinopathy screening and treatment, targets have exceeded those originally set by the programme team; by two thirds for screening, and a third for treatment.

CEHC Networks: Pathway to sustainability

⇒ Embedding research as a priority of these networks going forward stands to provide evidence on need (to make the case for increased investment to these conditions) and the effectiveness of working collaboratively (to make the case for channeling funds through coordinating mechanisms to maximize impact).

⇒ Many of the challenges that now face the DR-NET members may be effectively addressed at a regional level. Most members agree that face to face meetings support progress, but with a very large network, these are logistically challenging, costly and infrequent. Concentrating

effort regionally may reduce these barriers to bringing members together. Focusing the DR-NET on regional activity may also support ensuring local ownership and co-design, finding solutions to technical challenges such as equipment maintenance, delivering regional training and sharing expertise and lessons.

⇒ Packaging the DR-NET programme's mission, impact and strategy may help to accelerate progress and provide powerful advocacy tools to leverage further funding. The DR-NET's intention to develop an online repository of data and knowledge exchange has not been fully realised. A commitment to creating an identity and mechanism for knowledge sharing, may support the DR-NET and other CEHC-funded networks to better disseminate knowledge, tools and research generated through the programme, benefitting network members and other DR, Retinoblastoma and ROP stakeholders globally.

Peek

Introduction

Peek started as a programme to develop affordable technology for eye health programmes. It is developing tools and systems to connect people to eye health services. These are beginning to scale up to regional and national level programmes. The Supplementary Funding has supported scale up of these activities, enlargement of the core management and development team and catalysing the roll out of a national school vision screening programme in Botswana.

By the mid-point of the programme, Peek had achieved remarkable progress while undergoing significant organisational evolution. Setting up as a charitable trust with a wholly owned subsidiary limited company was initiated to allow Peek to operate with the freedom and flexibility necessary to raise revenue from commercial sales to support ongoing Peek programming in low- and middle-income countries. Peek's activity at the end of 2016 was focused on developing, validating and bringing to market software and hardware systems and in this, was largely on track. Considerable efforts were also being made to integrate EyeNotes - an electronic patient record system – into Peek as an additional activity. Strong relationships had been developed with decision makers in the countries in which Peek programmes were being trialed and scaled – notably Kenya and Botswana - and the team focused on introducing Peek systems for screening and identification only where infrastructure exists to support treatment.

Findings and analysis

Impact, outcomes and output

Impact	Outcome 3
Improved eye health services in LMIC commonwealth countries, due to training of eye care specialists; improvement in research capacity and eye care technology	Strengthened eye health systems in Commonwealth LMICs in three key areas of people, knowledge and tools
Impact Indicator 2 Number of people accessing eye care services supported by new technologies (Peek and OpenEyes) and through improved eye health systems	**Outcome Indicator 3 (Tools)** New technologies (Peek and EyeNotes) developed and adopted in 40+ clinical units and community settings
Target 1,000,000 people by programme end	Target 40 units by programme end
Close to 300,000 and rising quickly with multiple new programmes initiated	***Peek Acuity*** *available worldwide in English, Spanish and French, downloaded in around 170 countries to date, with approximately 43,000 downloads up to end January 2019.* ***Peek Retina Ophthalmoscope*** *Product brought to market, distributed in over 70 countries, sold directly in over 30 countries to date. Focus is on improving product in line with market needs before developing a market strategy.* ***Peek Solutions*** *utilising Peek tools in use in 18 units across seven countries for research, active programmes or pilot/design programmes including school eye health in Kenya, Rwanda, Zimbabwe, Indonesia and India, community eye health in Pakistan, Kenya and Zimbabwe* ***mRAAB*** *population survey tool upgraded to V7.0 and use in Cambodia, Palestine and Pakistan with planned use for a further 25 units in Pakistan commencing 2019.*

Output 7	Output 7
Output Indicator 7.1 Development of new apps and hardware to enable use of Peek	Output Indicator 7.2 Progress in the research and evaluation
Target (year 4) (1) Peek Contrast available (2) Peek Acuity available with multiple language support (3) Peek Retina in use in multiple countries (4) ROP camera design for manufacture (5) Peek School Screening roll out active (6) mRAAB completed [pending full funding] (7) Peek Community Screening in multiple pilot sites	Target (year 4) (1) Basic validation study completed (2) Peek Contrast validation (3) School screening, optom and reception app evaluated (4) Community Screening and Triage app validated (5) Community Screening trial utilising validated tests
(1) Peek Contrast Validation complete in Ethiopia, effectiveness trial underway in the Gambia, being prepared for product certification and release *(2) Peek Acuity available worldwide in English, Spanish and French, and has been downloaded in 98 countries to date.* *(3) Distributed to over 70 countries (crowdfunding campaign) and sold in over 30 countries* *(4) ROP Camera design for manufacture on target for clinical testing with working ergonomic designs and camera sensor technology* *(5) Peek school screening delivered county-wide programme in Trans Nzoia, Kenya, RCT in India and active programmes commencing in Rwanda and Zimbabwe. Reviewing options to support in Uganda and Tanzania.* *(6) mRAAB version 7.0 complete and in use in Palestine and Afghanistan* *(7) Peek community pilot sites identified in Pakistan, Kenya and Zimbabwe*	*(1) Peek retina paper published in JAMA Ophthalmology; Peek outreach system under evaluation in Kenya* *(2) Peek Contrast validation completed* *(3) School screening, optom and reception app evaluation ongoing and now in active use in several locations* *(4) Community Screening and Triage app validation first phase completed* *(5) Trial 40% complete (delayed due to political instability). Due to complete in July 2019.*

Output 7	Output 7
Output Indicator 7.3 Development of new functionality of Peek SYSTEMS for eye health	Output Indicator 7.4 Uptake of Peek SYSTEMS
Target Roll out of Peek EPR to all suitable DR.NET sites plus other sites outside the DRNET (estimated 10 by year 4 end; 40 by programme end)	Target (year 4) 30 Eye Depts with OpenEyes
Phase 1: New DR screening application has been developed *DR System has been pilot tested in Tanzania, operating in four linked hospitals.* *Peek Screening and Triage Systems have been developed and currently being tested* *Peek EPR - now named "Peek Reception" being utilised across all Peek programmes to ensure closed loop between screening and services. Additional functionality developed includes administration dashboard for live visualisation of programmes, in-built inter-observer variation tools, configurable stations to enable multiple set up configurations to suit wide range of on the ground needs and providing platform scalability, new integration with Peek Acuity built in to the core web-system (Peek Capture)*	*Peek Solutions utilising Peek tools in use in 18 units across seven countries for research, active programmes or pilot/design programmes including school eye health in Kenya, Rwanda, Zimbabwe, Indonesia and India, community eye health in Pakistan, Kenya and Zimbabwe*

An evolving programme

The Peek programme's aims have evolved since the beginning of the CEHC programme. The targets set out by the team at the beginning of the CEHC programme are less relevant now to Peek's strategy, as it has shifted its focus – in consultation with the Trust – towards developing an integrated platform incorporating a suite of tools including Peek Acuity and a micro Electronic Patient Record (EPR) system.

> *"Our focus has been on developing and improving the patient's journey from being invisible, to identified, to diagnosed and then routed to the correct location for treatment. And for that loop to be completed there needs to be something at the hospital service that allows us to know that a person has arrived and received treatment… we are utilising our Reception App as the end point of the system that captures high level data on demographics, key diagnosis and outcome and can also further follow them up to ensure desired outcomes have been met. Although we reduce barriers to get individuals to the services, we don't track them within the service."*
>
> Andrew Bastawrous | Peek founder and programme leader

This system has now taken priority over developing Peek hardware, which was also supported by the Trust. The Peek team have successfully brought Peek Retina to market, and an ROP camera is currently in development. If successful following trials, the team will not pursue directly taking the camera to market, but will look to an external manufacturer to do this. Despite being a deviation from the original proposal, all these developments have involved the Trust. This is a somewhat unique relationship, and as Peek Director Andrew Bastawrous outlines:

> *"I think it's fairly unusual in the non-profit world for an organisation to back a start-up, in the way that [the Trust] did. But they've been incredibly flexible with us as things have changed; as the external environment has changed*."

The question now is whether the programme is achieving equivalent impact to that which it set out to achieve albeit through different tools and approaches. What is noticeable through reviewing progress against targets is that the Peek programme is less aligned with the DRNET and ROPNET than originally planned.

The team has worked to trial Peek Retina for application in DR services, but as yet, the hardware is not providing results that allow it to be successfully used by non-specialists in screening for DR. In order to improve this, a more expensive model would have to be made, and the team has made the decision to determine which users would best benefit from the existing product (e.g. for glaucoma), than try to create something expensive and potentially unsustainable which would also be a distraction from the system solutions.

Peek systems: an emphasis on software and support

Focus has instead shifted to providing outreach teams serving schools and communities, with easy to use systems utilising smartphone, tablet or desktop-based software that can identify, screen and track patient journeys to services, and provide demographic and epidemiological data on the communities that health facilities serve.

In addition to the development of systems to support school and community screening and referral programmes, Peek has also developed mRAAB; a fully digital version of the Rapid Assessment of Avoidable Blindness (RAAB). mRAAB has already provided data from 11 national and regional surveys to be used in better planning of services to address avoidable blindness.

Although the structure of Peek's intended deployment of software and hardware has changed from initial targets set, there remains a commitment to ensuring accessibility through making Peek Acuity and mRAAB free for any user to download.

School and community screening

Hillary Rono's CEHC-supported PhD has made a major contribution to the development of Peek's school screening programme and will also support the development of the community programme. The school screening RCT implemented in Trans Nzoia county has been published in the high impact journal Lancet Global Health, and greatly benefited the development of Priya Morjaria's PhD; an effectiveness trial driven by Peek to determine adherence to spectacle wear by children. Following validation, the team in Kenya are now testing community screening through RCT within the same county.

> *"The RCT demonstrated that Peek technology could aid adherence to referrals, and that there's a potential application for the technology in the health system. From there, we wrote another proposal to scale it up from 50 schools from the trial to cover 300 schools*

in the whole of the county. Actually our total is 350 schools. I could see how it could change the whole process of identification of children with avoidable blindness."

Hillary Rono | CEHC research fellow and Peek research, design and development team | Kenya

Rono is an adept advocate, and has had great success in working with decision makers to increase investment to eye care in Kenya. His ability to demonstrate the effectiveness of a novel school and community screening and be an effective spokesperson for the Peek programme has already piqued Ministry interest in the programme and he is confident that this support will increase.

"In Kenya there is renewed interest from national and provincial government [in investing in eye care]. For government, you must have a product that is working which we have seen with Peek. We have tried Peek in several locations and it can work. Once [the evidence is] there we need to market and advocate to government… by 2025 we should have funding going through."

Through an iterative process, learning from the Kenya and India RCTs, along with the evaluation and ongoing refinement of Peek Botswana's work in school screening, has shaped the development of Peek Solutions, a five step process developed for replication in new programmes.

Expansion of Peek programmes

The work to develop, test and refine Peek Solutions has been made possible by the funding from the Trust, informed by Trust-funded trials in Kenya and India. The Trust has also supported Peek's work to roll out a national school screening programme in Botswana. This national programme stands to be the first of its kind; the government of Botswana paying for Peek services to deliver screening to every school child in the country. However, agreement by the government to fund the programme has been severely stalled. Panel 1 provides detail on the learnings Peek has taken from this delay, which are informing their approach to a major seven-year programme with CBM, agreed in 2018.

Peek Botswana: Addressing barriers to political influence

Peek Botswana grew from a partnership with Botswana-UPenn, Pennsylvania University's programme to build healthcare and research capacity in Botswana. The proposal for the Peek Vision Botswana school screening programme builds on the learning from the Peek team's work in Kenya.

Throughout 2018, the Peek Botswana programme has been engaged in efforts to secure a commitment from the government to funding a national programme of vision screening in schools. This national scale programme proposal is based on a pilot undertaken in 2016 and 2017, during which 12,877 school children were screened at 49 schools. This pilot tested, refined and demonstrated a business case for investing in Peek technology to screen all school children in the country.

The success of this pilot resulted in the Government of Botswana pledging to fund the national programme. This was further emphasised in April 2018, when His Excellency President Masisi of Botswana attended the Commonwealth Heads of Government meeting (CHOGM) in London, making a public announcement of Botswana's commitment to the programme.

Despite this remarkable commitment, in mid-2018 the process of securing formal agreement to this stalled for a number of reasons, not least a change of Health Minister leading to a complete reshuffle of the Ministry of Health and Wellbeing and the inevitable loss of institutional relationships for Peek.

Challenges in navigating procurement procedures within the ministry have followed, and due to cultural norms determining power and seniority, the national Peek Botswana team – predominantly young and with mainly female leadership - has had little influence in driving the agreement forward.

In June 2018, Peek recruited Partnerships Manager Stuart Mackie to support efforts to move forward the agreement with the government. Stuart has taken several trips to Gabarone to meet with the Peek team, national partners and members of the MoH to try to progress the agreement. Peek's director, Andrew Bastawrous and the Trust's director of programmes, Andrew Cooper have also met with officials. Despite this, there has been no formal agreement to funding the programme.

These efforts to influence have been undertaken with sensitivity to appropriate political protocols, and have drawn upon support from local influencers, including the senior leadership of Standard Chartered Bank in Botswana, and the British High Commissioner to Botswana. The team have used both opportunistic and formal approaches to engaging with Ministers.

While the Peek Botswana programme has hit delays in national implementation, the team has continued to work hard to develop the tools and systems necessary to implement a national programme. They have conducted rigorous user testing and piloting of the Peek system with the cadres who would be involved in a national roll out. The system has seen significant change since the pilot, influenced by the activity of the team in Botswana as well as testing in India and Kenya. The team are also developing health promotion materials to support the programme, have designed a kit bag for Peek outreach teams and secured its production through an annual e-solutions competition merging health and technology, and piloted a mapping app to locate resources and facilities to support implementation.

Lessons learned

Peek's global programme has expanded through its partnership with CBM to provide government programmes with technical support to use the Peek System. It will therefore rely increasingly on securing agreement from governments to procure these services. Learning from challenges in Botswana serves Peek well in planning future political engagement.

> *"Procurement of services is really challenging. The experience in Botswana has helped us in thinking about areas of high risk that needs to be considered in supporting governments. The progress we've made through our partnership with CBM in Zimbabwe, Pakistan and Rwanda has made significant progress."*
>
> Andrew Bastawrous | Peek founder and programme leader

Considering some of the issues that have been experienced by the DRNET team in achieving influence in developing DR services in Botswana, it may also be useful for the CEHC team to analyse the broader policy engagement and influence strategies used by stakeholders in both teams to determine if an alternative approach to political buy in is necessary.

A great deal of investment has been made into building the capacity of the Peek team in Botswana. The progamme now focuses on using this talent globally. As Peek expands, so the team works to disseminate learning from implementation and Peek team in Botswana has been an important part of that. Botswana's project delivery lead Keitumetse Thamane, for example, has been involved in training and project delivery support external to the Botswana programme.

One of the really big successes in Peek is that we are able to exchange ideas, like Keitumetse going to Pakistan. It's really important that we are able to develop our own team and we're very good at doing that.

Priya Morjaria | Research, Design and Development Manager | Peek

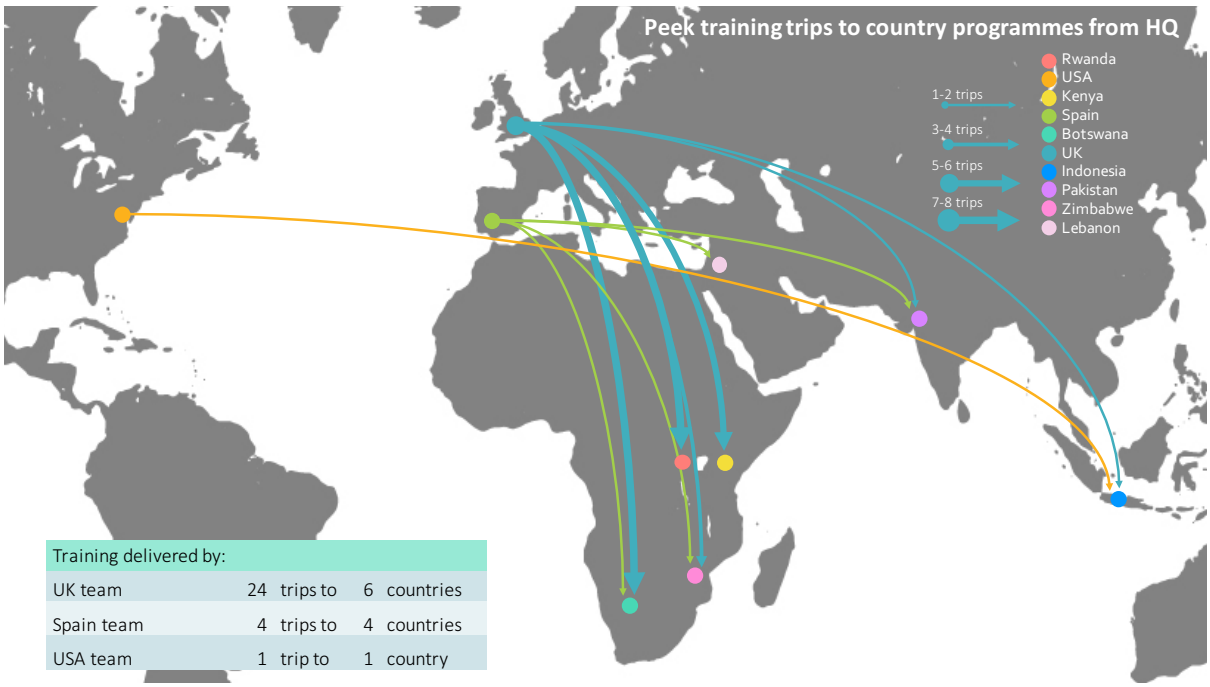
Across the global Peek programme, members of the development and delivery teams cite the benefits of utilising on-the ground experience, testing and innovation, and pooling data on challenges to improve systems. The delays in getting the Botswana national programme off the ground have made a significant contribution to that learning.

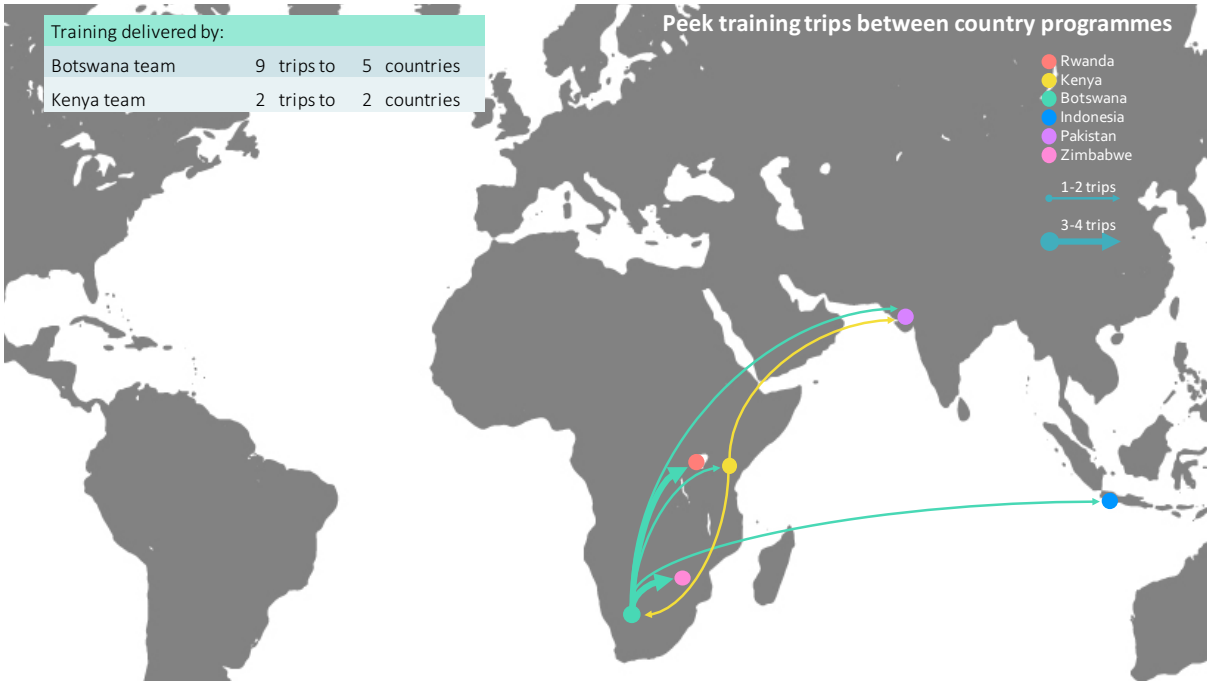
Panel 1: *Addressing barriers to implementation for Peek Botswana*

Peek's global agreement with CBM will roll out school and community screening programmes in multiple countries using Peek Solutions. Much of Peek's activity now focuses on this. Knowledge exchange between country programmes has intensified and those who have led in shaping the school and community screening approaches are becoming involved in training others, much of the time through South to South collaboration (see panel 2 for details on training exchange visits undertaken between countries since 2016). For example, since 2016, over one quarter of all training visits to Peek country programmes was delivered by LMIC country based Peek programme members.

"Bringing the Peek team in Botswana into more global discussions has been such a good experience. We've been able to share, learn, exchange ideas. I sat with Peek's Botswana country director when he started and was able to learn from it and improve it"

Priya Morjaria | Research, Design and Development Manager | Peek





Panel 2: *Training exchange visits 2016 – March 2019 within the Peek global community*

In the longer term, the Peek team foresee the growth of a model of programme and product development and refinement, training for delivery and ongoing programme support. This may be physically located as a 'centre of excellence' in Kitale, Kenya, which would undertake continued delivery and evolution of the school and community programme in the region, feeding improvements into the global Peek system. In addition, it would train teams to deliver the programme in other regions or elsewhere globally and provide ongoing support to existing programmes. This would extend the model of support already being provided through the team in Botswana, and ultimately would allow a greater proportion of programme development and support to take place in the regions in which they will be implemented.

Peek now has greater ability to invest in new models of training and technical assistance such as that proposed in Kitale. Although at the outset of the CEHC programme, around ninety percent of Peek's work was supported by this funding, since the beginning of 2018, Peek has begun to earn income through provision of services to NGO's and governments, reaching the point now where as well as benefiting from funding through the CEHC, Peek is also funding CEHC activities.

> *"This year we've just made our first grant, to the London School [of Hygiene & Tropical Medicine] of over £200,000 towards the development of RAAB work. We always wanted to get to the point where the [CEHC's] long term funding - at least a proportion of it - would come from Peek. As we become sustainable and therefore profitable that profit needs to be gifted, either back into company development to improve our services or to external parties with a shared mission. We're starting to deliver on that."*
>
> Andrew Bastawrous | Peek founder and programme leader

Legacy

⇒ Peek's development from proof of concept to a fully operational company and charitable foundation has been made possible through both the funding from, and the partnership with the Trust. Throughout the CEHC programme, the open relationship between the Trust and Peek has allowed for flexibility in adapting programme aims based on testing and feedback of software, hardware and systems. The Trust has provided Peek with important advocacy opportunities, providing public platforms to communicate Peek's work, and supporting country programmes directly through Commonwealth partnerships.

⇒ Within the five-year period of the CEHC programme, Peek has begun to generate revenue to a level at which it can fund programmes directly, moving it towards a self-funding, sustainable model. In 2018, the first Peek grant was made, to mRAAB implementation through the ICEH.

⇒ In 2018, Peek agreed a seven year, multi-country partnership with CBM. This agreement represents an important investment in the Peek programme. It will see the deployment of Peek Solutions - developed through the CEHC programme - to deliver large scale surveys (RAAB) to determine unmet need and deploy national school and community screening services to help meet that need, all in partnership government and local implementing partners including active work in Zimbabwe, Rwanda and Pakistan and plans to potentially start in Nepal, Uganda and Tanzania in the next year.

⇒ As the Peek programme expands, its country programmes are developing the capacity to implement, refine and support other programmes in programme initiation and training. South to south knowledge exchange provides contextually relevant training and technical support to Peek's newest programmes, and develops centres of expertise in the countries and regions where Peek strives to have impact.

⇒ Peek continuously refines and improves its apps and software products. mRAAB 7.0 is now available and refinements continue to make the process of data collection for these major prevalence surveys more efficient and accurate. Peek Acuity is now available in three languages and has been downloaded in around 170 countries worldwide (including 50 of the 53 commonwealth countries). Both of these apps are available to download for free and can be used on smartphone and tablet.

Path to sustainability

⇒ Peek has invested heavily into the development and rigorous testing of hardware and has learned a great deal about the challenges and costs of bringing medical devices to market. There is a desire within the CEHC to utilise these technologies within programmes - in particular for DR and ROP service development – which has been explored but not fully realised by the Peek programme. Peek must now determine whether to further prioritise the development and manufacture of the devices invested in, and if not, where opportunities lie for others to take this on to maximise the impact of the investment already made.

⇒ Since the CEHC began, the Peek programme has changed focus towards the provision of technology and technical support services to national programmes. As it moves forward in

developing service delivery programmes with Ministries of Health and partners it will continue to have to navigate the complexities of government tendering and procurement processes. The team has learned much from the challenges experienced in Botswana, and it is essential that these learnings inform the approach taken in securing future agreements with governments, in order to minimise the risk of delay or withdrawal of commitment.

E. Progress against CEHC Logframe

Impact

Improved eye health services in LMIC commonwealth countries, due to training of eye care specialists; improvement in research capacity and eye care technology

Outcome

Strengthened eye health systems in Commonwealth LMICs in three key areas of people, knowledge and tools

Impact Indicator 1	Impact Indicator 2	Outcome Indicator 1	Outcome Indicator 1	Outcome Indicator 2	Outcome Indicator 3
Number of patients per year screened for DR in eight Commonwealth LMICs	Number of people accessing eye care services supported by new technologies (Peek and OpenEyes) and through improved eye health systems	PEOPLE: Number of Clinical Fellows returning to their home institutions and using their new skills in eye care or planning.	PEOPLE: Number of Public Health Fellows returning to their home institutions and using their new skills in eye care or planning	KNOWLEDGE: Number of research papers published, studies produced, conferences presented at (demonstrating the strengthened research capacity in Commonwealth LMIC).	TOOLS: New technologies (Peek and EyeNotes) developed and adopted in 40+ clinical units and community settings
Target By year 5, 15,000 patients screened annually; 37,500 screened in total	Target 1,000,000 people by programme end	Target 100 returned fellows using new skills in eye care or planning	Target 17 MSc scholars 15 MPH scholars 10 diploma scholars	Target A minimum of 3 published papers per fellow	Target 40 units by programme end
By the end of 2018, DR-NET partners reported a total of 107,389 patients screened	*Close to 300,000 and rising quickly with multiple new programmes initiated*	*124 short- and long-term fellows appointed, training or returned home; 64 long-term, 60 short-term.* *14 short-term team trainings completed. 19 mentees receiving additional support.*	*On track for passes for:* *21 MSc scholars* *12 MPH scholars* *10 diploma students*	*By end 2018:* - *16 publications accepted or in press* - *11 publications submitted and in review* - *9 manuscripts in preparation* - *22 meetings held or attended to share findings* - *11 public engagement opportunities undertaken* - *7 resources produced (guidelines, toolkits, training materials)*	***Peek Acuity*** *available worldwide in English, Spanish and French, downloaded 43,000 times in close to 170 countries to date* ***Peek Retina Ophthalmoscope*** *Product brought to market, distributed in 71 countries, sold directly in 31 countries to date. Focus is on improving product in line with market needs before developing a market strategy.* ***Peek Solutions*** *utilising Peek tools in use in 18 units across seven countries for research, active programmes or pilot/design programmes including school eye health in Kenya, Rwanda, Zimbabwe, Indonesia and India, community eye health in Pakistan, Kenya and Zimbabwe* ***mRAAB*** *population survey tool upgraded to V7.0 and used in Cambodia, Palestine and Pakistan with planned use for a further 25 units in Pakistan commencing late 2018.*
Exceeded target	Target partly met	Exceeded target	Exceeded target	Target met	Target parameters changed

Output 1 Public Health for Eye Care Fellowships (LSHTM)	Output 2 MPH in Community Eye Health (UCT) / Post-graduate Diploma in Community Eye Health	Output 3 Open Educational Resources for Eye Care development	
Output Indicator 1.1	Output Indicator 2.1	Output Indicator 3.1	Output Indicator 3.2
11 ophthalmologists / programme managers from Commonwealth LMICs complete the one year MSc PHEC course; 6 additional fellowships from 2017	Nine ophthalmologists / programme managers, from LMIC complete the two year MSc PHEC course; 6 additional fellowships from 2017; 10 new diploma fellowships from 2017.	Completed development of three modules. Completed pilot testing in Cape Town. Expert review report.	Number of institutions and users accessing OER
Target 17 localities with a lead person, trained to initiate and implement eye care programmes	Target (MPH only) 15 localities with a lead person, trained to initiate and implement eye care programmes	Target 5 courses available and 1 in development	Target 20 Institutions
5 additional MSc's were funded through cofinancing from International Students House, London, through fee waiving for student accommodation. *On track therefore for 22 localities with a lead person. Though 1 fellow did not pass, they are actively using skills from training in their locality.*	*On track for 12 localities with lead person, though 3 of these are experiencing delays in submitting year 2 dissertations. Two scholars have dropped out of the course.*	*In use:* *Eliminating Trachoma* *Ophthalmic epidemiology: basic principles* *Ophthalmic epidemiology: application to eye disease* *Global blindness* *Diabetic Retinopathy* *In development:* *Retinopathy of Prematurity* *Glaucoma*	*19,620 users joining courses, of which 11,429 are active learners* *188 countries and territories reached*
Exceeded target	Target partly met	On track to exceed target	Target parameters changed

Output 4

Clinical Fellowships

Output Indicator 4.1	Output Indicator 4.2
Number of short-term Fellowships completed; Number of short-term team trainings completed	Number of long-term Fellowships completed. Number of clinical mentorships established
Target 40 ophthalmologists in LMICs; 5 additional fellowships from 2017 5 new team-trainings from 2017	Target 60 ophthalmologists in LMICs; 5 additional fellowships from 2017. 20 clinical mentorships established from 2017
58 short-term fellowships completed. 2 short-term fellowships appointed. *17 short-term team trainings completed (8 teams).*	*48 long-term fellowships completed. 14 long-term fellowships currently in progress. 2 long-term fellowships appointed* *15 mentorships with 19 mentees in six African countries.*
Exceeded target	On track to exceed target

Output 5

Diabetic Retinopathy Training Network (DRNET)

Output Indicator 5.1	Output Indicator 5.2
Network partners and National Prevention of Blindness Committees agreeing national framework for DR screening and treatment	National DR frameworks in place in eight Commonwealth LMICs
Target All 8 national DR frameworks agreed by 2016; plus one additional from Oct 2016.	Target All partners in eight LMICs have national DR frameworks in place 2019; plus one additional from Oct 2016
Agreement in place or draft in nine Commonwealth LMICs – Kenya, Tanzania, Zambia, Botswana, Uganda, Nigeria, Ghana, Malawi, Jamaica.	*National DR frameworks in place in Zambia, Botswana, Uganda, Tanzania and Kenya; work underway in Nigeria, Ghana, Malawi and Jamaica.*
Target partly met	Target partly met

Output 5

RbNET and ROPNET

Output Indicator 5.3	Output Indicator 5.4	Output Indicator 5.5	Output Indicator 5.6
Network workshop in June 2017. Network partners agreeing an action plan for each centre including data collection and development of local multidisciplinary Rb protocols.	Specialist training for the multidisciplinary team in each of the seven centres	Network partners agreeing local protocols for ROP screening and treatment.	Team strengthening in the five centres.
Target All centres have an action plan	Target Functioning multidisciplinary team treating RB in seven centres		
Action plans have been developed and are ongoing. Data collection is being done. Local multidisciplinary protocols are integral to the exchange visits.	*Training has taken place in 5 of the seven centres. Plans are underway for training to take place in Kenya.*	*Kenya, Ghana, Nigeria, Sri Lanka have these in place now. Tanzania is still to develop its local protocol but has started its baseline survey as it currently has no ROP programme in place therefore is at the earliest stage of all the mentees. Pakistan has a screening protocol and is updating its treatment protocol.*	*This has started in all countries with the help of ROP NET. It began with teams coming to the workshop and all countries have subsequently had team meetings and decided on new team members for training in ROP screening and treatment at the training institutions. Therefore team building is actively taking place.*
Target met	On track to meet target	No target set	No target set

Output 6 Research Fellowships	Output 7 Portable Eye Examination Kit (Peek)			
Output Indicator 6.1	**Output Indicator 7.1**	**Output Indicator 7.2**	**Output Indicator 7.3**	**Output Indicator 7.4**
Five Phd Students recruited (including one within Peek testing) and one post doc recruited through open competition	Development of new apps and hardware to enable use of Peek	Progress in the research and evaluation	Development of new functionality of Peek SYSTEMS for eye health	Uptake of Peek SYSTEMS
Target 6 researchers recruited and completed PhDs/post-docs	Target (year 4) (8) Peek Contrast available (9) Peek Acuity available with multiple language support (10) Peek Retina in use in multiple countries (11) ROP camera design for manufacture (12) Peek School Screening roll out active (13) mRAAB completed [pending full funding] (14) Peek Community Screening in multiple pilot sites	Target (year 4) (6) Basic validation study completed (7) Peek Contrast validation (8) School screening, optom and reception app evaluated (9) Community Screening and Triage app validated (10) Community Screening trial utilising validated tests	Target Roll out of Peek EPR to all suitable DR.NET sites plus other sites outside the DRNET (estimated 10 by year 4 end; 40 by programme end)	Target (year 4) 30 Eye Depts with OpenEyes
- *8 PhD and 2 post-doctoral fellows recruited* - *6 research fellows on track to complete PhDs by December 2019* - *1 research fellow failed to upgrade; on track to complete MPhil by May 2019* - *1 research fellow unable to undertake post doc; funds transferred to Peek budget for research* - *1 research fellow delayed in completing post doc. Completion expected by end 2019*	*(8) Peek Contrast Validation complete in Ethiopia and being prepared for product certification and release* *(9) Peek Acuity available worldwide in English, Spanish and French, and has been downloaded in 98 countries to date.* *(10) Distributed to 71 countries and (crowdfunding campaign) and sold in 31 countries* *(11) ROP Camera design for manufacture on target for clinical testing with working ergonomic designs and camera sensor technology* *(12) Peek school screening delivered county-wide programme in Trans Nzoia, Kenya, RCT in India and active programmes commencing in Rwanda, Zimbabwe and Indonesia* *(13) mRAAB version 7.0 complete and in use in Palestine, Eritrea and Afghanistan* *(14) Peek community pilot sites identified in Pakistan, Kenya and Zimbabwe*	*(6) Peek retina paper published in JAMA Ophthalmology; Peek outreach system under evaluation in Kenya* *(7) Peek Contrast validation completed* *(8) School screening, optom and reception app evaluation ongoing* *(9) Community Screening and Triage app validation first phase completed* *(10) Peek Acuity is available worldwide in English, Spanish and French, and has been downloaded in 98 countries to date, with a total of 20,604 downloads as 31st May 2018.*	*Phase 1: New DR screening application has been developed* *DR System has been pilot tested in Tanzania, operating in four linked hospitals.* *Peek Screening and Triage Systems have been developed and currently being tested* *Peek EPR - now named "Peek Reception" being utilised across all Peek programmes to ensure closed loop between screening and services. Additional functionality developed includes administration dashboard for live visualisation of programmes, in-built inter-observer variation tools, configurable stations to enable multiple set up configurations to suit wide range of on the ground needs and providing platform scalability, new integration with Peek Acuity built in to the core web-system (Peek Capture)*	*Peek Solutions utilising Peek tools in use in 18 units across seven countries for research, active programmes or pilot/design programmes including school eye health in Kenya, Rwanda, Zimbabwe, Indonesia and India, community eye health in Pakistan, Kenya and Zimbabwe*
On track to exceed target	Target met	Target met	Target parameters changed	Target parameters changed

F. Annexes

I: Research Fellow outputs

Furahini Mndeme

Public Engagement

- Trained community nurses who regularly examine children in Reproductive and Child Health (RCH) clinics on screening and early detection of cataract and retinoblastoma

Publications in press, accepted for publication or undergoing review

Screening study
Manuscript submitted and under review
Case control study
Under review for submission
Outcome study
Under review for submission

Guidelines, toolkits or training materials developed

- Developed training material for red reflex examination by non-ophthalmic nurses

Meetings held or attended to share findings

- Attended and presented results at an International Strabismological Association & American Association for Paediatric Ophthalmology and Strabismus scientific conference, 18th – 22nd March 2018, Washington, DC.

Prabhath Piyasena

Publications in press, accepted for publication or undergoing review:

Development and Validation of a Diabetic Retinopathy Screening Modality Using a Hand-Held Non-mydriatic Digital Retinal Camera by Physician Graders at a Tertiary-Level Medical Clinic: Protocol for a Validation Study
JMIR Res Protoc
Published 2018
Systematic review and meta-analysis of diagnostic accuracy of detection of any level of diabetic retinopathy using digital retinal imaging: *Systematic Reviews*
Published 2018
Validation of a DR screening intervention: *BMC-Ophthalmology*
Article accepted and under revision
Assessment of acceptability of a health educational intervention (leaflet and video) for DRS: *BMC Public Health*
Manuscript submitted and under review
Qualitative study on perceptions of barriers to access DR screening services in the Western province: *BMC Endocrine Disorders*
Manuscript submitted and under review
Systematic review of the literature on barriers to access DR screening: *PLOS-ONE*
Responding to reviewers' comments
Qualitative study on perceptions of barriers to access DR screening services in the Western province: perspectives of service providers: *BMC Health Services Research*
Revisions submitted and under review

Guidelines, toolkits or training materials developed:

- Training material and guidelines for physicians on DR screening using a hand-held retinal camera
- Health educational leaflets and videos (in Sinhala, Tamil and English) to improve referral uptake

Meetings held or attended to share findings:

- Oral presentation at the ISGEO-Hyderabad – 2018 – On barriers to access DR screening by the people with diabetes in the Western province

Simon Arunga

Publications in press, accepted for publication or undergoing review

Bilateral Candida keratitis in an HIV patient with asymptomatic genitourinary Candidiasis in Uganda: *Medical Mycology Case Reports*
Published
Emergency management of Microbial Keratitis: *Community Eye Health Journal*
Published
How to make Fluorescein strips: *Community Eye Health Journal*
Published
Management of Fungal Keratitis: A systematic review: *Wellcome Trust*
Draft manuscript ready
Challenges of management of Microbial Keratitis in Uganda: A hospital based audit: *BMC Ophthalmology*
Manuscript submitted and under review
Epidemiology of MK in Uganda: A hospital based cohort: *IOVS*
Manuscript submitted and under review
Risk factors for MK in Uganda: A community based case control study: IOVS
Manuscript submitted
Clinical / Microbiological correlation: *BJO*
Analysis underway
Delay along the care seeking pathway of patients with MK in Uganda: *Ophthalmic Epidemiology*
Manuscript submitted and under review
Role of Traditional Eye Medicine in treatment of MK in Uganda: A hospital and community based mixed methods study: *Tropical Medicine and International Health*
Quantitative and Qualitative analysis completed
Quality of Life of MK patients in Uganda: A matched comparison community based study / Effect of treatment on QoL among MK patients in Uganda: *TBD*
Analysis completed
Capacity of the Health system in Uganda to manage MK: A situational analysis: *BMC Health Systems*
Analysis underway

Meetings held or attended to share findings

- Presented on key findings from his PhD at Wellcome trust scientific meeting, Gambia 7th-10th January 2019
- Presented on A Baseline KAP study: Diabetic Retinopathy knowledge, attitudes and practices among diabetic patients and clinicians in SW Uganda, with his colleague Teddy Kwaga at the DR-NET meeting, Ethiopia August 2018
- Invited speaker, Presenting on "Training and Research in ECSA region at World Ophthalmology Congress, Spain 16th - 19th June 2018
- Presented on his area of research, Microbial Keratitis, at the COECSA Congress, Tanzania August 2016

Roseline Duke

Public Engagement

- Public engagement with the Ministry of Health is scheduled for the first week in June (by which time the publication of the two key articles on general description of cerebral palsy in the children population in Cross River state and the result of the intervention articles would have been ready for sharing with the ethical review board and key public stake holders.

Publications in press, accepted for publication or undergoing review:

Effect of visual support strategies on the quality of life of children with cerebral palsy and cerebral visual impairment and/or perceptual visual dysfunction in Nigeria: study protocol for a randomized controlled trial: *Trials*
Manuscript submitted and under review

Perception of carers about cerebral visual impairment/perceptual visual dysfunction in children with cerebral palsy in Nigeria: Implications for the use of the Insight Question Inventory and visual support strategies: *Disability and Education*
Manuscript submitted and under review

Profile of cerebral palsy in a community population of Nigerian children: *Developmental Medicine and Child Neurology*
Draft manuscript ready

Systemic Comorbidity in Children with Congenital Cataracts in Nigeria: *International Health Journal*
Draft manuscript ready

Guidelines, toolkits or training materials developed:

- Key informants training manual for the identification of children with cerebral palsy in cross river state Nigeria: Picture manual containing all research protocols used by key informants in the field

Meetings held or attended to share findings:

- One meeting held in primary health centres for each local government area in Biase, Obanliku, Akampka and Odukpani to update key informants and families of the children with CP of the outcome of their follow up visit at the tertiary hospital (mostly for seizure disorder and eye care) and to distribute wheel chairs and spectacles to those children who had been promised and are in need

Hillary Rono

Public Engagement

- March 2016: Coordinated the launch of the peek school eye project in Kenya, Nairobi, Key note address by the CEO of the standard charted bank.
- 2016-2018: Coordinated school teachers to conduct a county wide screening in Tranzoia County, Screened over 181000 children, referred 5000 and treated about 4500
- June 2017: Participated in the AFRICAN public service awards in Kenya, Runner up prize
- September 2018: Participated in the All African Public Service Innovation Awards (AAPSIA 2018) through peek school screening and eye health project, announced as the overall winner of the at a ceremony held in Addis Ababa, Ethiopia

Publications in press, accepted for publication or undergoing review

Smartphone-based screening for visual impairment in Kenyan school children: a cluster randomised controlled trial: *The Lancet Global Health*
Published 2018

The incidence of diabetes mellitus and diabetic retinopathy in a population-based cohort study of people age 50 years and over in Nakuru, Kenya: *BMC Endocr Disord*.
Published 2017

Six-Year Incidence and Progression of Age-Related Macular Degeneration in Kenya: Nakuru Eye Disease Cohort Study: *JAMA Ophthalmol.*
Published 2017

Glaucoma Features in an East African Population: A Six-year Cohort Study of Older Adults in Nakuru, Kenya: *Journal of Glaucoma*
Published 2018

Guidelines, toolkits or training materials developed

- Peek school eye health screening guidelines

Meetings held or attended to share findings

- Presented a paper at Royal Ophthalmological Congress, June, 2015, Liverpool, UK
- Presented a paper at College of Ophthalmological for Eastern Africa, August, 2015, Naivasha, Kenya
- Presented a paper at Royal Ophthalmological Congress, June, 2016, Birmingham, UK
- Presented a paper at College of Ophthalmology for Eastern Africa, August, 2016, Arusha, Kenya
- Presented a paper at IAPB's 10th General Assembly, October, 2016, Durban, South Africa
- Attended a meeting and presented a paper at the University of Botswana on school screening, September 2017, Gaborone, Botswana
- Presented a paper and poster at the Ophthalmological society on Kenya meeting, November 2018, Nairobi, Kenya

Nyawira Mwangi

Public Engagement

- April 2016: Coordinated 'Beat Diabetes' Public engagement event to mark World Health Day in Kenya. Keynote address by the Head of the Division of Non-Communicable Diseases in the Ministry of Health, Kenya, Dr Joseph Kibachio."
- November 2016: Coordinated public engagement event to mark World Diabetes Day in Kenya in partnership with the Ministry of Health, Kenya Medical Training College, Kenyatta National Hospital and City Eye Hospital. The Head of Ophthalmic Services at the Ministry of Health, Dr Michael Gichangi, gave the key note address.

Publications in press, accepted for publication or undergoing review:

Analysis of an international collaboration for capacity building of human resources for eye care: case study of the college-college VISION 2020 LINK: *Human Resources for Health*

Published 2017

Predictors of uptake of eye examination in people living with diabetes mellitus in three counties of Kenya*: Trop Med Health.*

Published 2017

Clinical guidelines for diabetic retinopathy in Kenya: an executive summary of the recommendations: *J Ophthalmol East Cent*

Published 2017

Adapting Clinical Practice Guidelines for Diabetic Retinopathy in Kenya: process and outputs: *Implementation Science*

Article accepted 2018

Guidelines, toolkits or training materials developed

- National guidelines for Kenya (Guidelines for Screening and Management of Diabetic Retinopathy in Kenya) produced
- OER course: Control of Diabetic Retinopathy

Meetings held or attended to share findings

- Facilitated Kenya DR stakeholders meeting August 2017
- Facilitated Kenya DR research group meeting February 2018
- Facilitated DR stakeholders meeting in Ghana, June 2018
- Presented a paper at World Ophthalmology Congress, June 16-19, 2018, Barcelona, Spain
- Presented on OER development at UNESCO workshop in Vipava, Slovenia, July 2018
- Presented at COECSA Congress, August 2018

Ada Aghaji

Public Engagement

- March 2016: Engagement with the ward development committee of the Ikeja Primary Health Care Centre in Lagos in conjunction with the National Primary Health Care Development Agency.
- 15th September 2017: Engagement with stakeholders in the national Centre for Disease Control on the need to increase measles coverage through Primary Eye Care
- 29th August 2018: Engagement with stakeholders in the national Centre for Disease Control on the need to increase measles vaccination coverage and introduce rubella vaccination through Primary Eye Care.

Publications in press, accepted for publication or undergoing review

Strengths, challenges and opportunities of implementing primary eye care in Nigeria. *BMJ Glob Health*

Published 2018

Coverage of Vitamin A Supplementation in Nigeria and Implications for Childhood Blindness: *BMC Public Health*

Article accepted 2019

Guidelines, toolkits or training materials developed

- A toolkit for assessing the technical capacities needed to implement the World Health Organisation Africa Region Primary Eye Care Package.

Meetings held or attended to share findings

- Aghaji AE, Gilbert CE. Why doesn't eye care get the priority it deserves? A Schifman & Smith framework Analysis. 10th General Assembly at the International Agency for the Prevention of Blindness in Durban South Africa. June 2016.
- Aghaji AE, Gilbert CE. How complex is it to implement the WHO AFRO Primary Eye Care package for eye health promotion and prevention in sub-Saharan Africa? World Ophthalmology Congress, Barcelona June 2018.

Botswana, 15th – 19th October 2018

A. Princess Marina Hospital Eye Clinic, Gabarone

1. Mogatosi Modise, Deputy Head Teacher at Primary School

Mogatosi's vision started to become blurry this year as a result of years living with diabetes. We meet him at Princess Marina Hospital Eye Clinic, a health service facility in Gaborone, Botswana. He is waiting to see a specialist for laser treatment on his right eye, which will hopefully restore his vision. This will be his second laser treatment within a month.

Mogatosi is from a small village just outside of Gaborone, about a 40-minute drive from the clinic. He lives at home with his wife and three older children, one boy and twin girls, who he speaks very highly of. This year marks his 30th year as a teacher where he's progressed to become deputy head at a primary school. He jokes that now he is "exempted from teaching the children" and spends his time advising others.

In 1991, following a routine doctor's appointment, he was told that he has diabetes and was prescribed with tablets to manage his blood sugar levels. His condition has since had a significant impact on his life, particularly on his sight in the last year:

"Ever since I was diagnosed I was doing well until the beginning of this year. I started to see blurred vision in my left eye not knowing what was the cause. Prior to that, it was fine because I was advised to check my eyes, kidneys, everything every year. But at the beginning of this year it started to be blurred….lately, I just see some shadows."

Since learning of his condition, Mogatosi has been attending routine checkups with his doctor and general nurses at a clinic in his village. He has also received support from a nutritionist to ensure his diet is controlled and has started leading a more active lifestyle. The complications that can arise due to diabetes is nothing new to Mogatosi as he explains his family history to me:

"I've always been aware of diabetes because of my relatives, especially my father. He died because of diabetes. My brother also. He had his legs amputated. He wasn't maintaining treatment to an extent that he only went to a few check-ups and only took his tablets sometimes. Actually he wasn't following the instructions he was given."

The experiences within his family have only made him understand the side effects of diabetes and the importance of taking the advised treatment. He explains that his family "*understand the condition and they do give [him] a lot of support",* especially with his diet.

Unfortunately, the preventative measures he has been taking have not managed to halt changes in his vision, which has begun to deteriorate in the last year. Following a consultation at his usual clinic, he was referred to Block 6 in Gaborone as his visual impairment had become more advanced. Since then he has already received a brief laser treatment on his left eye, which he tells me is healing well:

"I am here today for my right eye. They noticed an issue with both eyes when they saw me last but it was mild in the right eye. Treatment on my left eye went well…I can see a difference every day. I had the treatment one month ago and I think it will be ok. They said there were some bleeding vessels and they tried to block it so I think after a certain period it will clear and I can see properly again."

As we wait in the reception area for treatment on his right eye, Mogatosi is relaxed and confident. He tells me of his experience in the clinic since he was referred here and how happy he is with the team: "*The service is just perfect. It is quite good because they are cooperative. Everything is communicated to me and they understand the condition well. They know when I am due to come; we now know each other well."*

At that point he is called in by the nurse for his laser treatment, performed by Dr Shifa, an ophthalmologist at Princess Marina Hospital who was trained in laser treatment through the Vision 2020 LINK programme and is also involved in the Diabetic Retinopathy Network currently supported by the Commonwealth Eye Health Consortium. Following the short treatment, which goes very well, Mogatasi's eye is covered with a bandage and he is given a follow-up appointment.

Within a few weeks, Mogatosi will have his vision back and can continue his work in the education sector, inspiring and empowering the young children of Botswana.

Interview and case study by Ajla Nebi

B. Block 6 Diabetic Clinic, Gabarone

2. Kamogelo Moses (known as Moses), volunteer at Block 6 and diabetic since a child

Moses has been living with diabetes since she was a child, but it took a two-week coma for her to realise she needed to start taking the condition seriously and adjust her lifestyle. Since then she has become an advocate, supporting young people with diabetes in her community and volunteering at Block 6 clinic.

We first meet with Moses at the Block 6 diabetic clinic in Gaborone, Botswana. She is a young and enthusiastic woman, never without a smile. She tells us how living with diabetes has changed her life and made her a stronger person.

"I was diagnosed at an early age. This is my 18th year of diabetes. I would say I am coping given it has grown up with me and I have grown hard of it. It is more like a friend, not a condition. At school, back when I was young, it was more difficult because back then all the kids would buy sweets after school and I would think, 'oh, what's going to happen if I have a bite'. The sugars weren't controlled because I thought nobody is watching so let me just eat. There was a point when I thought this condition is gradually killing my body because diabetes has complications."

"When I was 16 I decided I need to take this more seriously. I fell into a coma in 2005. I really don't know what triggered it. I went into a coma for like two weeks or so and I was in South Africa at the time. I've had cataract (2011) in my eyes because I wasn't controlling my sugar levels also so I thought if I continue living like this I may end up having a heart attack, I might end up having stroke, I might end up having kidney problems and yet I'm still young."

Since suffering these incidences, Moses has had a complete turnaround in her attitude to dealing with her diabetes. Not only did she study medicine, she has also been involved in a youth engagement programme working with young people with diabetes:

"We come together as youth and we just go out and sometimes have camps whereby we take children who have been diagnosed and have days out. We learn, motivate, teach, play games and educate about when sugar levels are different. We speak from experience….you want to learn from somebody who has gone through that as well. They learn that I am diabetic and they think, "Wow! I'm not alone, this is nice."

On top of this, she has joined the Block 6 team as a volunteer helping raise awareness of diabetes to the wider community through education and health promotion.

"More needs to be done to educate people on diabetes and improve services…I am living like this because I have accepted and great because the more you accept the more life goes on and you will be enjoying it. It is important to understand the condition and learn how it can me controlled/managed because if you don't take care of it the high sugars literally kill your body."

Interview and case study by Ajla Nebi

C. Goodhope Primary School, Southern District

3. 1/ Aobakwe Motsumi

"I am 8 years old, in class 3a at Goodhope primary school. Every day I come from my home in Haku by combi, as it's far from the school. It's a busy combi, but I always have a space.

My favourite subject is maths and I am good at it. When I grow up I would like to be a solider, because I want to protect my country. I like the uniform.

I live with my mother, father and big brother. When I'm not at school I like playing football; I love kicking the ball, and being up front.

Before I had spectacles, I couldn't see and my eyes were often sore. I found it difficult to see the blackboard or my textbooks when I was struggling.

I remember the day they checked my eyes, and the day they brought my spectacles. I remember the phones, and being asked to cover one eye at a time to look at the letters. I was happy that they checked my eyes and agreed that I have a problem with my eyes. When they brought the spectacles and I tried them on, I could see well, and the pain I had in my eyes began to go away.

It has changed my study – I see properly now! I am very happy that I can see. Now that I have spectacles, I want to help other children who can't see. I want to be someone that people can come to in order to learn about what it feels like to wear glasses."

Interview by Lucy Lee

4. Uyapo Setimela: 12 years old, student at Goodhope Primary School

Twelve-year-old running enthusiast, Uyapo received his first pair of glasses last year. Ever since starting school he has struggled reading the blackboard, having to always sit at the front of the class away from his friends. However, even at the front of the class he continued to have trouble reading the letters. That has all changed now thanks to Peek Vision.

Between July 2016 and June 2017, the Commonwealth Eye Health Consortium funded a pilot school screening programme in Botswana using Peek Vision smartphone technology. The app allows non-eye care professionals to screen for refractive error using a simple eye test, identifying children who may have problems with their vision and correcting these at an early stage. During the pilot scheme in the Goodhope district of Botswana, over 12,000 children were screened in 49 schools.

We meet with Uyapo at his school, Goodhope Primary, to talk about the screening day and how things have changed for him since he got his glasses. At first, he is shy not wanting to reveal too much but soon begins to open up as we start talking about what he enjoys at school. He tells me: "I enjoy learning and I love social studies. I learn about the past and lots about Botswana history." But of course, as with all young boys, the best aspect about school is seeing his friends.

He explains that he started to notice changes in his eyes at school: "*When I was in the class I couldn't see the words on the chalkboard. I told my mother and she said I should sit behind the chalkboard to see. I could see better when I was closer; it helped a little bit."* This also affected his learning*: "[It was] difficult to learn and prepare for exams. I didn't tell my teachers about the problems I was having with my eyes because I thought they would be angry with me."*

For a long time his mother was unable to take him to see an eye doctor due to transport and money issues and so when he heard about the screening day he was elated: "*I was happy and excited to learn people were coming into school to test our eyes."* He found the eye test "hard because [he] was not seeing properly".

Following the short eye screening at his school, Uyapo was seen by an optometrist and given spectacles, which have had an incredible impact:

"I was happy [when I got my glasses] and when I sit at the back of the classroom, I see clearly. Now I can sit anywhere in the class…I have seen improvement in my studies. My friends were happy too that I got my glasses." He adds that it is important for all schoolchildren to have this opportunity *"because the glasses can help them to see and help them to learn."*

Interview and case study by Ajla Nebi

5. Warona Mosea: 8 years old, student at Goodhope Primary School

"*I am eight years old and in standard three. I have had my glasses for two years now.*
I live far away from the school and I have to walk to school. I normally walk to school with friends but cannot tell how long it takes us. Before getting my glasses, I had no trouble walking to school, I could see fine. When I was given glasses, I could still see. I was given glasses for allergies and to protect my eyes from the sun. I received medication for the allergies, and they have been helping. I am happy! My eyes were itching constantly, and I had to use cold water on them to stop them from itching. It was very irritating, but the glasses have helped. I wear my glasses all of the time and like wearing them."

"My friends say I am very beautiful with my glasses on!"

Interview by Ajla Nebi

6. Tshepiso Nkawana: 12 years old, student at Goodhope Primary School

Tshepiso suffers from occasional headaches due to problems with her vision. As a young girl still at school, this has been difficult for her to deal with. Originally from Francistown, Botswana Tshepiso recently moved to the Goodhope district with her mother, who is a doctor, grandmother and three siblings.

She was enrolled at Goodhope Primary School in 2016 just as they were preparing for the pilot school screening programme. This meant Tshepiso could finally have her eyes tested and the opportunity to stop the painful headaches: "*I was very excited because I wanted my eyes to stop bothering my head."*

The screening showed that she had refractive error in only one of her eyes and she was given a pair of spectacles. Although initially seeing an improvement, recently Tshepiso has started to have issues with her eyes again: "*I've had my glasses since last year. This year I had a problem with one of my eyes; my headaches still continue."* She has informed her teachers and *"they are trying to fix the problem."*

She adds that when she first started wearing her glasses, other children at the school weren't so kind. However, things have improved now that there is more awareness around eye health within the school and community:

"Last year they were very bad. They told me I was ugly, these specs aren't good for me. I felt very bad but things have changed now. Now they understand eye conditions better. I am happy now."

It is clear Tshepiso is an intelligent young woman who will go on to achieve great things; she hopes to be a psychologist and help others.

Interview and case study by Ajla Nebi

Uganda, 5th – 9th November 2018

Community visits: Rural South-Western Uganda

7. Willium Kaguhangire

Willium, 56, works as a farmer in Kazo, Uganda. In early 2018 he contracted fungal keratitis, a serious ocular infection which can lead to severe visual impairment if not treated immediately. This has had a great impact on his ability to work and support his family.

Willium grew up in a family of farmers and inherited the lush grounds from his parents. He grazes cattle and manages small crop production. He relies on his farm work to support his six children and three young grandchildren who he and his wife are bringing up following the death of their mother.

He describes to us the moment he first noticed there was something wrong. One day in January 2018 he began to feel a terrible pain in his right eye. After ignoring it for a while, the pain persisted. He put it down to tiredness and took some time off to rest. The following morning, the pain had subsided and so he assumed there was anything to worry about.

Later that day, the excruciating pain returned. The young children in the house were also complaining of eye pain/watering eyes so he thought it was merely allergies playing up. The pain continued and he sought advice from someone within his community; they looked at his eye and noticed a fat tissue growth.

He immediately thought to use traditional herbal medicine, a common remedy many people opt for in rural communities. The traditional medicine consisted of crushed herbs that were heated and left to cool before placing into the eye. Willium used this treatment for two days but there was no change.

Not able to take the pain any longer, he visited a nearby clinic. They could not identify what was wrong and recommended he buy three different types of eye drops which he continued to use for a few days. The pain continued. He decided to drive to Ruharo Eye Centre in Mbarara, a 150 mile journey from his home. The centre is the only one in the area that has services to tackle conditions as severe as what Willium was facing. He explains he "wasn't anxious" about what they might tell him, he "just wanted to get better."

Once he reached the clinic and was seen by a doctor, they told him there was already too much damage done to the eye and asked if they should remove his eye. He refused: "No, you should treat it!"

He was given two types of eye drops. The cost of the medication was too much for Willium, who had been unable to work on his farm for days due to the condition of his eye. He was then referred to Dr Simon Arunga's PhD research project, supported by the Commonwealth Eye Health Consortium. The team have provided dedicated care with follow up visits, and have covered treatment costs.

It has now been almost a year since Willium first felt the agonizing pain in his right eye. He has lost almost all vision in the affected eye. He has been able to return to work but sometimes feels bursts of pain in his eye and a headache if he works for long hours.

There is a high chance his vision will not return because of the severe scarring but he continues to have hope: *"If God really wishes me to see, I will see."*

Interview and case study by Ajla Nebi

8. Loy Baraba

Loy, a farmer and mother of ten, suffered a lesion in her left cornea leading to loss of vision. The resulting infection was treated by Dr Simon Arunga's research team and her vision restored.

We meet her in her beautiful home in the village of Marisa, surrounded by lush green hills and trees, which she shares with three of her ten children and one grandchild. She is from a family of farmers and spends her days working on the farm she now looks after. She does mostly crop production but we also spotted some turkeys, chickens and cattle during our visit. Farming is her only source of income and therefore she is often working from morning to evening. She has help from her children when they visit home from school and sometimes hires help if the work gets too much.

She describes her community as friendly and often visits neighbours when she has time off from work. With such a welcoming nature it is no suprise she likes to socialize; she hasn't stopped smiling and laughing since we arrived at her home.

She begins telling us about the infection she contracted in her eye. One day, after waking up, she felt feverish and decided to visit a local clinic. They prescribed her medication for the fever but Loy noticed no difference after taking it. She visited another clinic for more medication. She started to feel better and went back to work but began to feel something wrong with her left eye. The morning after, her eye was very painful. She went to see her neighbours and they advised her to try traditional eye medicine. She had used traditional medicine previously for other ailments with success so she was confident the traditional herbs would help with her eye. However, the traditional medicine had an adverse effect and the pain began to get worse: *"The pain was unbearable. It felt like my eye was coming out."*
She had heard about Ruharo Eye Centre from others and decided to go there for treatment. The pain continued and she was worried the clinic would suggest removing her eye. She says at this moment she felt "hopeless." They were able to offer her treatment but at a cost, which was too much for Loy to meet. They then referred her to Dr Simon Arunga's research project. She was given medication and had follow-up visits every week for three weeks to monitor her progress. Her eye healed and vision returned. However, her right eye then began to show the same signs but treatment was provided quickly with little damage to the eye.
Loy tells us "the experience has changed her life." The infection has cleared and she has vision in both eye. Moreover, others in the community are approaching her for advice and she has even accompanied people to the hospital.

Interview and case study by Ajla Nebi

III: List of documents reviewed

General/pan-programme

- Funding Proposal: Fellowships, Research and Technology: The Eye Health Innovation Consortium (previous name for Commonwealth Eye Health Consortium) 2013
- Funding Proposal: CEHC Additional Funding Proposal to QEDJT 2016
- All CEHC monthly narrative reports to QEDJT
- All CEHC six- monthly narrative reports to QEDJT
- CEHC Programme Logframe (all versions until May 2018)
- IAPB Africa Human Resources for Eye Health Strategic Plan 2014-2023: Vision for Africa Phase 1: 2014 – 2018
- Universal Eye Health: A Global Action Plan 2014-2019: World Health Organization
- Uganda Ministry of Health Guidelines for Eye Care October 2016
- Botswana National Multisectoral Strategy for the Prevention and Control of Non-Communicable Diseases 2017-2022
- Paper: Brealey E. et al. Strengthening eye care services in Botswana through the Botswana-Addenbrooke's Abroad VISION 2020 LINK *Eye News* April/May 2016
- Report: VISION 2020 Programme Evaluation: The Pono Letlotlo Eye Project Final Report October 2016
- Paper: Kerr-Muir M. et al. South-South collaboration for the treatment of avoidable blindness in Botswana *Eye News* October/November 2017
- Draft National Guideline for the management of Diabetic Retinopathy, Tanzania May 2018
- Situational Analysis: Paediatric Tertiary Ophthalmology Facilities in African VISION 2020 LINKS 2017
- Paper: Patel R. et al. Leadership skills training through the COECSA-RCOphth LINK *Eye News* June/July 2017
- Paper: Mwangi N. et al. Analysis of an international collaboration for capacity building of human resources for eye care: case study of the college-college VISION 2020 LINK *Human Resources for Health* 2017
- Study Protocol: The Simulated Ocular Surgery (Sos) Trials: Randomised-Controlled Trials Comparing Intense Simulation-Based Surgical Education for Cataract and Glaucoma Surgery to Conventional Training Alone in East and Southern Africa: Will Dean V 1.1 October 2017

Sub-specialty training

- Trip Report: Sub-specialty training development: Dr John Buchan (08 -13 October 2017, Nigeria)
- Workshop Report: Joint COECSA/WACS sub-specialist fellowship training programme development workshop (03 – 05 May 2018, KCMC, Tanzania)

Clinical fellowship training

- Reports: All Clinical Fellowship reporting forms completed by fellows (baseline, 6 months, 12 months/fellowship completion, 6 months post-fellowship
- Reports: Personal narrative reports and presentations by individual Clinical Fellows
- Email communication: Selected email correspondence between clinical fellows and Clinical Fellowship stream leader
- Survey: Clinical Fellowship final feedback survey (February 2019)

Diabetic Retinopathy Network (DR-NET)

- Workshop Report: First DR-NET Planning Workshop (November 2014, London, UK)
- Workshop Report: Second DR-NET Planning Workshop (24 to 26 October 2016, Durban, South Africa)
- Presentation: Planning Diabetic Retinopathy services for Botswana: Durban DR-NET Workshop 24-26 October 2016
- Presentation: Planning Diabetic Retinopathy services for Uganda: Durban DR-NET Workshop 24-26 October 2016
- Workshop Report: Course in diabetic retinal (DR) screening and grading of images (24 – 27 April 2017, Kampala, Uganda)
- Workshop Report: DR Caribbean Planning Workshop (25 – 27 September 2017, Kingston, Jamaica)
- Workshop Report: DR-NET Workshop on Diabetic Retinopathy Screening (04 – 05 April 2018, Dar es Salaam, Tanzania)
- Workshop Report: Ghana National DR Services Stakeholders' Workshop (11 – 13 June 2018, Accra, Ghana)
- Workshop Report: DR-NET Workshop, Addis Ababa 29 August 2018
- Workshop Report: Laser training workshops (13 – 14 September 2018, Kampala and 19 – 21 September 2018, Mbarara, Uganda)
- Meeting report: DR-NET laser training manual meeting (02 July 2018, London, UK)
- Toolkit: DR-NET Toolkit 2016
- Presentation: DR-NET COECSA 5th Congress 2017
- Poster: Stronger Together – DR-NET: A Network to Tackle the Burden of Diabetic Retinopathy in 13 Low- and Middle-Income Countries 2016
- Needs Assessment: Caribbean DR-NET Programme Needs Assessment Report (July 2017)

- Paper: Poore, S et al: Commonwealth nations join forces to prevent blindness from diabetes, *Eye News* 2015
- Paper: Blows P. et al: Situation analysis of diabetic retinopathy services in eleven countries *Eye News* December/January 2016
- Paper: Mowatt L. et al: Launch of the Diabetic Retinopathy Screening Service in UHWI Jamaica *Eye News* June July 2016
- Paper: Kayange P. et al: Cementing a VISION 2020 LINK partnership between Blantyre and Liverpool – building capacity for DR services alongside research *Eye News* August/September 2016
- Paper: Astbury N. et al: Tackling diabetic retinopathy globally through the VISION 2020 LINKS Diabetic Retinopathy Network *Eye News* February/March 2017
- Paper: Mwangi N et al: Predictors of Uptake of eye examination in people living with diabetes mellitus in three counties of Kenya, *Trop Med Health* (2017)
- Paper: Williams P. et al: Collaborating across the Caribbean to tackle diabetic retinopathy *Eye News* December/January 2018
- Paper: Zondervan M. et al: Diabetes and diabetic retinopathy: Changes in understanding of the disease over the last 25 years and how the UK is helping low-income countries tackle the challenges *Eye News* June/July 2018
- Email communication: Selected email correspondence between DR-NET stream leader and programme collaborators
- Transcript: Speech by Hon Dr. Joseph Kasonde, MP The Honourable Minister of Health for Zambia on the Occasion to Launch World Sight Day and Screening for Diabetic Retinopathy (22 October 2015, Lusaka, Zambia)

Mentorships

- Reports: All Mentorship reports completed by mentors and mentees

Public Health Fellowships

- Reports: All LSHTM MSc End of Year Reports
- Reports: All UCT MPH End of Year Reports
- Reports: All UCT Dip End of Year Reports

Open Education for Eye Health (OEEH)

- Various communications and publicity materials to promote OEER courses
- Transcript: ICEH Webinar: What is Open Education? 31 January 2017
- Transcript: ICEH Webinar: Open Education – Does it work? 22 February 2017
- Transcript: ICEH Webinar: Where to find and how to use Open Courses 15 March 2017
- Transcript: ICEH Webinar: Using Open Education to support local training and capacity building: 19 April 2017
- Transcript: ICEH Webinar: Creating and sharing your own Open Educational Resources: 24 May 2017
- Presentation: Designing purposive MOOCs for disease elimination: November 2018

Portable Eye Examination Kit (Peek)

- Report: Peek Narrative Report to LSHTM 01 September – 31 December 2016
- Report: Peek Narrative Report to LSHTM 01 January – 31 March 2017
- Report: Peek Narrative Report to LSHTM 01 April – 30 June 2017
- Report: Peek Narrative Report to LSHTM 01 July – 30 September 2017
- Report: Peek Narrative Report to LSHTM 01 October – 31 December 2017
- Report: Peek Narrative Report to LSHTM 01 January – 31 March 2018
- Report: Peek Narrative Report to LSHTM 01 April – 30 June 2018
- Report: The Peek Vision Foundation Annual Report and Financial Statements for year ended 31 December 2016
- Situational Analysis: Electronic Patient Record System: Nick Sawers, August 2015
- Report: Peek Botswana Phase 1 Progress Report 29 July 2016
- Presentation: Peek Botswana National Scale Business Case 05 June 2017
- Paper: Morjaria P. et al. Effectiveness of a novel mobile health education intervention (Peek) on spectacle wear among children in India: study protocol for a randomized controlled trial *Trials* Vol 18 2017
- Paper: Ramke J. and Kyari K. Strengthening eye health evidence for children in low-income and middle-income countries *Lancet Global Health* Vol 6 August 2018
- Paper: Rono H. K. et al. Smartphone-based screening for visual impairment in Kenyan school children: A cluster randomised controlled trial *Lancet Global Health* Vol 6 August 2018
- Strategic planning document: Peek Botswana Critical Success Factor Campaign Timeline 01 October 2018

Research Fellowships

- Poster: Diabetic retinopathy in Kenya: Predictors of retinal examination among people living with diabetes mellitus: Nyawira Mwangi 2017

- Paper: Mwangi N. et al. Predictors of uptake of eye examination in people living with diabetes mellitus in three counties of Kenya *Tropical Medicine and Health* 2017
- Paper: Mwangi N. et al. Effectiveness of peer support to increase uptake of retinal examination for diabetic retinopathy: study protocol for the DURE pragmatic cluster randomized clinical trial in Kirinyaga, Kenya *BMC Public Health* 2018

Retinoblastoma Network (Rb-NET)

- Workshop Report: Short Report on Retinoblastoma Planning Meeting, London UK, 16 May 2017
- Presentation: Global Retinoblastoma presentation 2017
- Presentation: The Evolution of Rb Management: Ido Fabian, Uganda August 2017
- Visit Report: VISION 2020 Rb-NET LINKS visit to Uganda, 19-23 March 2018
- Visit Report: VISION 2020 Rb-NET LINKS visit to Tanzania, 07-10 May 2018
- Paper: Williams P. et al. Rb-NET: a network to save life and preserve vision in children in Africa *Eye News* April/May 2018
- Grant Application: Assessing the effectiveness of primary care workers in red reflex screening of serious treatable eye conditions in children and compare the effectiveness of two screening devices; submitted 2018

Training The Trainers

- Evaluation feedback forms: RCOphth/COECSA Trainer The Trainers Course Pre- and Post-test evaluation
- Paper: Corbett M. C. et al. Cascading training the trainers in ophthalmology across Eastern, Central and Southern Africa *Globalisation and Health* 2017
- Presentation: Cascading training the trainers in ophthalmology across Eastern, Central and Southern Africa, Melanie Corbett 2017

IV: List of participants interviewed

CEHC Theme leaders

- Matthew Burton: CEHC Programme Director
- Nick Astbury: Clinical Fellowships Theme Leader
- Andrew Bastawrous: CEO Peek
- Victor Hu: Mentorships Theme Leader
- John Buchan: Capacity Building Theme Leader
- Marcia Zondervan: DR-NET Theme Leader
- Daksha Patel: OEER Theme Leader
- Cova Bascaran: Public Health Fellowships Theme Leader (LSHTM MSc)/DR-NET Caribbean Lead
- Colin Cook: Public Health Fellowships Theme Leader (UCT MPH/Dip)
- Melanie Corbett: Training The Trainer co-Theme Leader (UK)
- Ciku Mathenge: Training The Trainer co-Theme Leader (Africa/COECSA)
- Aeesha Malik: RoP-NET Theme Leader

Royal College of Ophthalmologists

- Mike Burdon: President: RCOphth

DR-NET

- Malawi DR-NET key stakeholders: Dr Patty Mopamboli (Ophthalmologist, Mzuzu, Malawi), Dr Joseph Msosa (Ophthalmologist, Lilongwe, Malawi), Dr Petros Kiyange (Ophthalmologist, Blantyre, Malawi), Dr Caroline Styles (UK Vision 2020 UK-Malawi LINK Lead, Fife, UK), Dr Vincent Moyo (Ophthalmologist, Nsanje, Malawi)
- Zambia DR-NET key stakeholders: Dr Grace Mutati (Ophthalmologist, Zambia), Dr Geeta Menon (UK Vision 2020 UK-Zambia LINK Lead, London, UK), Dr Mumba (MoH Zambia)
- Botswana DR-NET key stakeholders: Alice Lehasa (National Eye Health Coordinator, MoH Botswana), Dr Freddy Mbumba (Ophthalmologist, Botswana), Dr Aderonke Oyewo (Physician and Head of Block 6 Diabetes Clinic, Gabarone, Botswana), Pearl Mbulawa (Eye Care Nurse and DR-NET member, Botswana)
- Jamaica DR-NET key stakeholders: Dr Lizette Mowatt (Kingston, Jamaica), Dr Dawn Sim (UK Vision 2020 UK-Jamaica LINK Lead, London, UK), Cova Bascaran (DR-NET Caribbean lead)
- DR-NET National guideline development working group: Mike Burdon (President: Royal College of Ophthalmologists), Hannah Faal (University of Calabar teaching hospital), James Addy (Head of Eye Care, Ghana Health Service), Michael Gichangi (Head of Ophthalmic services, MoH Kenya), Josiah Onyango (Programme Manager COECSA), Nyawira Mwangi (DR-NET Key Stakeholder, Kenya)
- Tunde Peto: DR-NET Technical Advisor
- Sam Ruvuma: DR-NET key stakeholder and trainer, Uganda
- Claire Walker: DR-NET Programme Officer
- John Onyango: DR-NET Uganda key stakeholder
- Dr Moses Kasadhakawo: DR-NET Uganda key stakeholder
- Dr Grace Ssali: DR-NET Uganda key stakeholder
- Clare Davey: Vision 2020 UK-Uganda LINK Lead/DR-NET Technical Advisor/DR-NET trainer in laser
- Laser training recipients Uganda (Mulago Hospital, Kampala): Dr Moses Kasadhakawo (Trainer in Laser), Hamad Yusef (2nd Year Ophthalmology Resident), Catherine (2nd Year Ophthalmology Resident), Ben Mulinde (2nd Year Ophthalmology Resident), Betty (2nd Year Ophthalmology Resident), Caroline (2nd Year Ophthalmology Resident)
- Laser training recipients Uganda (Ruharo Eye Hospital, Mbarara): Teddy Kwaga (2nd Year Ophthalmology Resident), David (2nd Year Ophthalmology Resident), Anne-Marie (2nd Year Ophthalmology Resident)
- Heiko Philippin: DR-NET Technical Advisor/Data Manager
- Teddy Kwaga: DR-NET KAP Study Manager, Uganda
- Evelyn Brealey: Vision 2020 LINKS UK-Botswana Lead

Research Fellowships

- Hillary Rono: PhD Candidate
- Nyawira Mwangi: PhD Candidate
- Godfrey Mndeme: PhD Candidate
- Simon Arunga: PhD Candidate
- Stephen Gichuhi: Post-Doc Candidate
- Prabhath Piyasena: PhD Candidate
- Simon Arunga's research team, MUST: Bernard (Research Assistant), Pauline (Nurse, Data Entry Officer), Gilbert (Lead Research Assistant), Martin (Ophthalmic Nurse, Data Collection)

Public Health Fellowships

- Sucheta Kulkarni: MSc graduate
- Pearl Mbelawa: Dip graduate
- Desiree Murray: MSc graduate
- Egide Gisagara: MSc graduate
- Emmanuel Kobia Acquah: MSc graduate

Patients/beneficiaries

- Ugandan and Botswanan patients (see Annexe II)
- Botswanan school children (see Annexe II)

Peek

- Priya Morjavia: Peek Research, Design and Development Manager
- Stuart Mackie: Peek Project Delivery and Partnerships Manager
- Peek team Botswana: Ryan Littman-Quinn, Maipelo Jeremiah, Itumeleng Kgwelokgwelo, Zambo Dikai, Cynthia Mautswe, Malcolm Kiilu, Faruk Maunge
- Peek national rollout stakeholders Botswana: Mr Mpho Masupe (CEO, Standard Chartered Botswana), Emily Summers (Deputy British High Commissioner to Botswana), Alice Lehasa (Eye Health Programme Coordinator, Ministry of Health Botswana), Mr Simon Coles (Acting Permanent Secretary, Ministry of Basic Education, Botswana)

Rb-NET

- Tanzania Rb-NET: Dr Bernadetha Shilio (MoH Tanzania), Dr Milka Mafwiri (MoH Tanzania), Denise Mabey (Rb-NET volunteer)
- Uganda Rb-NET: Dr Keith Waddell (Ophthalmologist and Retinoblastoma programme Director, Ruharo Eye Centre, Mbarara, Uganda), Dr Raymond Atwine (MUST Pathology Department, Mbarara, Uganda), Dr Grace Ssali (Paediatric Ophthalmologist, Mulago Hospital, Kampala, Uganda), Dr Abubakar Kalinaki (Ophthalmologist, Mulago Hospital, Kampala, Uganda), Georgina Kemigisa (Ophthalmic Nurse, Mulago Hospital, Kampala, Uganda)
- Dr Kahaki Kimani: Kenya Rb-NET

Open Education for Eye Health (OEEH)

- Students using OER Uganda: Rachel (3rd Year Ophthalmology Resident), Geoffrey (2nd Year Ophthalmology Resident), Nana (3rd Year Ophthalmology Resident)
- Amir Bello: Public Health Ophthalmologist, Brazzaville, Republic of Congo, World Health Organization
- OEEH programme team: Daksha Patel (OEER Theme Leader), Sally Parsley (Technical Lead OEEH), Astrid Leck (Evaluation Lead, OEEH)

Clinical Fellowships

- Dr N. Venkatesh Prajna: Chief of Medical Education, Aravind Eye Care System, India
- Edward Nkurunziza: Clinical Fellow, Uganda
- James Msigwe: Clinical Fellow, Uganda
- Elisante Muna: Clinical Fellow, Tanzania
- Calist Bidwell: Clinical Fellow, Uganda
- Aminatu Ali AbdulRahman: Clinical Fellow, Nigeria

Queen Elizabeth Diamond Jubilee Trust

- Andrew Cooper: Director of Programmes
- Matt Little: Programmes Manager

COECSA

- Josiah Onyango: COECSA Programme Manager

V: Consent form for participation in recorded interviews for CEHC Final Evaluation

Informed Consent for Involvement in CEHC Final Evaluation 2018 - 2019

This interview is being conducted as part of an independent final evaluation of the CEHC programme. The purpose of this evaluation is to assess the impact and legacy of the entire CEHC programme and to provide a report to the programme donor and management team on how to continue or adapt implementation of the programme based on the findings of this evaluation.

The interview I conduct with you today will help to inform our understanding of the successes, challenges and lessons learned through the implementation of this programme. Participation is entirely voluntary and you are free to decline involvement or to withdraw at any point.

The interview will be recorded and quotations from it may be used to illustrate examples within the final evaluation report. This report will be shared with the programme donor, implementation team and programme partners and may be made available to the public. Please let me know if you do not want to be named in this report and prefer your responses to be made anonymous.

In addition, extracts from this interview may be used in additional media outputs including a detailed case study of programme activities or a podcast. These outputs may be made available to the general public. If you agree to parts of this audio recording being used for these purposes, you will be asked to sign an additional interview release form.

Many thanks,

Lucy Lee
External Evaluation Lead

Name _____ Date _____

Position _____ Signed _____

☐ I agree to be interviewed and understand that extracts of this interview may be quoted in the final evaluation report

*Please select **only one** of the following boxes:*

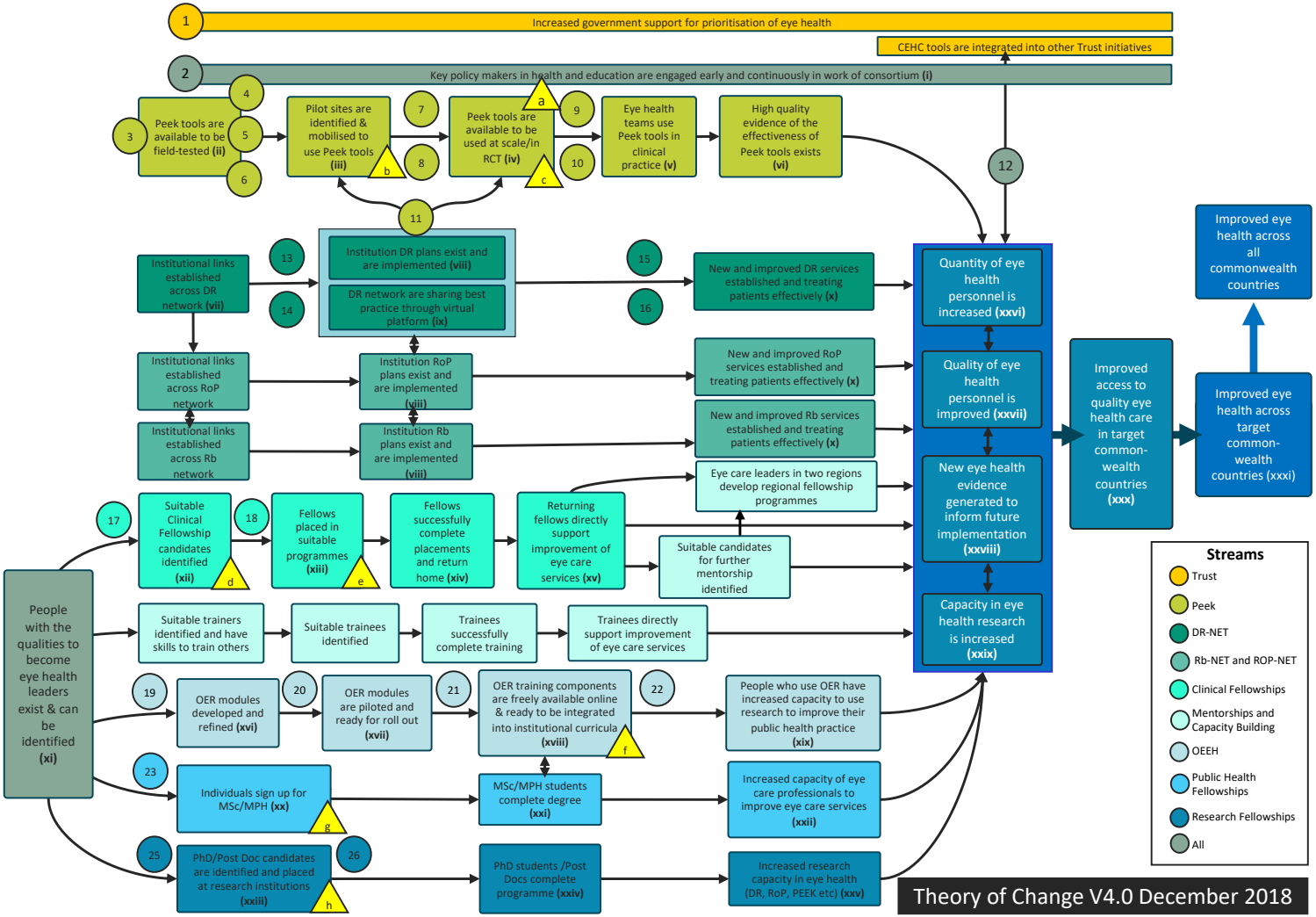
☐ **I agree for my name to be used** in association with extracts of this interview in the final evaluation report and understand that this will be shared with the programme donor, implementation team and programme partners and may be made available to the public

OR

☐ **I do not wish to be named** in this report and would prefer my responses to be made anonymous

VI: Commonwealth Eye Health Consortium Theory of Change

The CEHC ToC was revised to include the programmes added in 2016 and the projected pathways to change and interactions with existing programme themes of these new funded programmes.



1 INTERVENTIONS

Commonwealth Trust

1. Trust engages key policy makers

All CEHC streams

2. Engage with local policy makers to facilitate programme activities

Peek

3. Development and validation of Peek tools, development of Eye Health HMIS software
4. Identification of test sites to test Peek tools
5. Development of a generic mobile phone-based electronic health system
6. Adapt EyeNotes to local sites including integration into local HMIS
7. Eye teams trained to use Peek tools
8. Field testing of Peek tools
9. Testing of Peek implementation of community health system in districts
10. Testing of Peek in RCT
11. Peek tools implemented in Clinical Fellows home services and in research programmes in DR and Peek
12. Integration of Peek and Eye Health HMIS into other Trust initiatives

DR Network

13. DR plans developed collaboratively in workshop
14. Virtual DR platform developed and operational
15. Exchange training visits with UK link team
16. Peek and Eye Health HMIS integrated into DR services by end 2016

Clinical Fellowships

17. Identification of fellows through targeted searches to ensure representation across commonwealth nations
18. Host institutions for Clinical Fellowships identified

Open Educational Resource (OER)

19. Development of OER MOOC
20. Pilot testing of OER
21. OER embedded into UCT MPH curriculum and other training institutions
22. OER materials are promoted for use

MSc/MPH

23. Targeted promotion of MSc/MPH
24. LSHTM PHEC MSc and UCT MPH in community eye care trains eye care professionals

PhD and post-doc fellowships

25. PhD and post-doc opportunities advertised
26. PhD and post-doc programme runs

a ASSUMPTIONS

a) Health care workers are willing to and have the skills to use Peek
b) Sites are willing to use Eye Health HMIS
c) Health care workers and managers are willing and have capacity to adopt Eye Health HMIS
d) Suitable placements for Clinical Fellows can be found
e) Clinical Fellows have a positive experience in in their placements and are progressing as expected
f) The Open Educational Resource (OER) is acceptable to be incorporated into institutional curricula
g) Enough quality candidates apply for the MPH in UCT
h) Adequate supervision for PhD students exists

(i) INDICATORS

All indicators are marked as roman numerals within outcome boxes on the ToC.
A full indicator list is available in a separate indicator list, and includes indicators by stream, and modes of measurement for data collection.