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Complete List of Authors:	Aghaji, Ada; London School of Hygiene & Tropical Medicine; University of Nigeria Faculty of Medical Sciences Burchett, Helen; London School of Hygiene and Tropical Medicine Faculty of Public Health and Policy, Global Health and Development Mathenge, Wanjiku Faal, Hannah; African Vision Research Institute; University of Calabar, Ophthalmology Umeh, Rich; University of Nigeria Faculty of Medical Sciences, Ophthalmology Ezepue, Felix; University of Nigeria Faculty of Medical Sciences, Ophthalmology Isiyaku, Sunday; Sight Savers International Kyari, Fatima; Baze University Wiafe, Boateng Foster, Allen; London School of Hygiene & Tropical Medicine Gilbert, Clare; London School of Hygiene & Tropical Medicine, Clinical Research Unit, ITD
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Technical capacities needed to implement the World Health Organization's primary eye care package for Africa: results of a Delphi process

Aghaji, Ada [1, 2]; Burchett, Helen [3]; Mathenge, Wanjiku [4]; Faal, Hannah [5]; Umeh, Rich [2]; Ezepue, Felix [2]; Isiyaku, Sunday [6]; Kyari, Fatima[7]; Wiafe, Boateng[8]; Foster, Allen[1]; Gilbert, Clare[1]

1. International Centre for Eye Health, London School of Hygiene & Tropical Medicine
2. Department of Ophthalmology, College of Medicine, University of Nigeria
3. Faculty of Public Health and Policy, London School of Hygiene & Tropical Medicine
4. Rwanda International Institute of Ophthalmology, Kigali
5. Department of Ophthalmology, University of Calabar, Calabar, Nigeria
6. Sightsavers, Nigeria & Ghana
7. Baze University, Abuja.
8. Operation Eyesight, Ghana

Corresponding author Aghaji Ada
aaghaji@yahoo.co.uk, ada.aghaji@unn.edu.ng
https://orcid.org/0000-0003-1308-447X

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Technical capacities needed to implement the World Health Organization's primary eye care package for sub-Saharan Africa: results of a Delphi process

ABSTRACT

Objective The aim of the study was to establish the technical capacities needed to deliver WHO AFRO's primary eye care package in primary health care facilities.

Design A two-round Delphi exercise was used to derive expert consensus on the technical complexity of each component of the package using Gericke's framework of technical feasibility, and then the technical capacities needed to deliver them. The panel comprised nine eyecare experts in primary eyecare in sub-Saharan Africa. In each round panel members used a 4-point Likert scale to express their agreement, and consensus was predefined as ≥70% agreement on each statement. For round 1, statements on technical complexity were identified through a literature search of primary eyecare in sub-Saharan Africa. The capacities needed to deliver each agreed item in the technical complexity framework were identified for round 2.

Results Technical complexity statements were classified into four broad elements: intervention characteristics, delivery characteristics, government capacity requirements and usage characteristics. 34 of the 38 (89%) statements on health promotion and 40 of the 43 (93%) statements on facility case management were considered necessary technical capacities for implementation.

Conclusion This study established the technical capacities needed to implement the WHO AFRO primary eye care package which may be generalizable to countries in Sub-Saharan Africa

Article Summary

Strengths and limitations of this study

- This is the first study to establish the technical capacities needed to implement primary eye care in sub-Saharan Africa.
- A recognised technical feasibility framework was used, and statements were derived from a literature review of primary eye care in sub-Saharan Africa.
- A Delphi exercise was used garner expert opinion and to reach consensus.
- Our expert panel was a non-random sample, and this may have led to hidden biases as the participants may not be representative of all the experts with the pre-determined inclusion criteria.

INTRODUCTION

Scope of the problem

Estimates from sub-Saharan Africa (SSA) indicate that about 22 million people are blind or visually impaired, mainly from avoidable causes such as cataract and uncorrected refractive errors. In addition, over 100 million people in SSA are estimated to have near visual impairment.(1) The age standardised prevalence of blindness (≥50 years) is highest of all world regions, being in 5.1% in western and 4.3% eastern sub-Saharan Africa (2) and much of the regional variation in prevalence is explained by variability in access to eye care.[3] Although there are limited data on regional estimates for non-visually impairing conditions (NVICs) in SSA, such as allergic/infective conjunctivitis, and dry eye syndrome, studies of the prevalence of NVICs in Kenya and Nigeria are estimated to be 15% and 25% respectively.(3, 4) These figures suggest a high need for eye care services in SSA, yet only 30% of Africans have access to eye care.(5)

Primary Eye care in sub-Saharan Africa

The inclusion of primary eye care (PEC) into primary health care (PHC) has been recommended as a strategy to increase access to eye care services, (6) (7) and there is global and regional support for PEC. (8) Indeed, the World Health Organisation (WHO) through the Global Action Plan 2014-2019, reiterates the importance of accessible eye care services for the effective control of blindness and visual impairment, and calls on member states to secure the inclusion of PEC within PHC.(9) However, a literature review of PEC in SSA reported many challenges to effective implementation of PEC, which included lack of agreement on the scope of PEC which affects the scope of training and supervision, and lack of clear guidelines on the technical eye related skills required by PHC workers.(10) In response to this, the WHO Africa Office (WHO AFRO) recently developed and pilot tested a package of interventions for PEC in SSA. The WHO AFRO PEC Package consists of eight elements which cover two broad areas i.e. health promotion and facility based case management (11, 12) For health promotion the package has (two elements): 1. four sets of health messages for healthy people, people at risk of and with eye diseases, for children and carers, those aged 40 and above, people of all ages and those with diabetes and 2. instructions on how to give a health talk. For facility-based case management the package has six elements 1. five evidence-based algorithms for red eye, eye swelling, trauma, vision loss for distance and near, and children 0-5 years, 2. a set of 12 evidence-based protocols covering five topics: how to measure visual acuity (VA), how to cover an eye, medication, referrals, removal of foreign bodies), 3. A training package (curriculum and materials), 4. Core lists of essential consumables, technologies and medicines, 5. a set of 10 standards and indicators for monitoring and evaluation and 6. templates to collect health information, monitoring and evaluation. Although this health initiative has the potential to increase

coverage of eye health services in sub-Saharan Africa (SSA),[16] not all health initiatives proposed may be feasible to implement. Feasibility research can help identify the challenges as well as opportunities in implementing a new health initiative. Feasibility in relation to health initiatives is a multifaceted construct which Snowdon described as having the following components: technical, political, cultural, financial and legal feasibility, (13) and the technical feasibility component was selected for this study. Technical feasibility is a balance between how complex the intervention is and the technical capacities required to implement it.(14)

The WHO AFRO PEC package has many different technical components, and the overall purpose of this study was to assess the feasibility of integrating the package into PHC in SSA. In this paper we report the processes involved in developing the content of the feasibility framework for PEC for use in PHC settings in sub-Saharan African countries.

METHODS

Our approach was framed by awareness of the limited published literature on the effectiveness of PEC in sub-Saharan Africa (10) and the need to adopt a systematic method to provide expert consensus on the feasibility of PEC implementation to guide policy makers. Against this backdrop, we used a combination of methods: literature reviews of feasibility frameworks for public health interventions, and of PEC in SSA and a Delphi process. The Delphi method is an iterative method of collecting opinions from a group of experts where evidence from other more robust sources is not available. It uses a series of questionnaires, and responses are modified based on feedback.(15) The Delphi process has been used in a wide variety of research areas, including health research.(16) The classic Delphi process is characterised by a) anonymity of the participants to each other, which encourages free expression of opinion, b) iteration, c) controlled feedback from the group, and d) statistical aggregation of the group response.(16)

Step 1. Delphi Questionnaire Development

The WHO AFRO PEC package was divided into two components: eye health prevention/promotion and case management.

An appropriate technical feasibility framework was identified. PubMed was searched from January 2000 to April 2018 using the search terms “technical feasibility” and “frameworks.” The titles and abstracts of articles identified by the search strategy were screened, and potential full text articles were reviewed by a single author (AA), Figure 1A.

Figure 1. Literature searches for A, technical feasibility framework, and B primary eye care in sub-Saharan Africa.

The conceptual framework to evaluate the technical complexity of public health interventions selected for this study, which was developed by Gericke et al(14) has four dimensions: basic characteristics of the intervention, delivery characteristics, government capacity/need for regulation or legislation, and usage characteristics(14)(Table 1). Gericke's framework has been used to determine the technical complexity of condom social marketing for the prevention of HIV/AIDS and other sexually transmitted diseases(14) and to assess aflatoxin risk reduction strategies in Africa, for example.(17) For an intervention to be deemed feasible, the technical capacity must match the technical complexity of the intervention, thus intervention complexity complements the concept of institutional capacity.(14)

Table 1: Technical feasibility framework(14)

Gericke's framework	
Category	**Criteria**
Intervention characteristics	
Basic product design	Stability
	Standardizability
	Safety profile
	Ease of storage
	Ease of transport
Supplies	Need for regular supplies
Equipment	High-technology equipment and infrastructure needed
	Ease of acquisition
	Number of different types of equipment needed
	Maintenance needed
Delivery characteristics	
Facilities	Outreach services
Facilities	First-level care
Facilities	Hospital care
Human resources	Skill level required for service provision
	Skill level required for staff supervision
	Intensity of professional services in terms of frequency or duration
	Management and planning requirements
Communication and transport	Dependence of delivery on communication and transport infrastructure
Government capacity requirements	
Regulation/legislation	Need for regulation.
Management systems	Need for sophisticated management systems
Collaborative action	Need for inter-sectoral action within government.
	Need for partnership between government and external funding agencies
Usage characteristics	
Ease of use	Need for information and education
Pre-existing demand	Need for promotion
Black market risk	Need to prevent resale/counterfeiting

The WHO AFRO PEC package was divided into two components: eye health prevention/promotion and case management. The four dimensions of Gericke's framework were applied to each component i.e., intervention characteristics, delivery characteristics, government capacity requirements and usage characteristics.

To populate the framework, a literature search on PEC in sub-Saharan Africa was conducted and all articles of primary eye care in sub-Saharan Africa up to April 2018 were searched for using MEDLINE. Search terms included "primary eye care ", with "sub Saharan Africa" and "eye disease" or "eye" with "primary healthcare" and "Africa"(10) In addition, we used all the relevant articles from the two most recent published reviews on primary eye care in SSA, (10, 18) to identify evidence-based criteria for the technical complexities required to implement each component of the WHO AFRO PEC package (Figure 1B).

Further implementation characteristics were identified by two of the authors (CG and AA) who have more than 40 years' combined experience of eye care in sub-Saharan Africa. This yielded a list of key criteria for the technical complexity of PEC. A four-point Likert scale (where 1=strongly agree and 4= strongly disagree), was applied to each of the statements and this formed the Delphi questionnaires. The Delphi questionnaires were reviewed by an expert in international eye health, (CG) a health interventions expert (HB) and a statistician (DM). They were then sent to a panel of experts in PEC in sub-Saharan Africa.

Step 2. Selection of experts for the Delphi exercise

The aim was to recruit a panel of eye care professionals who were experts in eye care in sub-Saharan Africa, with expertise to validate the relevance of the selected technical complexities and capacities required to implement the WHO AFRO PEC Package. Eligibility criteria included an eye care professional with a minimum of 10 years' experience of community eye care in sub Saharan Africa, still professionally active, and with experience of eye health policy. They were selected by a modified exponential snowball sampling method where an initial participant provides multiple referrals.(19) Each new referral was vetted and included in the study if the eligibility criteria were met.

Step 3. Delphi Round 1

Members of the team were contacted by email and telephone and their availability was confirmed. Informed consent was obtained. Members were sent the following documents: the methods to be used during the Delphi exercise, an explanation of Gericke's framework of technical complexity, a draft of the technical complexities required to deliver both components of the WHO AFRO PEC package in the form of the first Delphi questionnaires. Participants were invited to state their level of agreement to each statement in the

questionnaire by ticking the appropriate level in the Likert scale in a Microsoft Excel® spreadsheet. A comments box was included beside each statement for comments or suggestions.

Step 4. Analysis of Delphi Round 1

Once all the questionnaires had been received, they were analysed for consensus. Analyses were performed using STATA V, 15.1 (Statcorp, Texas) to generate descriptive statistics. No universally accepted criteria for consensus have been defined for Delphi studies.(20) However, it has been shown that consensus can be said to have been achieved if a certain proportion of the votes fall within a predefined range.(21) Consensus for this study was defined as at least 70% agreement on each statement in the upper 50th percentile (Likert scores 1 and 2). Where consensus was reached, the statements were adopted. Statements where consensus was not reached were modified based on the suggestions/comments and incorporated into the second round, as were newly identified statements.

Step 5. Modification for technical capacity

Statements included from the first round were modified so that panel members could indicate their agreement on the technical capacities which need to be available to deliver the WHO PEC package.

Step 6. Delphi Round 2

For this round, the participants received the questionnaires with the comments/suggestions of other panel members from the first round. However, this was modified for technical capacity as stated above and sent to the same expert panel using the same Likert scale and level of consensus.

Step 7. Analysis of Delphi Round 2

Only statements that achieved at least 70% consensus in the upper 50th percentile (Likert scores 1 and 2) in the second round were included in the final document. Where consensus was reached, the statements were adopted and formed the basis of the final document. Any minority views (<70% consensus) did not form part of the adopted technical capacities but were documented. The technical capacities needed were mapped unto the WHO health system's building blocks.(22)

Patients were not involved in this study.

RESULTS

Composition of Delphi panel of experts

A total of 12 experts were contacted, nine of whom agreed to participate (Table 2). No response was received from the other three invitees despite at least three contacts by email. All nine completed the two rounds of the Delphi survey.

Table 2: Characteristics of the Delphi Panel n=9

Characteristics		*N (%)
Gender	Female	5 (55.6)
Age	<50 years >50 years	2 (22.2) 7 (77.8)
Professional group	Ophthalmologist Administrator	7 (77.8) 2 (22.2)
Primary function	Clinician Researcher NGO Administrator	3 (33.3) 3 (33.3) 3 (33.3)
Type of institution	Academic Hospital Non-academic Hospital Research Institute Eyecare NGO	2 (22.2) 1(11,1) 3 (33.3) 3 (33.3)
Region of practice	West Africa East Africa South Africa Central Africa Europe	5 (56) 2 (22) 2 (22) 1 (11) 1 (11)
Involved in national policy making	Yes	9 (100)

*some participants had multiple roles/had worked in multiple regions.

The mean number of years of experience in eye health of the participants was 31.1±8.9 years while the range was 18-43 years.

Delphi questionnaire development

A total of 81 statements on the technical complexity of the WHO AFROPEC package were developed from Gericke's framework, 38 for health promotion and 43 for facility-based case management (Table 3).

Table 3 Statements for each component of the WHO AFRO Primary Eye Care Package

Gericke's Framework Domains		Component of WHO AFRO PEC Package	
		Health promotion and prevention	Facility case management
		Number of statements	
Intervention characteristics	Basic product design	7	10
	Supplies	2	1
	Equipment	3	5
Delivery characteristics	Type of facility needed	3	4
	Human resource requirement	8	9
	Communication and transport	3	2
Government capacity requirements	Regulation/legislation	2	4
	Management systems	2	1
	Collaborative action	4	3
Usage characteristics	Ease of use	2	2
	Pre-existing demand	1	1
	Black Market Risk	1	1
Total		**38**	**43**

In the first round, there was consensus in 84% of the statements with over 40% of the statements achieving 100% consensus. *(See Supplementary material: Appendix 1.)* Based on comments from Delphi round 1, six modifications were made in the health promotion component and seven in the facility case management component. (See S*upplementary material: Appendix 2.)* The modified questionnaire formed the basis of technical capacity questionnaire for round two.

In the second round, four statements were deemed to be inapplicable by 89% of participants and were removed. Consensus was achieved in 94% of the statements, with 62% achieving 100% consensus. *(Supplementary material: Appendix 3.)* Results of the 34 statements on technical capacity for health promotion for which consensus was reached are shown in Table 4A with their respective Likert ratings, quartile and 50th percentile values. Results of the 40 statements on technical capacity for facility case management for which consensus was reached are shown in Table 4B with their respective Likert ratings, quartile and 50th percentile values. The top quartile shows the number and proportion of participants that strongly agreed to each of the statements, while the 50th percentile shows the number and proportion of participants that strongly agreed or agreed. The technical capacities needed were mapped unto the WHO health system's building blocks. (Tables 5A and 5B)

Table 4A: Consensus statements (34) on technical capacity for health promotion, with analysis of Likert scales.

Category / criteria	Technical capacity needed (elements that need to be available)	Top quartile		50th Percentile		Median
		Likert 1		Likert 2		(IQR)
		N	%	N	%	
1. Intervention characteristics						
Basic product design						
Stability: usable lifetime and risk of destruction	Posters that promote eye health	7	77.8	9	100	**1 (1-1)**
	Durable posters are available	4	44.4	9	100	**1 (1-2)**
Standardizability: the degree to which an intervention can be standardized	Standardized posters available to deliver the same message per target group	5	55.6	9	100	**1 (1-2)**
	Posters available in the language of the community	6	66.7	7	77.8	**1 (1-2)**
	Posters with self-explanatory graphics available for the non-literate	8	88.9	9	100	**1 (1-1)**
	Different types of posters available for different target groups which are appropriately displayed	5	55.6	8	88.9	**1 (1-2)**
Number of different types of equipment needed. Maintenance needed.	Health promotion materials available that are easy to maintain	5	55.6	9	100	**1 (1-2)**
	A system for the easy procurement of health promotion materials	6	66.7	9	100	**1 (1-2)**
2. Delivery characteristics						
Facilities						
Retail sector, outreach services, first-level care, hospital care	Health promotion in the community that includes young children and their carers, diabetics and the elderly as their target audience	4	44.4	9	100	**1 (1-2)**
	Time, space and willingness to deliver opportunistic eye health promotion to groups in the facility	7	77.8	8	88.9	**1 (1-1)**
	Time and the willingness to deliver opportunistic eye health promotion to targeted individuals in the facility e.g. diabetics	5	55.6	7	77.8	**1(1-2)**
Human resources						
Skill level required for service provision	Staff skilled in communicating with community members	7	77.8	9	100	**1 (1-1)**
	Staff who are knowledgeable about community, eye diseases and where to access care	7	77.8	9	100	**1 (1-1)**
	Village health workers resident in the community who are able to deliver health promotion	6	66.7	9	100	**1 (1-2)**
	Facility based staff who are able to deliver health promotion	5	55.6	9	100	**1 (1-2)**
	Professionals to train staff on eye health promotion and develop health promotion materials	9	100.0	9	100	**1 (1-1)**
Skill level required for staff supervision. Degree of supervision required	Supervisors who are able to supervise health promotion activities including eye health	7	77.8	9	100	**1 (1-1)**
Intensity of professional services in terms of frequency or duration e.g. on schedule/periodic or continuous to accommodate emergencies	Staff who regularly deliver health promotion on schedule	7	77.8	9	100	**1 (1-1)**
Need for managerial staff: management and planning requirements	Existing managerial staff who plan and organise target audience to be sensitised in appropriate locations e.g. carers of young children	5	55.6	9	100	**1 (1-2)**
Communication and transport						

Category / criteria	Technical capacity needed (elements that need to be available)	Top quartile		50th Percentile		Median
		Likert 1		Likert 2		(IQR)
		N	%	N	%	
Dependence of delivery on communication and transport infrastructure: telephones, roads	Local transport infrastructure to visit communities	6	66.7	7	77.8	**1 (1-2)**
Need for substantial exchange of information between different sectors or levels of care	Appropriate communication channels between the community and frontline health facilities	8	88.9	9	100	**1 (1-1)**
	Staff who are able to communicate in the local language	9	100	9	100	**1 (1-1)**
3. Government capacity requirements						
Regulation/legislation						
Need for legislation/regulation, monitoring regulatory measures and enforcement of regulation	Health promotion materials which have been approved and endorsed by local regulatory authorities	5	55.6	8	88.9	**1 (1-2)**
	Eye health promotion activities that are recorded and monitored	4	44.4	7	77.8	**1 (1-1)**
	National blindness prevention strategy that incorporates eye health promotion	9	88.9	8	88.9	**1 (1-1)**
Need for sophisticated management systems and managerial staff. Level of management and planning requirements	Existing managerial structures for health promotion that can be used to manage eye health promotion	4	44.4	7	77.8	**2(1-2)**
Collaborative action						
Need for inter-sectoral action within government. Need for partnership between government and civil society.	Intersectoral activities within government or partnerships between government and civil society	6	66.7	9	100	**1 (1-2)**
	Existing school health programmes.	3	33.3	7	77.8	**2(1-2)**
Need for partnership between government and external funding agencies	Collaborations with NGOs to provide health promotion	1	11.1	7	77.8	**2(1-2)**
	Collaboration between communities and frontline health communities	7	77.8	9	100	**1 (1-1)**
4. Usage characteristics						
Ease of use						
Need for information and education	Communication channels with community to inform target population	9	88.9	9	100	**1 (1-1)**
Need for supervision	Staff to supervise health promotion activities	9	88.9	9	100	**1 (1-1)**
Pre-existing demand						
Need for promotion	Staff who engage in health promotion which includes the uptake of eye care when required.	9	88.9	9	100	**1 (1-1)**
Black market risk						
Need to prevent resale/counterfeiting	Staff who engage and train traditional healers to identify and refer eye conditions, with a system to support training	7	77.8	9	100	**1 (1-1)**

Table 4B: Consensus statements (40) on technical capacity for Facility Case Management, with analysis of Likert scales

Category / Criteria	Technical capacity needed (elements that need to be available)	Top quartile		50th percentile		Median
		Likert 1		Likert 2		(IQR)
		N	%	N	%	
1. Intervention characteristics						
Basic product design						
Stability/ease of storage/ease of transport	Torches can be solar powered and are stable	6	66.7	9	100	**1(1-2)**
	Appropriate and secure storage for drugs and consumables	8	88.9	9	100	**1(1-1)**
	Eye drops that do not require cool storage should be stocked	5	55.6	8	88.9	**1(1-2)**
	Tetanus toxoid, which requires cool storage	6	66.7	8	88.9	**1(1-2)**
	Topical antibiotic ointment does not require cold storage	6	66.7	8	88.9	**1(1-2)**
	Sterile saline solution for eye irrigation is stable	4	44.4	7	77.8	**1(1-2)**
	High dose vitamin A is stable	5	55.6	9	100	**2(1-2)**
	Injectable antibiotics, for ophthalmia neonatorum and other conditions, may require cool storage	4	44.4	7	77.8	**1(1-2)**
	Pre-existing PHC transport channels should be available to transport PEC consumables.	7	77.8	9	100	**1(1-1)**
Standardizability	The WHO AFRO PEC Package is standardized	6	66.7	9	100	**1(1-2)**
Safety profile	Staff who are trained/can be trained to deliver the intervention correctly and not cause harm	8	88.9	9	100	**1(1-1)**
Supplies						
Need for regular supplies	Medication supply system to support regular supply of eye medications and consumables	8	88.9	9	100	**1(1-1)**
Equipment						
High-technology equipment and infrastructure needed	Diagnostic equipment: Snellen distance visual acuity chart; near visual acuity chart, torches and batteries	7	77.8	9	100	**1(1-1)**
	Adequate space to use appropriate, standardized visual acuity charts	6	66.7	8	88.9	**1(1-2)**
	Adequate space for counselling patients	8	88.9	9	100	**1(1-1)**
Number of different types of equipment needed	One set of diagnostic equipment	6	66.7	8	88.9	**1(1-2)**
Maintenance needed	System to maintain equipment in the facility	5	55.6	9	100	**1(1-2)**
2. Delivery characteristics						
Facilities						
First-level care	Eye care services to manage uncomplicated eye conditions.	6	66.7	9	100	**1(1-2)**
Hospital care	Referral hospital to manage complicated eye conditions.	8	88.9	9	100	**1(1-1)**
Human resources						
Skill level required for service provision	Staff able to make a diagnosis (take a history; measuring visual acuity; basic eye examination)	8	88.9	9	100	**1(1-1)**
	Staff able to manage some conditions e.g., eye irrigation; remove foreign bodies; give IM injections	8	88.9	9	100	**1(1-1)**
	Staff able to identify which cases to refer and the level of urgency	8	88.9	9	100	**1(1-1)**

Category / Criteria	Technical capacity needed (elements that need to be available)	Top quartile		50th percentile		Median
		Likert 1		Likert 2		(IQR)
		N	%	N	%	
Skill level required for staff supervision. Degree of supervision required.	Primary health care supervisors knowledgeable about eye conditions and their management.	6	66.7	9	100	**1(1-2)**
	Regular supervision of PHC activities and PEC activities	6	66.7	9	100	**1(1-2)**
Frequency or duration of services: e.g. on schedule /periodic or continuous to accommodate emergencies	Staff trained in PEC always available to manage eye conditions and emergencies	8	88.9	9	100	**1(1-1)**
	Facility managers who supply consumables and plan purchasing	6	66.7	9	100	**1(1-2)**
Management and planning requirements. Need for managerial staff	Facility managers establish and maintain referral and feedback between the PH centre and eye care facilities	5	55.6	7	77.8	**1(1-2)**
	Managerial systems to coordinate staff rotations to ensure daily facility coverage by trained PEC staff	7	77.8	9	100	**1(1-1)**
Communication and Transport						
Depends on delivery of communication and transport infrastructure	Communication channels to maintain referral and feedback mechanisms between the PH centre and referral centre	6	66.7	9	100	**1(1-2)**
	Transportation between the PH facility and referral centre	3	33.3	7	77.8	**1(1-2)**
3. Government capacity requirements						
Regulation/legislation						
Need for regulation	National Essential Drug List includes appropriate medication and equipment for eye care in PH facilities	6	66.7	8	88.9	**1(1-1)**
Regulatory measures need to be enforced and regulated	System that regulates drug prescribing and dispensing by appropriate staff	7	77.8	9	100	**1(1-1)**
	Reporting systems for measles outbreaks	9	100.0	9	100	**1(1-1)**
	Reporting system for ophthalmia neonatorum	7	77.8	9	100	**1(1-1)**
Management systems						
Sophisticated management systems required	Managerial structures for PH care include eye care	7	77.8	9	100	**1(1-1)**
Collaborative action						
Inter-sectoral action needed within government, and partnership between government and civil society	Intersectoral action within government or partnerships between government and civil society	6	66.7	9	100	**1(1-2)**
4. Usage Characteristics						
Need for supervision	Staff who make supervisory home visits	5	55.6	7	77.8	**1(1-2)**
	Staff who supervise referrals to ensure compliance	4	44.4	8	88.9	**1(1-2)**
Pre-existing demand						
Need for promotion	Staff who engage in eye health promotion to target audiences	4	44.4	8	88.9	**1(1-2)**
Black market risk						
Need to prevent resale/counterfeiting	Staff who engage and train traditional healers to identify and refer eye conditions, with a system to support training	6	66.7	8	88.9	**1(1-2)**

Tables 5A and B: Gericke's framework; technical capacities needed to deliver (A) health promotion, and (B) facility-based case management.

A. Health promotion

Category	Criteria	Technical Capacity: Elements that need to be available	Health system building block
Intervention characteristics			
Basic product design	*Stability*	Posters that promote eye health should be available. Posters should be durable.	Infrastructure, technology etc
	Standardizability	Standardized posters, delivering the same message per target group.	
		Posters that are in the language of the community.	
		Posters with self-explanatory graphics should be available for the illiterate.	
Supplies and equipment	*Ease of acquisition*	Easy system to procure health promotion materials.	Infrastructure, technology etc
	Number of different types of equipment needed	Different types of posters available for different target groups which are appropriately displayed.	
	Maintenance needed	Health promotion materials available that are easy to maintain.	
Delivery characteristics			
Facilities	*Outreach services*	Health promotion that includes young children and their carers, diabetics and the elderly as the target audience in the community.	Service delivery
	First-level care	Time and space available, and staff willing to deliver opportunistic eye health promotion to specific groups in the facility	
	First-level care	Time and space available, and staff willing to deliver opportunistic eye health promotion to specific individuals in the facility e.g. diabetics.	

Human resources	*Skill level required for service provision*	Staff skilled in communicating with community members	Health workforce
		Staff who are knowledgeable about community, eye diseases and where to access care	
	Intensity of professional services in terms of frequency or duration	Village health workers resident in the community who are able to regularly deliver health promotion.	
		Facility-based staff who are able to regularly deliver health promotion.	
		Professionals to train staff on eye health promotion and develop health promotion materials.	
	Skill level required for staff supervision	Supervisors who are able to supervise health promotion activities including eye health.	
		Staff who regularly deliver health promotion on schedule.	
	Management and planning requirements	Existing managerial staff who plan and organise target audience to be sensitised in appropriate locations e.g. carers of young children.	

Communication and transport	*Dependence of delivery on communication and transport infrastructure*	Local transport infrastructure to visit communities.	Infrastructure, technology etc
		Appropriate communication channels between the community and PHC facilities.	Service delivery/HMIS
		Staff who are able to communicate in the local language.	Health workforce
Government capacity requirements			
Regulation/legislation	*Need for regulation/legislation.*	Health promotion materials which have been approved and endorsed by local regulatory authorities.	Governance and leadership
		A national blindness prevention strategy that incorporates eye health promotion.	
Management systems	*Need for management systems*	Existing managerial structures for health promotion can be used. Eye health promotion activities that are recorded and monitored.	HMIS
Collaborative action	*Need for inter-sectoral action within government.*	Intersectoral activities within government or partnerships between government and civil society.	Governance and leadership
		Existing school health programmes.	Service delivery
	Need for partnership between government and external funding agencies	Collaborations with NGOs to provide health promotion	Governance and leadership
		Collaboration between communities and PHC facilities is required.	
Usage characteristics			
Ease of use	*Need for information and education/need for supervision*	Communication channels with community that are available to inform target population	Service delivery
		Staff who are available to supervise health promotion activities	Governance and leadership
Pre-existing demand	*Need for promotion*	Staff who are able to engage in eye health promotion to target audience to significantly increase demand.	Service delivery
Black market risk	*Need to prevent resale/counterfeiting*	Staff who are able and willing to engage with traditional healers and train them to identify and refer eye conditions. A system that supports this training.	

Table B Facility-based case management

Category	Criteria	Technical Capacity: Elements that need to be available	Health system building block
Intervention characteristics			
Basic product design	*Stability and ease of storage*	Torches should be available. They can be solar powered and are stable.	Infrastructure, technology etc
		Appropriate and secure storage for drugs and consumables should be available	
		Eye drops that do not require cool storage should be stocked	
		Tetanus toxoid will require cool storage and should be available from facility childhood immunisation activities	
		Topical antibiotic ointment does not require cold storage and should be available.	
		Injectable antibiotics for ophthalmia neonatorum may require cool storage but should be available to treat other conditions.	
		Sterile saline solution for eye irrigation is stable and should be available	
		High dose vitamin A is stable and should be available from Maternal and Child health activities.	
	Ease of transport	Pre-existing PHC transport channels should be available to transport PEC consumables.	
	Standardizability	The WHO AFRO PEC Package is standardized and can be available in all Primary Care facilities	
	Safety profile	Available staff who are trained/can be trained to deliver the intervention correctly so as not to cause harm.	Health workforce
Supplies and equipment	*Need for regular supplies*	A medication supply system that can support the regular supply of eye medications and consumables	Infrastructure, technology etc
	High-technology equipment and infrastructure needed	Diagnostic equipment is available: Snellen distance visual acuity chart; near visual acuity chart, torches and batteries.	
		Adequate space to support the use of appropriate and standardized visual acuity charts.	
		Adequate space for counselling patients should be available.	
	Number of different types of equipment needed	The availability of one set of diagnostic equipment	
	Maintenance needed	An available system for the maintenance of facility equipment.	

Delivery characteristics			
Facilities	*First-level care*	The availability of eye care services to manage uncomplicated eye conditions.	Service delivery
Facilities	*Hospital care*	The availability of a referral hospital to manage complicated eye conditions.	
Human resources	*Skill level required for service provision*	Staff who are able to make a diagnosis (eliciting a history; measuring visual acuity; basic eye examination)	
		Staff who are able to manage some conditions e.g., eye irrigation; removal of foreign bodies; give IM injections (tetanus toxoid; antibiotics)	
		Staff who are able to identify which cases to refer and the level of urgency	
	Skill level required for staff supervision	PHC supervisors who are knowledgeable about eye conditions and their management.	Governance and leadership
		Supervisors who regularly supervise PHC activities and can supervise PEC activities	
	Intensity of professional services in terms of frequency or duration	Staff trained in PEC who are available continuously to manage eye conditions, especially emergencies.	Service delivery
	Management and planning requirements	Existing managerial facility staff who are able to manage the supply of consumables and plan purchasing.	Governance and leadership
		Existing managerial facility staff who are able to establish and maintain referral and feedback mechanisms between the PHC facility and eye department/clinic.	
		Existing managerial systems to coordinate staff rotations to ensure daily facility coverage by trained PEC staff.	
Communication and transport	*Dependence of delivery on communication and transport infrastructure*	Communication channels to maintain referral and feedback mechanisms between the PHC facility and the referral centre.	Infrastructure, technology etc
		Transport between the PHC facility and the referral centre.	
Government capacity requirements			
Regulation/legislation	*Need for regulation.*	Appropriate medication and equipment need to be on the national essential drug list to facilitate availability.	Governance and leadership
Management systems	*Need for sophisticated management systems*	A system that regulates drug prescription and dispensing by appropriate staff.	
		Communication channels to report measles outbreaks to relevant authorities.	
		Communication channels to report cases of ophthalmia neonatorum to relevant authorities	
		Existing managerial structures for PHC that can be used to manage PEC.	HMIS

Collaborative action	*Need for inter-sectoral action within government or partnership between government and external funding agencies.*	Availability of inter-sectoral action within government or partnerships between government and civil society.	Governance and leadership
Usage characteristics			
Ease of use	*Need for information and education/need for supervision*	Staff who are available to make supervisory home visits.	Governance and leadership
		Staff who are able to supervise referrals to secondary centres to ensure compliance.	
Pre-existing demand	*Need for promotion*	Staff who are able to engage in eye health promotion to target audience.	Service delivery
Black market risk	*Need to prevent resale/counterfeiting*	Staff who are able and willing to engage with traditional healers and train them to identify and refer eye conditions. A system that supports this training.	

DISCUSSION

Despite global and regional interest in PEC,(7, 9, 23, 24) insights into the technical complexity of PEC and the technical capacities required to deliver it within PHC in SSA are lacking. To the best of our knowledge, this is the first Delphi exercise to explore the technical capacities needed to implement the WHO AFRO PEC package in sub-Saharan Africa.

Our study complements a recent systematic review on health systems preparedness for integration of services at the PHC level,(25) and any tools developed from our study will enable identification of elements of the health system at primary level which need to be strengthened to deliver PEC. Having said this, it is important to recognise that eye health needs to be integrated into all levels of the health system to achieve universal coverage for eye health.(9, 26)

Gericke's framework was selected after a rigorous review of the literature on technical feasibility frameworks; it is a technical complexity framework that complements the notion of institutional capacity in determining the feasibility of implementing or scaling up an intervention.(14) Data to populate the frameworks were largely derived from a detailed review of the literature of PEC in SSA.

Consensus for these capacities were reached after a two-round Delphi exercise by experts in public health for eye care in sub-Saharan Africa; researchers, clinicians, policy makers and administrators. The primary function of panel members was evenly distributed between these three categories, and as all had been involved in policy development and service delivery for eye care, they were experienced in what was feasible and what was not. The literature review and the high consensus from the panel of experts increase the validity of the findings.

In the first round over four-fifths of the statements reached the predefined consensus, which implies that the majority of the technical complexities aligned with the views of the expert panel and their familiarity with the literature.

In the second round, there was consensus on almost all the statements, with 100% consensus for almost two thirds. This is to be expected, as the technical capacities were derived from the technical complexities. For example, one of the technical complexities was "hospital services are needed for referrals, severe cases, treatment failures, further investigations and management, as required" and the technical capacity derived was "the availability of a referral hospital to manage complicated eye conditions".

The agreed human resource elements of the delivery characteristics domain for health promotion and facility-based management had perfect consensus. Human resources for health (HRH) has been identified as a key component for the successful implementation of health interventions(27) and this has been emphasised by two review articles on PEC in

SSA.(10, 18) Government support and strong partnerships are crucial for the success of PEC in terms of sustainability and scaling up, as advocated in the WHO Global Action Plan (2014-2019) and for regulatory activities.(9) Hence the majority of elements in this domain had near perfect consensus. All the elements in the usage characteristics domain for health promotion had perfect consensus in the final round, emphasizing the importance of creating demand (28) and reducing the impact of harmful traditional eye practices. (29)

The WHO Health systems building blocks were mapped unto appropriate elements of the final technical capacity profile for PEC. Adopting a health systems strengthening approach in which eye health is included in all the building blocks will amplify the benefits of the intervention(30) and encourage sustainability.

The technical capacity frameworks for delivering the WHO AFRO PEC package are likely to be generalizable to other SSA contexts, as they were developed using data and experts from a range of SSA countries. Local adaptation may be required to reflect the eye health needs of the population, such as the cadres providing PHC and the availability of informal health providers, for example. Furthermore, these capacity frameworks can be used as a template to develop, monitor and evaluate capacity development for PEC.

There are several strengths and limitations of this study. The selection of the expert panel is a crucial part of the Delphi process as the output is based on their expert opinion.(31) Our expert panel was a non-random sample, and this may have led to hidden biases as the participants may not be representative of all the experts with the pre-determined inclusion criteria. Indeed, almost half of the participants were from the west Africa, but the majority had worked in agencies that had oversight of sub-Saharan African eye health care. Another limitation is that although all panel members had relevant expertise and experience, primary health care practitioners were not included, as the focus was on eye care which the majority of primary health care practitioners in Africa would have little experience of.

One of the disadvantages of the Delphi consensus is that it is provides low level evidence (expert opinion) (32) as randomised controlled trials provide the highest level evidence; only a few trials have been undertaken on PEC in low and middle income countries.(33) However, the Delphi method is useful when there are limited data to guide clinical practice. In this study, the framework for the questionnaires was a validated framework which has been used to assess the non-financial inputs needed to implement new interventions with a view to scaling up.(14) Our study used anonymity, which is an inherent strength of the Delphi process, which helped avoid undue influence by any members and the efficient harnessing of expert opinion from diversely geographically dispersed experts(34) (35) from East, West, Southern Africa and the United Kingdom. Another strength of our study is the low non-

response bias. Although 12 experts were invited to participate, nine agreed and all completed both Delphi rounds.

This study has generated the first technical feasibility capacity profile for primary eye care to guide countries wishing to implement primary eye care, based on an internationally accepted feasibility framework, a review of the PEC literature and expert opinion. However, there was limited published evidence on PEC in SSA, from which the technical capacities were derived. As more high-level evidence studies on PEC in SSA are conducted, the document will need to be revised.

Future research

Mixed-methods data collection tools for different participant groups (village health workers, PHC workers, heads of facilities, district supervisors) in Nigeria have been developed based on our capacities' frameworks i.e., structured questionnaires, observational check lists and topic guides for in-depth interviews. A number of PHC facilities in Southeast Nigeria have been assessed using these tools and a gap analysis will be conducted. The capacity of PHC to deliver eye care has sparked passionate debates(26) and robust studies on the effectiveness of PEC will be needed in the future.

CONCLUSIONS

Consensus was reached on the technical capacities which need to be in place to deliver the WHO AFRO PEC package using a Delphi exercise. Based on this document, study tools have been developed to assess health system gaps in primary health care in Nigeria. Countries or health units wishing to implement PEC using the WHO AFRO PEC package should address any capacity gaps before implementing or scaling up this intervention.

Abbreviations

HMIS	Health management information systems
IM	intramuscular
NGO	Non-Governmental Organisation
PEC	Primary Eye Care
PHC	Primary Health Care
SSA	sub Saharan Africa

Declarations

Ethics approval and consent to participate.

This was part of a wider study on PEC, and ethical approval was obtained from the Ethics Committees of the Federal Ministry of Health, Nigeria (NHREC Approval Number NHREC/01/01/2007-12/03/2018) and the London School of Hygiene & Tropical Medicine (LSHTM Ethics Ref: 14624).

Consent for publication

Not Applicable

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

Author Contributions

AA, HB and CG were responsible for the design and conception of the work. WM, HF, RU, UE, SI, FK, BW contributed to the acquisition of data. AA drafted the work. AA, HB and CG substantially revised it. All authors made some input into the final version and have approved the submitted version.

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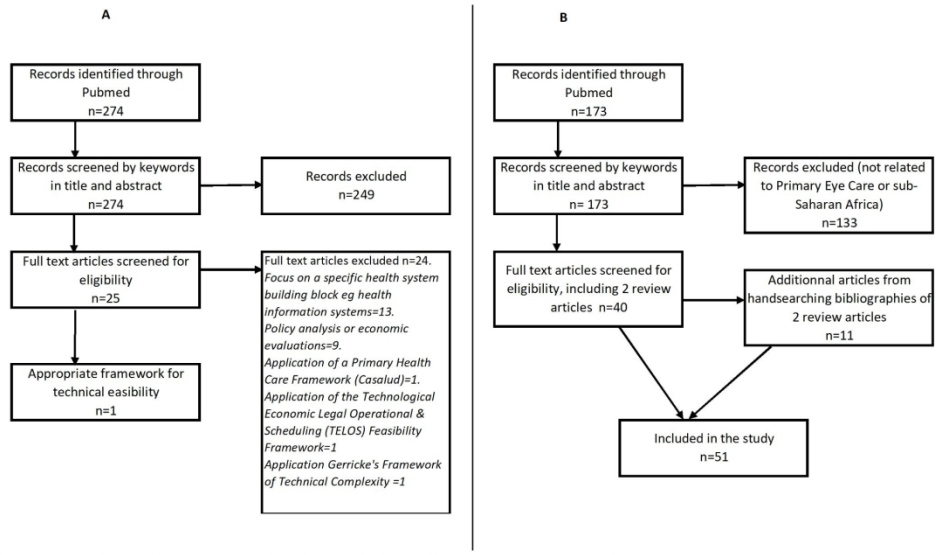

Figure 1. Literature searches for A, technical feasibility framework, and B primary eye care in sub-Saharan Africa

Figure 1. Literature searches for A, technical feasibility framework, and B primary eye care in sub-Saharan Africa.

235x149mm (240 x 240 DPI)

Appendix 1

Delphi Round 1 Health Promotion

Technical Complexity of community based interventions which comprises health promotion and prevention

Health promotion includes health messages for healthy people; health prevention comprises health messages for people at risk for eye diseases targeting children and their carers, those aged 40 years and above, people of all ages and those with diabetes.

Category	Criteria	Technical Complexity (Elements that need to be addressed)	Strongly Agree		Agree		Disagree		Strongly disagree	
Intervention characteristics			n	%	n	%	n	%	n	%
Basic product design	Stability: usable lifetime and risk of destruction	Posters for health Prevention and promotion are needed.	7	77.8	2	22.2	0	0	0	0.0
		Posters should be made durable by lamination.	5	55.6	2	22.2	2	22.2	0	0.0
	Standardizability: the degree to which an intervention can be standardized	The Posters should be standardised by having the same message per target group.	6	66.7	3	33.3	0	0	0	0.0
		This should be translated into the language of the community as is done for other health promotion posters.	7	77.8	2	22.2	0	0	0	0.0
	Safety profile of the intervention in terms of adverse effects, and risks associated with inappropriate use, e.g. from over-the-counter sales of prescription-only medications.	No risk of serious side effects.	5	55.6	1	11.1	2	22.2	1	11.1
		Messages should be clear, unambiguous and understandable displaying appropriate information.	8	88.9	1	11.1	0	0	0	0.0
	Ease of storage e.g. the need for refrigeration. Ease of transport	Health promotion materials do not have any specific requirements for storage and transportation.	4	44.4	4	44.4	1	11.1	0	0.0
Supplies	Need for regular supplies, and the number and types of different supplies needed. Ease of acquisition.	No requirements for regular supplies.	2	22.2	6	66.7	1	11.1	0	0.0
		Different types of posters are be needed for different target groups, e.g. diabetics, the elderly, carers of young children.	7	77.8	2	22.2	0	0	0	0.0
Equipment	High-technology equipment and infrastructure needed. Ease of acquisition.	High technological equipment not required.	4	44.4	4	44.4	1	11.1	0	0.0
	Number of different types of equipment needed. Maintenance needed.	Low maintenance.	6	66.7	3	33.3	0	0	0	0.0
		Health promotion materials relatively easy to acquire.	3	33.3	4	44.4	2	22.2	0	0.0
Delivery characteristics			Strongly Agree		Agree		Disagree		Strongly disagree	
			n	%	n	%	n	%	n	%
Facilities	Retail sector, Outreach services, First-level care, Hospital care	Should be delivered in the community through outreach services for diabetics, carers of young children during maternal and child health activities.	3	33.3	4	44.4	2	22.2	0	0.0
		Should be delivered to specific **groups** that attend the primary health facility e.g. people over 40 years,	4	44.4	1	11.1	4	44.4	0	0.0
		Should be delivered to specific **people** that attend the primary health facility e.g. people over 40 years,	4	44.4	1	11.1	3	33.3	1	11.1
Human resources	Skill level required for service provision	Low skill requirement.	2	22.2	3	33.3	1	11.1	3	33.3
		Will require knowledge about community, eye diseases and where to access care.	6	66.7	2	22.2	1	11.1	0	0.0
		Village Health Workers who live in the community should be trained to deliver health promotion in the communities.	6	66.7	3	33.3	0	0	0	0.0
		Facility based workers should deliver health prevention to groups/individuals in the facility.	2	22.2	6	66.7	1	11.1	0	0.0
		Development of the health promotion materials and staff training will require professional instruction.	5	55.6	4	44.4	0	0	0	0.0
	Skill level required for staff supervision. Degree of supervision required.	Mid-level skill required to supervise health promotion/prevention activities.	3	33.3	5	55.6	0	0	0	0.0
	Intensity of professional services in terms of frequency or duration e.g. on schedule/periodic or continuous to	Health Promotion and prevention activities should be delivered on schedule.	6	66.7	3	33.3	0	0	0	0.0
	Need for managerial staff: Management and planning requirements.	Planning will be required to organise target audience to be sensitised in appropriate locations e.g. Mothers or care givers of young children.	7	77.8	2	22.2	0	0	0	0.0
Communication and transport	Dependence of delivery on communication and transport infrastructure: roads, telephones, need for substantial exchange of information between different sectors or levels of care.	Local transport infrastructure will be needed to visit communities.	4	44.4	3	33.3	2	22.2	0	0.0
		Communication between the communities and the Front Line Health Facilities required.	7	77.8	2	22.2	0	0	0	0.0
		Communication in local language required.	7	77.8	2	22.2	0	0	0	0.0
Government capacity requirements			Strongly Agree		Agree		Disagree		Strongly disagree	
			n	%	n	%	n	%	n	%
Regulation/legislation	Need for legislation/regulation, monitoring regulatory measures. Need for enforcement of regulation.	No special legislation required.	3	33.3	3	33.3	1	11.1	2	22.2
		A national prevention of blindness strategy will be ideal as is advocated in the Global Action Plan.	7	77.8	2	22.2	0	0	0	0.0
Management systems	Need for sophisticated management systems. Need for managerial staff. Level of management and planning requirements.	No need for sophisticated management systems.	2	22.2	6	66.7	1	11.1	0	0.0
		Health Promotion logistics should be managed by managerial structure at frontline health facilities.	5	55.6	2	22.2	1	11.1	1	11.1
Collaborative action	Need for inter-sectoral action within government. Need for partnership between government and civil society. Need for partnership between government and external funding agencies	There is need for intersectoral action within government in trachoma endemic areas to implement water sanitation and hygiene programmes.	8	88.9	1	11.1	0	0	0	0.0
		Eye health promotion could be effectively done in schools.	6	66.7	3	33.3	0	0	0	0.0
		Health Promotion will require collaboration with NGOs.	4	44.4	4	44.4	1	11.1	0	0.0
		Collaboration between communities and Front Line Health Facilities is required.	7	77.8	2	22.2	0	0	0	0.0
Usage characteristics			Strongly Agree		Agree		Disagree		Strongly disagree	
			n	%	n	%	n	%	n	%
Ease of use	Need for information and education	Information and education of the target population in the community is necessary.	7	77.8	1	11.1	1	11.1	0	0.0
	Need for supervision	Supervision of the Village Health Workers is important.	8	88.9	1	11.1	0	0	0	0.0
Pre-existing demand	Need for promotion	The burden of ocular morbidity/BL/VI has been established in many setting in LMICs, but the demand for eye care services is low. Significant level of health promotion needed.	7	77.8	1	11.1	1	11.1	0	0.0
Black market risk	Need to prevent resale/counterfeiting	In some communities, itinerant couchers and traditional healers may compete with orthodox eye care practionners for the patients. Need to limit harmful practices of traditional eye healers by engaging them in eye health prevention activities.	4	44.4	4	44.4	1	11.1	0	0.0

Delphi Round 1 Facility Case Management

Technical Complexity of facility-based intervention

Category	Criteria	**Technical Complexity** (elements that need to be addressed)	Strongly Agree		Agree		Disagree		Strongly disagree	
Intervention characteristics			n	%	n	%	n	%	n	%
Basic product design	Stability/ease of storage/ease of transport	Batteries for torches are not stable in hot climates. Will require frequent replacement.	1	11.1	2	22.2	5	55.6	2	22.2
		Eye drops will require cool storage.	1	11.1	5	55.6	2	22.2	1	11.1
		Tetanus toxoid will require cold storage (refridgeration)	6	66.7	1	11.1	1	11.1	0	0.0
		Topical antibiotic ointment does not need cold storage	4	44.4	4	44.4	1	11.1	0	0.0
		Injectable antibiotics for ophthalmia neonatorum will require cold storage	2	22.2	4	44.4	1	11.1	1	11.1
		Sterile saline solution for eye irrigation is needed and is stable	6	66.7	3	33.3	0	0	0	0.0
		High dose vitamin A is needed and is stable	4	44.4	5	55.6	0	0	0	0.0
		All the above consummables will be transported by pre existing PHC transport channels	8	88.9	1	11.1	0	0	0	0.0
	Standardizability	The WHO AFROC PEC package as 5 algorithms for facility-based care with 12 protocols and 7 standards. Hence the intervention is standardized.	6	66.7	3	33.3	0	0	0	0.0
	Safety profile	None of the products cause any harm, if delivered correctly	4	44.4	4	44.4	1	11.1	0	0.0
Supplies	Need for regular supplies	Regular supplies of eye medication are needed.	8	88.9	1	11.1	0	0	0	0.0
Equipment	High-technology equipment and infrastructure needed	Diagnostic equipment needed: Snellen distance visual acuity chart; near visual acuity chart, torches and batteries.	6	66.7	3	33.3	0	0	0	0.0
		Infrastructure: 6m distance to measure visual acuity.	1	11.1	4	44.4	3	33.3	1	11.1
		Space for counselling required.	4	44.4	5	55.6	0	0	0	0.0
	Number of different types of equipment needed	One set of diagnostic equipment per facility is needed	3	33.3	5	55.6	1	11.1	0	0.0
	Maintenance needed	Torch batteries will need to be changed.	2	22.2	5	55.6	0	0	1	11.1
Delivery characteristics			Strongly Agree		Agree		Disagree		Strongly disagree	
			n	%	n	%	n	%		%
Human resources	Retail sector	Not applicable	0	0	1	11.1	6	66.7	2	22.2
	Outreach services	None (see health promotion framework)	1	11.1	0	0.0	5	55.6	3	22.2
	First-level care	Diagnoses of management of uncomplicated cases can be delivered in Primary Health Centres and Health Posts.	5	55.6	4	44.4	0	0	0	0
	Hospital care	Hospital services are needed for referrals, severe cases and treatment failures, further investigations and management, as required.	7	77.8	2	22.2	0	0	0	0
	Skill level required for service provision	Mid-level skill is required to make a diagnosis (eliciting a history; measuring visual acuity; basic eye examination)	7	77.8	1	11.1	0	0	0	0
		Mid-level skill is required for management of some conditions e.g., eye irrigation; removal of foreign bodies; giving intramuscular injections (tetanus toxoid; antibiotics)	5	55.6	2	22.2	0	0	1	11.1
		Mid-level skill is required for identifying which cases to refer and the level of urgency	5	55.6	2	22.2	0	0	0	0.0
	Skill level required for staff supervision. Degree of supervision required.	Primary Health Care supervisors need a good level of knowledge of eye conditions and their management and be skilled in the above. activity needed.	5	55.6	3	33.3	0	0	1	11.1
		Regular supervision of PEC required.	8	88.9	1	11.1	0	0	0	0
	Intensity of professional services in terms of frequency or duration. e.g. on schedule /periodic or continuous to accommodate emergencies.	Primary Health Care workers trained in eye care should be available continuously to manage emergencies	7	77.8	2	22.2	0	0	0	0
	Management and planning requirements. Need for managerial staff	Managerial staff needed to manage supplies of consumables and plan purchasing	3	33.3	5	55.6	1	11.1	0	0
		Managerial staff needed to establish and maintain referral and feedback mechanisms between the PH centre and eye department/clinic.	4	44.4	2	22.2	3	33.3	0	0
		Managerial systems to coordinate staff rotations to ensure daily facility coverage by trained PEC staff.	5	55.6	3	33.3	1	11.1	0	0
Communication and Transport	Depends on delivery of communication and transport infrastructure	Depends on communication to establish and maintain referral and feedback mechanisms between PH centres and eye department/clinic. Respond to feedback from referrals.	7	77.8	2	22.2	0	0	0	0
		Transportation between PH Centre and referral centre imperative.	6	66.7	2	22.2	1	11.1	0	0
Government capacity requirements			Strongly Agree		Agree		Disagree		Strongly disagree	
			n	%	n	%	n	%	n	%
Regulation/legislation	Need for regulation.	Appropriate medication & equipment need to be on the national essential drug list to facilitate availability.	8	88.9	1	11.1	0	0	0	0
	Need for monitoring regulatory measures. Need for enforcement of regulation.	There is need for regulation of drug prescription and dispensing by appropriate staff.	7	77.8	2	22.2	0	0	0	0
		Measles is a notifiable condition and should be reported to appropriate regulatory authorities.	8	88.9	0	0.0	1	11.1	0	0
		Ophthalmia neonatorum is a notifiable condition and should be reported	6	66.7	1	11.1	2	22.2	0	0
Management systems	Need for sophisticated management systems	No need for sophisticated management systems	2	22.2	5	55.6	2	22.2	0	0
Collaborative action	Need for inter-sectoral action within government. Need for partnership between government and civil society.	Intersectoral action withingovernment or partnerships between government and civil society are desirable but not mandatory.	4	44.4	4	44.4	1	11.1	0	0
	Need for partnership between government and external funding agencies	Need for partnerships between governments and NGOs.	4	44.4	5	55.6	0	0	0	0
		NGOs are responsible for the bulk of eye care in LMICs.	2	22.2	5	55.6	2	22.2	0	0
Usage characteristics			Strongly Agree		Agree		Disagree		Strongly disagree	
	XXXXXXnEED FOR INFORMATION		n	%	n	%	n	%	n	%
Ease of use	Need for supervision	Outcomes of consultation at the PH Centre will be reassurance, treatment (and) or referral. At this level, prescribed treatments may not require supervision at home.	3	33.3	3	33.3	3	33.3	0	0
		Referrals to secondary centres may require supervision to ensure compliance and may have to be supported.	7	77.8	2	22.2	0	0	0	0
Pre-existing demand	Need for promotion	The burden of ocular morbidity/BL/VI has been established in many setting in LMICs but the demand for eye care services is low. Significant level of health promotion needed.	7	77.8	2	22.2	0	0	0	0
Black market risk	Need to prevent resale/counterfeiting	Need to limit harmful practices of traditional eye healers by training them to identify and refer eye conditions.	6	66.7	3	33.3	0	0	0	0

Appendix 2

Modifications made in the technical complexity requirements after Delphi round 1

Gericke's Framework Dimensions	WHO AFRO PEC Package Component	
	Health Promotion and Prevention	Case Facility Management
	Statements Modified	
Intervention Characteristics Basic Product Design Equipment	Community Health Workers should be instructed on the potential side effects of any health Promotion materials.	Torches can be solar- powered and are stable. Appropriate and secure storage for drugs and consummables should be available. Eye drops that do not require cool storage should be stocked. Injectable antibiotics for ophthalmia neonatorum may require cool storage but should be available to treat other conditions. Adequate space to support the use of appropriate and standardized visual acuity charts.eg 3m or 6m
Delivery Characteristics Type of Facility needed Human Resource Requirement Communication and Transport	Availability of community leaders to deliver eye health promotion when required Opportunistic eye health promotion can be delivered to groups in the facility Opportunistic health promotion can be delivered to individual people in the facility- if time permits.	Existing managerial facility staff should be able to establish and maintain referral and feedback mechanisms between the PH centre
Government Capacity Requirements Regulation/Legislation **Usage Characteristics** Ease of use& Need for Supervision	Health promotion materials should be approved and endorsed by local regulatory authorities. Eye health promotion activities should be recorded and monitored.	Staff who are available to make supervisory home visits.

Appendix 3

Delphi Round 2 Health Promotion

Technical Capacity for community based interventions which comprises health promotion and prevention

Category	Criteria	Technical Complexity (Elements that need to be addressed)	Technical Capacity needed (Elements that need to be available)	Strongly Agree n	Strongly Agree %	Agree n	Agree %	Disagree n	Disagree %	Strongly disagree n	Strongly disagree %
Intervention characteristics											
	Stability: usable lifetime and risk of destruction	Posters for health Prevention and promotion are needed.	Posters that promote eye health should be available.	7	77.8	2	22.2	0	0	0	0
		Posters should be made durable by lamination.	The availability of durable posters.	4	44.4	5	55.6	0	0	0	0
	Standardizability: the degree to which an intervention can be standardized	The Posters should be standardised by having the same message per target group.	The availability of standardized posters, delivering the same message per target group.	5	55.6	4	44.4	0	0	0	0
		This should be translated into the language of the community as is done for other health promotion posters.	Available posters should be in the language of the community.	6	66.7	1	11.1	2	22.2	0	0
Basic product design	Safety profile of the intervention in terms of adverse effects, and risks associated with inappropriate use, e.g. from over-the-counter sales of prescription-only medications.	No risk of serious side effects.	Community Health Workers should be instructed on the potential dangers, such as fire, of wall posters of any health Promotion materials. Mechanisms for the proper disposal of old posters should be in place.	3	33.3	3	33.3	2	22.2	1	11.1
		Messages should be clear, unambiguous and understandable displaying appropriate information.	Posters with self expanatory graphics should be available to accommodate the illiterate.	8	88.9	1	11.1	0	0	0	0
Supplies	Ease of storage e.g. the need for refrigeration. Ease of transport	Health promotion materials do not have any specific requirements for storage and transportation.	NA								
	Need for regular supplies, and the number and types of different supplies needed. Ease of acquisition.	No requirements for regular supplies.	NA								
		Different types of posters are be needed for different target groups, e.g. diabetics, the elderly, carers of young children.	Availability of different types of posters for different target groups which are appropriately displayed.	5	55.6	3	33.3	1	11.1	0	0
Equipment	High-technology equipment and infrastructure needed. Ease of acquisition.	High technological equipment not required.	NA								
	Number of different types of equipment needed. Maintenance needed.	Low maintenance.	The availability of health promotion materials that are easy to maintain.	5	55.6	4	44.4	0	0	0	0
		Health promotion materials relatively easy to acquire.	A system for the easy procurement of health promotion materials.	6	66.7	3	33.3	0	0	0	0
Delivery characteristics				Strongly Agree n	Strongly Agree %	Agree n	Agree %	Disagree n	Disagree %	Strongly disagree n	Strongly disagree %
	Retail sector, Outreach services, First-level care, Hospital care	Should be delivered in the community through outreach services for diabetics, carers of young children during maternal and child health activities.	Availability of health promotion in the community that includes young children and their carers, diabetics and the elderly as their target audience.	4	44.4	5	55.6	0	0	0	0
			Availability of community leaders to deliver eye health promotion when required	3	33.3	2	22.2	3	33.3	1	11.1
Facilities		Should be delivered to specific **groups** that attend the primary health facility e.g. people over 40 years,	The availability of time, space and willingness to deliver opportunistic eye health promotion to groups in the facility	7	77.8	1	11.1	1	11.1	0	0
		Should be delivered to specific **people** that attend the primary health facility e.g. people over 40 years,	The availability of time and the willingness to deliver opportunistic eye health promotion to targeted individuals in the facility e.g. diabetics.	5	55.6	2	22.2	2	22.2	0	0
	Skill level required for service provision	Low skill requirement.	Availability of staff skilled in communicating with community members	7	77.8	2	22.2	0	0	0	0
		Will require knowledge about community, eye diseases and where to access care.	Availability of staff who are knowledgeable about community, eye diseases and where to access care	7	77.8	2	22.2	0	0	0	0
		Village Health Workers who live in the community should be trained to deliver health promotion in the communities.	Availability of village health workers resident in the community who are able to deliver health promotion.	6	66.7	3	33.3	0	0	0	0
Human resources		Facility based workers should deliver health prevention to groups/individuals in the facility.	Facility based staff who are able to deliver health promotion.	5	55.6	4	44.4	0	0	0	0
		Development of the health promotion materials and staff training will require professional instruction.	Availability of professionals to train staff on eye health promotion and develop health promotion materials.	9	100	0	0	0	0	0	0
	Skill level required for staff supervision. Degree of supervision required.	Mid-level skill required to supervise health promotion/prevention activities.	Availability of supervisors who are able to supervise health promotion activities including eye health.	7	77.8	2	22.2	0	0	0	0
	Intensity of professional services in terms of frequency or duration e.g. on schedule/periodic or continuous to	Health Promotion and prevention activities should be delivered on schedule.	Availability of staff who regularly deliver health promotion on schedule.	7	77.8	2	22.2	0	0	0	0
	Need for managerial staff: Management and planning requirements.	Planning will be required to organise target audience to be sensitised in appropriate locations e.g. Mothers or care givers of young children.	Availability of existing managerial staff who plan and organise target audience to be sensitised in appropriate locationes e.g. carers of young children.	5	55.6	4	44.4	0	0	0	0
Communication and transport	Dependence of delivery on communication and transport infrastructure: roads, telephones, need for substantial exchange of information between different sectors or levels of care.	Local transport infrastructure will be needed to visit communities.	The availability of local transport infrastructure to visit communities.	6	66.7	1	11.1	2	22.2	0	0
		Communication between the communities and the Front Line Health Facilities required.	The availability of appropriate communication channels between the community and frontline health facilities.	8	88.9	1	11.1	0	0	0	0
		Communication in local language required.	The availability of staff who are able to communicate in the local language.	9	100	0	0	0	0	0	0
Government capacity requirements				Strongly Agree n	Strongly Agree %	Agree n	Agree %	Disagree n	Disagree %	Strongly disagree n	Strongly disagree %
Regulation/legislation	Need for legislation/regulation, monitoring regulatory measures. Need for enforcement of regulation.	No special legislation required.	Health promotion materials which have been approved and endorsed by local regulatory autorities.	5	55.6	3	33.3	1	11.1	0	0
			Eye health promotion activities that are recorded and monitored.	4	44.4	3	33.3	1	11.1	0	0
		A national prevention of blindness strategy will be ideal as is advocated in the Global Action Plan.	Availability of a national blindness prevention strategy that incoporates eye health promotion.	8	88.9		0	1	11.1	0	0
Management systems	Need for sophisticated management systems. Need for managerial staff. Level of management and planning requirements.	No need for sophisticated management systems.	NA								
		Health Promotion logistics should be managed by managerial structure at frontline health facilities.	Availability of existing managerial structures for Health Promotion that can be used to manage eye health promotion.	4	44.4	3	33.3	1	11.1	1	11.1
Collaborative action	Need for inter-sectoral action within government. Need for partnership between government and civil society. Need for partnership between government and external funding agencies	There is need for intersectoral action within government in trachoma endemic areas to implement water sanitation and hygiene programmes.	Availability of intersectoral activities within government or partnerships between government and civil society.	6	66.7	3	33.3	0	0	0	0
		Eye health promotion could be effectively done in schools.	The availability of existing school health programmes.	3	33.3	4	44.4	1	11.1	1	11.1
		Health Promotion will require collaboration with NGOs.	The availability of collaborations with NGOs to provide health promotion	1	11.1	6	66.7	2	22.2	0	0
		Collaboration between communities and Front Line Health Facilities is required.	Availability of collaboration between communities and frontline health communities is required.	7	77.8	2	22.2	0	0	0	0
Usage characteristics				Strongly Agree n	Strongly Agree %	Agree n	Agree %	Disagree n	Disagree %	Strongly disagree n	Strongly disagree %
Ease of use	Need for information and education	Information and education of the target population in the community is necessary.	Communicaton channels with community that are available to inform target population	8	88.9	1	11.1	0	0	0	0
	Need for supervision	Supervision of the Village Health Workers is important.	Staff who are available to to supervise health promotion activities.	8	88.9	1	11.1	0	0	0	0
Pre-existing demand	Need for promotion	The burden of ocular morbidity/BL/VI has been established in many setting in LMICs, but the demand for eye care services is low. Significant level of health promotion needed.	Staff who are able to engage in health promotion which includes the uptake of eye care when required.	8	88.9	1	11.1	0	0	0	0
Black market risk	Need to prevent resale/counterfeiting	In some communities, itinerant couchers and traditional healers may compete with orthodox eye care practionners for the patients. Need to limit harmful practices of traditional eye healers by engaging them in eye health prevention activities.	Staff who are able and willing to engage with traditional healers and train them to identify and refer eye conditions. A system that supports this training.	7	77.8	2	22.2	0	0	0	0

Delphi Round 2 Facility Case Management

Technical Capacity for facility-based intervention

Category	Criteria	Technical Complexity (elements that need to be addressed)	Technical Capacities (elements that need to be assessed)	Strongly Agree		Agree		Disagree		Strongly disagree	
Intervention characteristics				n	%	n	%	n	%	n	%
		Batteries for torches are not stable in hot climates. Will require frequent replacement.	Torches can be solar powered and are stable. They should be available.	6	66.67	3	33.3	0	0	0	0
			Appropriate and secure storage for drugs and consummables should be available.	8	88.89	1	11.1	0	0	0	0
		Eye drops will require cool storage.	Eye drops that do not require cool storage should be stocked	5	55.56	3	33.3	0	0	0	0
		Tetanus toxoid will require cold storage (refridgeration)	Tetanus toxoid will require cool storage and should be available from the facility childhood immunisation activities	6	66.67	2	22.2	0	0	0	0
	Stability/ease of storage/ease of transport	Topical antibiotic ointment does not need cold storage	Topical antibiotic ointment does not require cold storage and should be available.	6	66.67	2	22.2	0	0	0	0
		Injectable antibiotics for ophthalmia neonatorum will require cold storage	Injectable antibiotics for ophthalmia neonatorum may require cool storage but should be available to treat other conditions.	4	44.44	3	33.3	1	11.1	0	0
Basic product design		Sterile saline solution for eye irrigation is needed and is stable	Sterile saline solution for eye irrigation is stable and should be available	4	44.44	3	33.3	1	11.1	0	0
		High dose vitamin A is needed and is stable	High dose vitamin A is stable and should be available from Maternall and Child health activities.	5	55.56	4	44.4	0	0	0	0
		All the above consummables will be transported by pre existing PHC transport channels	Pre existing PHC transport channels should be available to transport PEC consummables.	7	77.78	2	22.2	0	0	0	0
	Standardizability	The WHO AFROC PEC package as 5 algorithms for facility-based care with 12 protocols and 7 standards. Hence the intervention is standardized.	The WHO AFRO PEC Package is standardized and can be available in all Primary Care facilities	6	66.67	3	33.3	0	0	0	0
	Safety profile	None of the products cause any harm, if delivered correctly	Available staff who are trained/can be trained to deliver the intervention correctly so as not to cause harm.	8	88.89	1	11.1	0	0	0	0
Supplies	Need for regular supplies	Regular supplies of eye medication are needed.	A medication supply system that can support the regular supply of eye medications and consummables	8	88.89	1	11.1	0	0	0	0
	High-technology equipment and infrastructure needed	Diagnostic equipment needed: Snellen distance visual acuity chart; near visual acuity chart, torches and batteries.	Diagnostic equipment is available: Snellen distance visual acuity chart; near visual acuity chart, torches and batteries.	7	77.78	2	22.2	0	0	0	0
		Infrastructure: 6m distance to measure visual acuity.	Adequate space to support the use of appropriate and standardized visual acuity charts.	6	66.67	2	22.2	0	0	0	0
Equipment		Space for counselling required.	Adequate space for counselling patients should be available.	8	88.89	1	11.1	0	0	0	0
	Number of different types of equipment needed	One set of diagnostic equipment per facility is needed	The availability of one set of diagnostic equipment.	6	66.67	2	22.2	1	11.1	0	0
	Maintenance needed	Torch batteries will need to be changed.	An available system for the maintenace of facility equipment.	5	55.56	4	44.4	0	0	0	0
Delivery characteristics				**Strongly Agree**		**Agree**		**Disagree**		**Strongly disagree**	
				n	%	n	%	n	%	n	%
	First-level care	Diagnoses of management of uncomplicated cases can be delivered in Primary Health Centres and Health Posts.	The availability of eye care services to manage uncomplicated eye conditions.	6	66.67	3	33.3	0	0	0	0
	Hospital care	Hospital services are needed for referrals, severe cases and treatment failures, further investigations and management, as required.	The availability of a referral hospital to manage complicated eye conditions.	8	88.89	1	11.1	0	0	0	0
		Mid-level skill is required to make a diagnosis (eliciting a history; measuring visual acuity; basic eye examination)	Staff who are able to make a diagnosis (eliciting a history; measuring visual acuity; basic eye examination)	8	88.89	1	11.1	0	0	0	0
	Skill level required for service provision	Mid-level skill is required for management of some conditions e.g., eye irrigation; removal of foreign bodies; giving intramuscular injections (tetanus toxoid; antibiotics)	Staff who are able to manage some conditions e.g., eye irrigation; removal of foreign bodies; giving intramuscular injections (tetanus toxoid; antibiotics)	8	88.89	1	11.1	0	0	0	0
		Mid-level skill is required for identifying which cases to refer and the level of urgency	Staff who are able to identify which cases to refer and the level of urgency	8	88.89	1	11.1	0	0	0	0
	Skill level required for staff supervision. Degree of supervision required.	Primary Health Care supervisors need a good level of knowledge of eye conditions and their management and be skilled in the above. activity needed.	Primary Health Care supervisors who are knowledge of eye conditions and their management.	6	66.67	3	33.3	0	0	0	0
Human resources		Regular supervision of PEC required.	Supervisors who regularly supervise PHC activities and can supervie PEC activities	6	66.67	3	33.3	0	0	0	0
	Intensity of professional services in terms of frequency or duration. e.g. on schedule /periodic or continuous to accommodate emergencies.	Primary Health Care workers trained in eye care should be available continuously to manage emergencies	Staff trained in PEC who are available continuosly to manage eye conditions, especially emergencies.	8	88.89	1	11.1	0	0	0	0
		Managerial staff needed to manage supplies of consumables and plan purchasing	Existing managerial facility staff who are able to manage the supply of consummables and plan purchasing.	6	66.67	3	33.3	0	0	0	0
	Management and planning requirements. Need for managerial staff	Managerial staff needed to establish and maintain referral and feedback mechanisms between the PH centre and eye department/clinic.	Existing managerial facility staff who are able to establish and maintain referral and feedback mechanisms between the PH centre and eye department/clinic.	5	55.56	2	22.2	1	11.1	0	0
		Managerial systems to coordinate staff rotations to ensure daily facility coverage by trained PEC staff.	Existing managerial systems to coordinate staff rotations to ensure daily facility coverage by trained PEC staff.	7	77.78	2	22.2	0	0	0	0
Communication and Transport	Depends on delivery of communication and transport infrastructure	Depends on communication to establish and maintain referral and feedback mechanisms between PH centres and eye department/clinic. Respond to feedback from referrals.	The availability of communication channels to maintain referral and feedback mechanisms between the primary health facility and the referral centre.	6	66.67	3	33.3	0	0	0	0
		Transportation between PH Centre and referral centre imperative.	The availability of transportation between the Primary health facility and the referral centre.	3	33.33	4	44.4	1	11.1	0	0
Government capacity requirements				**Strongly Agree**		**Agree**		**Disagree**		**Strongly disagree**	
				n	%	n	%	n	%	n	%
	Need for regulation.	Appropriate medication & equipment need to be on the national essential drug list to facilitate availability.	The inclusion of appropriate medication & equipment need to be on the national essential drug list to facilitate availability.	6	66.67	2	22.2	0	0	0	0
Regulation/legislation	Need for monitoring regulatory measures. Need for enforcement of regulation.	There is need for regulation of drug prescription and dispensing by appropriate staff.	A system that regulates drug prescription and dispensing by appropriate staff.	7	77.78	2	22.2	0	0	0	0
		Measles is a notifiable condition and should be reported to appropriate regulatory authorities.	The availability of communication channels to report measles outbreaks to relevant authorities.	9	100	0	0	0	0	0	0
		Ophthalmia neonatorum is a notifiable condition and should be reported	The availability of communication channels to report outbreaks of ophthalmia neonatorum to relevant authorities.	7	77.78	2	22.2	0	0	0	0
Management systems	Need for sophisticated management systems	No need for sophisticated management systems	Existing managerial structures for Primary Health Care that can be used to manage PEC.	7	77.78	2	22.2	0	0	0	0
	Need for inter-sectoral action within government. Need for partnership between government and civil society.	Intersectoral action withingovernment or partnerships between government and civil society are desirable but not mandatory.	Availability of intersectoral action within government or partnerships between government and civil society.	6	66.67	3	33.3	0	0	0	0
Collaborative action	Need for partnership between government and external funding agencies	Need for partnerships between governments and NGOs.	Availability of health care NGOs in the community.	0	0	5	55.6	4	44.4	0	0
		NGOs are responsible for the bulk of eye care in LMICs.	Availability of eye care NGOs in the community.	1	11.11	5	55.6	2	22.2	1	11.1
Usage characteristics				**Strongly Agree**		**Agree**		**Disagree**		**Strongly disagree**	
				n	%	n	%	n	%	n	%
	Need for supervision	Outcomes of consultation at the PH Centre will be reassurance, treatment (and) or referral. At this level, prescribed treatments may not require supervision at home.	Staff who are available to make supervisory home visits.	5	55.56	2	22.2	2	22.2	0	0
		Referrals to secondary centres may require supervision to ensure compliance and may have to be supported.	Staff who are able to supervise referrals to secondary centres to ensure compliance.	4	44.44	4	44.4	1	11.1	0	0
Pre-existing demand	Need for promotion	The burden of ocular morbidity/BL/VI has been established in many setting in LMICs but the demand for eye care services is low. Significant level of health promotion needed.	Staff who are able to engage in eye health promotion to target audience.	4	44.44	4	44.4	1	11.1	0	0
Black market risk	Need to prevent resale/counterfeiting	Need to limit harmful practices of traditional eye healers by training them to identify and refer eye conditions.	Staff who are able and willing to engage with traditional healers and train them to identify and refer eye conditions. A system that supports this training.	6	66.67	2	22.2	1	11.1	0	0

Reporting checklist for quality improvement study.

Based on the SQUIRE guidelines.

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	Reporting Item	Page Number
Title		
#1	Indicate that the manuscript concerns an initiative to improve healthcare (broadly defined to include the quality, safety, effectiveness, patientcenteredness, timeliness, cost, efficiency, and equity of healthcare)	1

Abstract			
	#02a	Provide adequate information to aid in searching and indexing	2
	#02b	Summarize all key information from various sections of the text using the abstract format of the intended publication or a structured summary such as: background, local problem, methods, interventions, results, conclusions	2
Introduction			
Problem description	#3	Nature and significance of the local problem	3
Available knowledge	#4	Summary of what is currently known about the problem, including relevant previous studies	3
Rationale	#5	Informal or formal frameworks, models, concepts, and / or theories used to explain the problem, any reasons or assumptions that were used to develop the intervention(s), and reasons why the intervention(s) was expected to work	3
Specific aims	#6	Purpose of the project and of this report	4
Methods			
Context	#7	Contextual elements considered important at the outset of introducing the intervention(s)	4
Intervention(s)	#08a	Description of the intervention(s) in sufficient detail that others could reproduce it	4-6
Intervention(s)	#08b	Specifics of the team involved in the work	4,6,8

Study of the Intervention(s)	#09a	Approach chosen for assessing the impact of the intervention(s)	'n/a'
Study of the Intervention(s)	#09b	Approach used to establish whether the observed outcomes were due to the intervention(s)	'n/a'
Measures	#10a	Measures chosen for studying processes and outcomes of the intervention(s), including rationale for choosing them, their operational definitions, and their validity and reliability	4
Measures	#10b	Description of the approach to the ongoing assessment of contextual elements that contributed to the success, failure, efficiency, and cost	5-6
Measures	#10c	Methods employed for assessing completeness and accuracy of data	7
Analysis	#11a	Qualitative and quantitative methods used to draw inferences from the data	7
Analysis	#11b	Methods for understanding variation within the data, including the effects of time as a variable	'n/a'
Ethical considerations	#12	Ethical aspects of implementing and studying the intervention(s) and how they were addressed, including, but not limited to, formal ethics review and potential conflict(s) of interest	4, 22

Results

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	#13b	Details of the process measures and outcome	11-14
	#13c	Contextual elements that interacted with the intervention(s)	'n/a'
	#13d	Observed associations between outcomes, interventions, and relevant contextual elements	'n/a'
	#13e	Unintended consequences such as unexpected benefits, problems, failures, or costs associated with the intervention(s).	'n/a'
	#13f	Details about missing data	'n/a'
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Technical capacities needed to implement the World Health Organization's primary eye care package for Africa: results of a Delphi process

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Technical capacities needed to implement the World Health Organization's primary eye care package for Africa: results of a Delphi process

Aghaji, Ada [1, 2]; Burchett, Helen [3]; Mathenge, Wanjiku [4]; Faal, Hannah [5]; Umeh, Rich [2]; Ezepue, Felix [2]; Isiyaku, Sunday [6]; Kyari, Fatima[7]; Wiafe, Boateng[8]; Foster, Allen[1]; Gilbert, Clare[1]

1. International Centre for Eye Health, London School of Hygiene & Tropical Medicine, London, United Kingdom.
2. Department of Ophthalmology, College of Medicine, University of Nigeria, Enugu, Nigeria.
3. Faculty of Public Health and Policy, London School of Hygiene & Tropical Medicine, London, United Kingdom.
4. Rwanda International Institute of Ophthalmology, Kigali, Rwanda.
5. African Vision Research Institute, Durban, KwaZulu- Natal, South Africa.
6. Sightsavers Country Office, Kaduna, Nigeria.
7. Department of Ophthalmology, Baze University, Abuja, Nigeria.
8. Operation Eyesight, Accra, Ghana.

Corresponding author Aghaji Ada
aaghaji@yahoo.co.uk, ada.aghaji@unn.edu.ng
https://orcid.org/0000-0003-1308-447X

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Technical capacities needed to implement the World Health Organization's primary eye care package for sub-Saharan Africa: results of a Delphi process

ABSTRACT

Objective The aim of the study was to establish the technical capacities needed to deliver the World Health Organization African Region's primary eye care package in primary health care facilities.

Design A two-round Delphi exercise was used to obtain expert consensus on the technical complexity of each component of the package and the technical capacities needed to deliver them, using Gericke's framework of technical feasibility. The panel comprised nine eyecare experts in primary eyecare in sub-Saharan Africa. In each round panel members used a 4-point Likert scale to indicate their level of agreement. Consensus was predefined as ≥70% agreement on each statement. For round 1, statements on technical complexity were identified through a literature search of primary eyecare in sub-Saharan Africa from January 1980 to April 2018. Statements for which consensus was achieved were included in round 2 and the technical capacities were agreed.

Results Technical complexity statements were classified into four broad categories: intervention characteristics, delivery characteristics, government capacity requirements and usage characteristics. 34 of the 38 (89%) statements on health promotion and 40 of the 43 (93%) statements on facility case management were considered necessary technical capacities for implementation.

Conclusion This study establishes the technical capacities needed to implement the WHO AFRO primary eye care package which may be generalizable to countries in Sub-Saharan Africa

Article Summary

Strengths and limitations of this study

- This is the first study to establish the technical capacities needed to implement primary eye care in sub-Saharan Africa.
- A recognised technical feasibility framework was used, and statements were derived from a literature review of primary eye care in sub-Saharan Africa.
- A Delphi exercise was used to garner expert opinion and to reach consensus.
- Our expert panel was a non-random sample, and this may have led to hidden biases as the participants may not be representative of all the experts with the pre-determined inclusion criteria.

INTRODUCTION

Scope of the problem

Estimates from sub-Saharan Africa (SSA) indicate that about 22 million people are blind or visually impaired, mainly from avoidable causes such as cataract and uncorrected refractive errors. In addition, over 100 million older adults in SSA are estimated to have near visual impairment.(1) The age standardised prevalence of blindness (≥50 years) is highest of all world regions, being in 5.1% in western and 4.3% eastern sub-Saharan Africa (2), with 80% of causes being preventable or treatable. Much of the regional variation in prevalence is explained by variability in access to eye care.(3)

Although there are limited data on regional estimates for non-visually impairing conditions (NVICs) in SSA, such as allergic/infective conjunctivitis and dry eye syndrome, the prevalence of NVICs in Kenya and Nigeria are estimated to be 15% and 25%, respectively. (4, 5) These figures suggest a high need for eye care services in SSA, yet only 30% of Africans have access to eye care.(6)

Primary Eye care in sub-Saharan Africa

The inclusion of primary eye care (PEC) in primary health care (PHC) has been recommended as a strategy to increase sustainability and access to eye care services, (7) (8) and there is global and regional support for PEC. (9) Indeed, the World Health Organisation (WHO) in their Global Action Plan 2014-2019, reiterates the importance of accessible eye care services for the effective control of blindness and visual impairment, and calls on member states to secure the inclusion of PEC within PHC.(10) However, a literature review of PEC in SSA reported many challenges to the effective implementation of PEC. These include a lack of agreement on the scope of PEC and a lack of clear guidelines on the technical eye related skills required by PHC workers; these affect the extent of training, supervision, and the type of equipment and consumables required.(11) In response to this, the WHO Africa Office (WHO AFRO) recently developed and pilot tested a package of interventions for PEC in SSA. The WHO AFRO PEC Package consists of eight elements which cover two broad areas i.e. health promotion and facility based case management.(12, 13) For health promotion the package has (two elements): 1. four sets of health messages for healthy people, people at risk of and with eye diseases, for children and carers, those aged 40 and above, people of all ages and those with diabetes and 2. instructions on how to give a health talk. For facility-based case management the package has six elements 1. five evidence-based algorithms for red eye, eye swelling, trauma, vision loss for distance and near, and children 0-5 years, 2. a set of 12 evidence-based protocols covering five topics: how to measure visual acuity (VA), how to cover an eye, medication, referrals, removal of

foreign bodies), 3. a training package (curriculum and materials), 4. core lists of essential consumables, technologies and medicines, 5. a set of 10 standards and indicators for monitoring and evaluation and 6. templates to collect health information, monitoring and evaluation. Although this health initiative has the potential to increase coverage of eye health services in sub-Saharan Africa (SSA),(8) not all health initiatives proposed may be feasible to implement. Feasibility research can help identify the challenges as well as opportunities in implementing a new health initiative. This is particularly true for the WHO AFRO sub-region where there is a marked variability in the ability of the 47 member states to implement additional interventions within PHC. (14)

Feasibility in relation to health initiatives is a multifaceted construct which Snowdon described as having the following components: technical, political, cultural, financial and legal feasibility; (15) the technical feasibility component was selected for this study. Technical feasibility is a balance between how complex the intervention is and the technical capacities required to implement it.(16) The WHO AFRO PEC package has many different technical components, and the overall purpose of this study was to assess the feasibility of integrating the package into PHC in SSA. In this paper we report the processes involved in developing the content of the feasibility framework for PEC for use in PHC settings in sub-Saharan African countries.

METHODS

Our approach was framed by awareness of the limited published literature on the effectiveness of PEC in sub-Saharan Africa (11) and the need to adopt a systematic method to provide expert consensus on the feasibility of implementing PEC to guide policy makers. Against this backdrop, we used a combination of methods: literature reviews (of feasibility frameworks for public health interventions, and of PEC in SSA) and a Delphi process. The Delphi method is an iterative method of collecting opinions from a group of experts where evidence from other more robust sources is not available. It uses a series of questionnaires, and responses are modified based on feedback.(17) The Delphi process has been used in a wide variety of research areas, including health research.(18) The classic Delphi process is characterised by a) anonymity of the participants to each other, which encourages free expression of opinion, b) iteration, c) controlled feedback from the group, and d) statistical aggregation of the group response.(18)

Step 1. Delphi Questionnaire Development

The WHO AFRO PEC package was divided into two components: eye health prevention/ promotion and case management. An appropriate technical feasibility framework was identified by searching PubMed from January 2000 to April 2018 using the search terms "technical feasibility" and "frameworks." The titles and abstracts of articles identified by the search strategy were screened, and potential full text articles were reviewed by a single author (AA) Figure 1A. *(See Supplementary material: Appendix 1.)*

Figure 1. Literature searches for A, technical feasibility framework, and B primary eye care in sub-Saharan Africa.

The conceptual framework to evaluate the technical complexity of public health interventions selected for this study, which was developed by Gericke et al,(16) has four dimensions: basic characteristics of the intervention, delivery characteristics, government capacity/need for regulation or legislation, and usage characteristics(16)(Table 1). Gericke's framework has been used to determine the technical complexity of condom social marketing for the prevention of HIV/AIDS and other sexually transmitted diseases(16) and to assess aflatoxin risk reduction strategies in Africa, for example.(19) For an intervention to be deemed feasible, the technical capacity must match the technical complexity of the intervention, thus intervention complexity complements the concept of institutional capacity.(16)

Table 1: Technical feasibility framework of Gericke

Gericke's framework	
Category	**Criteria**
Intervention characteristics	
Basic product design	Stability
	Standardizability
	Safety profile
	Ease of storage
	Ease of transport
Supplies	Need for regular supplies
Equipment	High-technology equipment and infrastructure needed
	Ease of acquisition
	Number of different types of equipment needed
	Maintenance needed
Delivery characteristics	
Facilities	Outreach services
Facilities	First-level care
Facilities	Hospital care
Human resources	Skill level required for service provision
	Skill level required for staff supervision
	Intensity of professional services in terms of frequency or duration

Gericke's framework	
Category	**Criteria**
	Management and planning requirements
Communication and transport	Dependence of delivery on communication and transport infrastructure
Government capacity requirements	
Regulation/legislation	Need for regulation.
Management systems	Need for sophisticated management systems
Collaborative action	Need for inter-sectoral action within government.
	Need for partnership between government and external funding agencies
Usage characteristics	
Ease of use	Need for information and education
Pre-existing demand	Need for promotion
Black market risk	Need to prevent resale/counterfeiting

The WHO AFRO PEC package was divided into two components: eye health prevention/ promotion and case management. The four dimensions of Gericke's framework were applied to each component i.e., intervention characteristics, delivery characteristics, government capacity requirements and usage characteristics.

To populate the framework, a literature search on PEC in sub-Saharan Africa was conducted and all articles of primary eye care in sub-Saharan Africa up to April 2018 were searched for using MEDLINE. Search terms included "primary eye care ", with "sub Saharan Africa" and "eye disease" or "eye" with "primary healthcare" and "Africa"(11) In addition, we used all the relevant articles from the two most recent published reviews on primary eye care in SSA, (11, 20) to identify evidence-based criteria for the technical complexities required to implement each component of the WHO AFRO PEC package. (Figure 1B).

Further implementation characteristics were identified by two of the authors (CG and AA) who have more than 40 years' combined experience of eye care in sub-Saharan Africa. This yielded a list of key criteria for the technical complexity of PEC. A four-point Likert scale (where 1=strongly agree and 4= strongly disagree), was applied to each of the statements and this formed the Delphi questionnaires. The Delphi questionnaires were reviewed by an expert in international eye health, (CG) a health interventions expert (HB) and a statistician (DM). They were then sent to a panel of experts in PEC in sub-Saharan Africa.

Step 2. Selection of experts for the Delphi exercise

The aim was to recruit a panel of eye care professionals who were experts in eye care in sub-Saharan Africa, with expertise to validate the relevance of the selected technical complexities and capacities required to implement the WHO AFRO PEC Package. Eligibility criteria included an eye care professional with a minimum of 10 years' experience of community eye

care in sub-Saharan Africa, still professionally active, and with experience of eye health policy. They were selected by a modified exponential snowball sampling method where an initial participant provides multiple referrals.(21) Each new referral was vetted and included in the study if the eligibility criteria were met. Two of the authors AA and CG selected the initial participants and these participants nominated others based on the stated eligibility criteria.

Step 3. Delphi Round 1

Members of the team were contacted by email and telephone and their availability was confirmed. Written informed consent was obtained. Members were sent the following documents: the methods to be used during the Delphi exercise, an explanation of Gericke's framework of technical complexity, a draft of the technical complexities required to deliver both components of the WHO AFRO PEC package in the form of the first Delphi questionnaires. Participants were invited to state their level of agreement to each statement in the questionnaire by ticking the appropriate level in the Likert scale in a Microsoft Excel® spreadsheet. A comments box was included beside each statement for comments or suggestions.

Step 4. Analysis of Delphi Round 1

Once all the questionnaires had been received, they were analysed for consensus. Analyses were performed using STATA V, 15.1 (Statcorp, Texas) to generate descriptive statistics. No universally accepted criteria for consensus have been defined for Delphi studies.(22) However, it has been shown that consensus can be said to have been achieved if a certain proportion of the votes fall within a predefined range.(23) Consensus for this study was defined as at least 70% agreement on each statement in the upper 50th percentile (Likert scores 1 and 2). Where consensus was reached, the statements were adopted. Statements where consensus was not reached were modified based on the suggestions/comments and incorporated into the second round, as were newly identified statements.

Step 5. Modification for technical capacity

Statements included from the first round were modified so that panel members could indicate their agreement on the technical capacities which need to be available to deliver the WHO PEC package.

Step 6. Delphi Round 2

For this round, the participants received the questionnaires with the comments/suggestions of other panel members from the first round. However, this was modified for technical capacity, as stated above, and sent to the same expert panel using the same Likert scale and level of consensus.

Step 7. Analysis of Delphi Round 2

Only statements that achieved at least 70% consensus in the upper 50th percentile (Likert scores 1 and 2) in the second round were included in the final document. Where consensus was reached, the statements were adopted and formed the basis of the final document. Any minority views (<70% consensus) did not form part of the adopted technical capacities but were documented. The technical capacities needed were mapped unto the WHO health system's building blocks.(24)

Patients were not involved in this study.

RESULTS

Composition of Delphi panel of experts

A total of 12 experts were contacted, nine of whom agreed to participate (Table 2). No response was received from the other three invitees despite at least three contacts by email. All nine completed the two rounds of the Delphi survey.

Table 2: Characteristics of the Delphi Panel n=9

Characteristics		*N (%)
Gender	Female	5 (55.6)
Age	<50 years >50 years	2 (22.2) 7 (77.8)
Professional group	Ophthalmologist Administrator	7 (77.8) 2 (22.2)
Primary function	Clinician Researcher NGO Administrator	3 (33.3) 3 (33.3) 3 (33.3)
Type of institution	Academic Hospital Non-academic Hospital Research Institute Eyecare NGO	2 (22.2) 1(11,1) 3 (33.3) 3 (33.3)
Region of practice	West Africa East Africa South Africa Central Africa Europe	5 (56) 2 (22) 2 (22) 1 (11) 1 (11)
Involved in national policy making	Yes	9 (100)

*some participants had multiple roles/had worked in multiple regions.

The mean number of years of experience in eye health of the participants was 31.1±8.9 (range 18-43) years.

Delphi questionnaire development

A total of 81 statements on the technical complexity of the WHO AFRO PEC package were developed from Gericke's framework, 38 for health promotion and 43 for facility-based case management (Table 3).

Table 3 Statements for each component of the WHO AFRO Primary Eye Care Package

Gericke's Framework Domains		Component of WHO AFRO PEC Package	
		Health promotion and prevention	Facility case management
		Number of statements	
Intervention characteristics	Basic product design	7	10
	Supplies	2	1
	Equipment	3	5
Delivery characteristics	Type of facility needed	3	4
	Human resource requirement	8	9
	Communication and transport	3	2
Government capacity requirements	Regulation/legislation	2	4
	Management systems	2	1
	Collaborative action	4	3
Usage characteristics	Ease of use	2	2
	Pre-existing demand	1	1
	Black Market Risk	1	1
Total		**38**	**43**

In the first round, there was consensus in 84% of the statements with over 40% of the statements achieving 100% consensus. *(See Supplementary material: Appendix 2.)* Based on comments from Delphi round 1, six modifications were made in the health promotion component and seven in the facility case management component. (See S*upplementary material: Appendix 3.)* The modified questionnaire formed the basis of technical capacity questionnaire for round two.

In the second round, four statements were deemed not to be applicable by 89% of participants and were removed. Consensus was achieved in 94% of the statements, with 62% achieving 100% consensus. *(Supplementary material: Appendix 4.)* Results of the 34 statements on technical capacity for health promotion for which consensus was reached are shown in Table 4A with their respective Likert ratings, quartile and 50th percentile values. Results of the 40 statements on technical capacity for facility case management for which consensus was reached are shown in Table 4B with their respective Likert ratings, quartile and 50th percentile values. The top quartile shows the number and proportion of participants who strongly agreed with each of the statements, while the 50th percentile shows the number and proportion of participants that strongly agreed or agreed. The technical capacities needed were mapped unto the WHO health system's building blocks (Tables 5A and 5B).

Table 4A: Consensus statements on technical capacity for health promotion, with analysis of Likert scales.

Category / criteria	Technical capacity needed (elements that need to be available)	Top quartile		50th Percentile		Median
		Likert 1		Likert 2		(IQR)
		N	%	N	%	
1. Intervention characteristics						
Basic product design						
Stability: usable lifetime and risk of destruction	Posters that promote eye health	7	77.8	9	100	**1 (1-1)**
	Durable posters are available	4	44.4	9	100	**1 (1-2)**
Standardizability: the degree to which an intervention can be standardized	Standardized posters available to deliver the same message per target group	5	55.6	9	100	**1 (1-2)**
	Posters available in the language of the community	6	66.7	7	77.8	**1 (1-2)**
	Posters with self-explanatory graphics available for the non-literate	8	88.9	9	100	**1 (1-1)**
	Different types of posters available for different target groups which are appropriately displayed	5	55.6	8	88.9	**1 (1-2)**
Number of different types of equipment needed. Maintenance needed.	Health promotion materials available that are easy to maintain	5	55.6	9	100	**1 (1-2)**
	A system for the easy procurement of health promotion materials	6	66.7	9	100	**1 (1-2)**
2. Delivery characteristics						
Facilities						
Retail sector, outreach services, first-level care, hospital care	Health promotion in the community that includes young children and their carers, diabetics and the elderly as their target audience	4	44.4	9	100	**1 (1-2)**
	Time, space and willingness to deliver opportunistic eye health promotion to groups in the facility	7	77.8	8	88.9	**1 (1-1)**
	Time and the willingness to deliver opportunistic eye health promotion to targeted individuals in the facility e.g. diabetics	5	55.6	7	77.8	**1(1-2)**
Human resources						
Skill level required for service provision	Staff skilled in communicating with community members	7	77.8	9	100	**1 (1-1)**
	Staff who are knowledgeable about community, eye diseases and where to access care	7	77.8	9	100	**1 (1-1)**
	Village health workers resident in the community who are able to deliver health promotion	6	66.7	9	100	**1 (1-2)**
	Facility based staff who are able to deliver health promotion	5	55.6	9	100	**1 (1-2)**
	Professionals to train staff on eye health promotion and develop health promotion materials	9	100.0	9	100	**1 (1-1)**
Skill level required for staff supervision. Degree of supervision required	Supervisors who are able to supervise health promotion activities including eye health	7	77.8	9	100	**1 (1-1)**
Intensity of professional services in terms of frequency or duration e.g. on schedule/periodic or continuous to accommodate emergencies	Staff who regularly deliver health promotion on schedule	7	77.8	9	100	**1 (1-1)**
Need for managerial staff: management and planning requirements	Existing managerial staff who plan and organise target audience to be sensitised in appropriate locations e.g. carers of young children	5	55.6	9	100	**1 (1-2)**
Communication and transport						

Category / criteria	Technical capacity needed (elements that need to be available)	Top quartile		50th Percentile		Median
		Likert 1		Likert 2		(IQR)
		N	%	N	%	
Dependence of delivery on communication and transport infrastructure: telephones, roads	Local transport infrastructure to visit communities	6	66.7	7	77.8	**1 (1-2)**
Need for substantial exchange of information between different sectors or levels of care	Appropriate communication channels between the community and frontline health facilities	8	88.9	9	100	**1 (1-1)**
	Staff who are able to communicate in the local language	9	100	9	100	**1 (1-1)**
3. Government capacity requirements						
Regulation/legislation						
Need for legislation/regulation, monitoring regulatory measures and enforcement of regulation	Health promotion materials which have been approved and endorsed by local regulatory authorities	5	55.6	8	88.9	**1 (1-2)**
	Eye health promotion activities that are recorded and monitored	4	44.4	7	77.8	**1 (1-1)**
	National blindness prevention strategy that incorporates eye health promotion	9	88.9	8	88.9	**1 (1-1)**
Need for sophisticated management systems and managerial staff. Level of management and planning requirements	Existing managerial structures for health promotion that can be used to manage eye health promotion	4	44.4	7	77.8	**2(1-2)**
Collaborative action						
Need for inter-sectoral action within government. Need for partnership between government and civil society.	Intersectoral activities within government or partnerships between government and civil society	6	66.7	9	100	**1 (1-2)**
	Existing school health programmes.	3	33.3	7	77.8	**2(1-2)**
Need for partnership between government and external funding agencies	Collaborations with NGOs to provide health promotion	1	11.1	7	77.8	**2(1-2)**
	Collaboration between communities and frontline health communities	7	77.8	9	100	**1 (1-1)**
4. Usage characteristics						
Ease of use						
Need for information and education	Communication channels with community to inform target population	9	88.9	9	100	**1 (1-1)**
Need for supervision	Staff to supervise health promotion activities	9	88.9	9	100	**1 (1-1)**
Pre-existing demand						
Need for promotion	Staff who engage in health promotion which includes the uptake of eye care when required.	9	88.9	9	100	**1 (1-1)**
Black market risk						
Need to prevent resale/counterfeiting	Staff who engage and train traditional healers to identify and refer eye conditions, with a system to support training	7	77.8	9	100	**1 (1-1)**

Table 4B: Consensus statements on technical capacity for Facility Case Management, with analysis of Likert scales

Category / Criteria	Technical capacity needed (elements that need to be available)	Top quartile		50th percentile		Median
		Likert 1		Likert 2		(IQR)
		N	%	N	%	
1. Intervention characteristics						
Basic product design						
Stability/ease of storage/ease of transport	Torches can be solar powered and are stable	6	66.7	9	100	**1(1-2)**
	Appropriate and secure storage for drugs and consumables	8	88.9	9	100	**1(1-1)**
	Eye drops that do not require cool storage should be stocked	5	55.6	8	88.9	**1(1-2)**
	Tetanus toxoid, which requires cool storage	6	66.7	8	88.9	**1(1-2)**
	Topical antibiotic ointment does not require cold storage	6	66.7	8	88.9	**1(1-2)**
	Sterile saline solution for eye irrigation is stable	4	44.4	7	77.8	**1(1-2)**
	High dose vitamin A is stable	5	55.6	9	100	**2(1-2)**
	Injectable antibiotics, for ophthalmia neonatorum and other conditions, may require cool storage	4	44.4	7	77.8	**1(1-2)**
	Pre-existing PHC transport channels should be available to transport PEC consumables.	7	77.8	9	100	**1(1-1)**
Standardizability	The WHO AFRO PEC Package is standardized	6	66.7	9	100	**1(1-2)**
Safety profile	Staff who are trained/can be trained to deliver the intervention correctly and not cause harm	8	88.9	9	100	**1(1-1)**
Supplies						
Need for regular supplies	Medication supply system to support regular supply of eye medications and consumables	8	88.9	9	100	**1(1-1)**
Equipment						
High-technology equipment and infrastructure needed	Diagnostic equipment: Snellen distance visual acuity chart; near visual acuity chart, torches and batteries	7	77.8	9	100	**1(1-1)**
	Adequate space to use appropriate, standardized visual acuity charts	6	66.7	8	88.9	**1(1-2)**
	Adequate space for counselling patients	8	88.9	9	100	**1(1-1)**
Number of different types of equipment needed	One set of diagnostic equipment	6	66.7	8	88.9	**1(1-2)**
Maintenance needed	System to maintain equipment in the facility	5	55.6	9	100	**1(1-2)**
2. Delivery characteristics						
Facilities						
First-level care	Eye care services to manage uncomplicated eye conditions.	6	66.7	9	100	**1(1-2)**
Hospital care	Referral hospital to manage complicated eye conditions.	8	88.9	9	100	**1(1-1)**
Human resources						
Skill level required for service provision	Staff able to make a diagnosis (take a history; measuring visual acuity; basic eye examination)	8	88.9	9	100	**1(1-1)**
	Staff able to manage some conditions e.g., eye irrigation; remove foreign bodies; give IM injections	8	88.9	9	100	**1(1-1)**
	Staff able to identify which cases to refer and the level of urgency	8	88.9	9	100	**1(1-1)**

Category / Criteria	Technical capacity needed (elements that need to be available)	Top quartile		50th percentile		Median
		Likert 1		Likert 2		(IQR)
		N	%	N	%	
Skill level required for staff supervision. Degree of supervision required.	Primary health care supervisors knowledgeable about eye conditions and their management.	6	66.7	9	100	**1(1-2)**
	Regular supervision of PHC activities and PEC activities	6	66.7	9	100	**1(1-2)**
Frequency or duration of services: e.g. on schedule /periodic or continuous to accommodate emergencies	Staff trained in PEC always available to manage eye conditions and emergencies	8	88.9	9	100	**1(1-1)**
	Facility managers who supply consumables and plan purchasing	6	66.7	9	100	**1(1-2)**
Management and planning requirements. Need for managerial staff	Facility managers establish and maintain referral and feedback between the PH centre and eye care facilities	5	55.6	7	77.8	**1(1-2)**
	Managerial systems to coordinate staff rotations to ensure daily facility coverage by trained PEC staff	7	77.8	9	100	**1(1-1)**
Communication and Transport						
Depends on delivery of communication and transport infrastructure	Communication channels to maintain referral and feedback mechanisms between the PH centre and referral centre	6	66.7	9	100	**1(1-2)**
	Transportation between the PH facility and referral centre	3	33.3	7	77.8	**1(1-2)**
3. Government capacity requirements						
Regulation/legislation						
Need for regulation	National Essential Drug List includes appropriate medication and equipment for eye care in PH facilities	6	66.7	8	88.9	**1(1-1)**
Regulatory measures need to be enforced and regulated	System that regulates drug prescribing and dispensing by appropriate staff	7	77.8	9	100	**1(1-1)**
	Reporting systems for measles outbreaks	9	100.0	9	100	**1(1-1)**
	Reporting system for ophthalmia neonatorum	7	77.8	9	100	**1(1-1)**
Management systems						
Sophisticated management systems required	Managerial structures for PH care include eye care	7	77.8	9	100	**1(1-1)**
Collaborative action						
Inter-sectoral action needed within government, and partnership between government and civil society	Intersectoral action within government or partnerships between government and civil society	6	66.7	9	100	**1(1-2)**
4. Usage Characteristics						
Need for supervision	Staff who make supervisory home visits	5	55.6	7	77.8	**1(1-2)**
	Staff who supervise referrals to ensure compliance	4	44.4	8	88.9	**1(1-2)**
Pre-existing demand						
Need for promotion	Staff who engage in eye health promotion to target audiences	4	44.4	8	88.9	**1(1-2)**
Black market risk						
Need to prevent resale/counterfeiting	Staff who engage and train traditional healers to identify and refer eye conditions, with a system to support training	6	66.7	8	88.9	**1(1-2)**

Tables 5A and B: Gericke's framework; technical capacities needed to deliver (A) health promotion, and (B) facility-based case management.

A. Health promotion

Category	Criteria	Technical Capacity: Elements that need to be available	Health system building block
Intervention characteristics			
Basic product design	*Stability*	Posters that promote eye health should be available. Posters should be durable.	Infrastructure, technology etc
	Standardizability	Standardized posters, delivering the same message per target group.	
		Posters that are in the language of the community.	
		Posters with self-explanatory graphics should be available for the illiterate.	
Supplies and equipment	*Ease of acquisition*	Easy system to procure health promotion materials.	Infrastructure, technology etc
	Number of different types of equipment needed	Different types of posters available for different target groups which are appropriately displayed.	
	Maintenance needed	Health promotion materials available that are easy to maintain.	
Delivery characteristics			
Facilities	*Outreach services*	Health promotion that includes young children and their carers, diabetics and the elderly as the target audience in the community.	Service delivery
	First-level care	Time and space available, and staff willing to deliver opportunistic eye health promotion to specific groups in the facility	
	First-level care	Time and space available, and staff willing to deliver opportunistic eye health promotion to specific individuals in the facility e.g. diabetics.	

Human resources	*Skill level required for service provision*	Staff skilled in communicating with community members	Health workforce
		Staff who are knowledgeable about community, eye diseases and where to access care	
	Intensity of professional services in terms of frequency or duration	Village health workers resident in the community who are able to regularly deliver health promotion.	
		Facility-based staff who are able to regularly deliver health promotion.	
		Professionals to train staff on eye health promotion and develop health promotion materials.	
	Skill level required for staff supervision	Supervisors who are able to supervise health promotion activities including eye health.	
		Staff who regularly deliver health promotion on schedule.	
	Management and planning requirements	Existing managerial staff who plan and organise target audience to be sensitised in appropriate locations e.g. carers of young children.	

Communication and transport	*Dependence of delivery on communication and transport infrastructure*	Local transport infrastructure to visit communities.	Infrastructure, technology etc
		Appropriate communication channels between the community and PHC facilities.	Service delivery/HMIS
		Staff who are able to communicate in the local language.	Health workforce
Government capacity requirements			
Regulation/legislation	*Need for regulation/legislation.*	Health promotion materials which have been approved and endorsed by local regulatory authorities.	Governance and leadership
		A national blindness prevention strategy that incorporates eye health promotion.	
Management systems	*Need for management systems*	Existing managerial structures for health promotion can be used. Eye health promotion activities that are recorded and monitored.	HMIS
Collaborative action	*Need for inter-sectoral action within government.*	Intersectoral activities within government or partnerships between government and civil society.	Governance and leadership
		Existing school health programmes.	Service delivery
	Need for partnership between government and external funding agencies	Collaborations with NGOs to provide health promotion	Governance and leadership
		Collaboration between communities and PHC facilities is required.	
Usage characteristics			
Ease of use	*Need for information and education/need for supervision*	Communication channels with community that are available to inform target population	Service delivery
		Staff who are available to supervise health promotion activities	Governance and leadership
Pre-existing demand	*Need for promotion*	Staff who are able to engage in eye health promotion to target audience to significantly increase demand.	Service delivery
Black market risk	*Need to prevent resale/counterfeiting*	Staff who are able and willing to engage with traditional healers and train them to identify and refer eye conditions. A system that supports this training.	

Table 5B Facility-based case management

Category	Criteria	Technical Capacity: Elements that need to be available	Health system building block
Intervention characteristics			
Basic product design	*Stability and ease of storage*	Torches should be available. They can be solar powered and are stable.	Infrastructure, technology etc
		Appropriate and secure storage for drugs and consumables should be available	
		Eye drops that do not require cool storage should be stocked	
		Tetanus toxoid will require cool storage and should be available from facility childhood immunisation activities	
		Topical antibiotic ointment does not require cold storage and should be available.	
		Injectable antibiotics for ophthalmia neonatorum may require cool storage but should be available to treat other conditions.	
		Sterile saline solution for eye irrigation is stable and should be available	
		High dose vitamin A is stable and should be available from Maternal and Child health activities.	
	Ease of transport	Pre-existing PHC transport channels should be available to transport PEC consumables.	
	Standardizability	The WHO AFRO PEC Package is standardized and can be available in all Primary Care facilities	
	Safety profile	Available staff who are trained/can be trained to deliver the intervention correctly so as not to cause harm.	Health workforce
Supplies and equipment	*Need for regular supplies*	A medication supply system that can support the regular supply of eye medications and consumables	Infrastructure, technology etc
	High-technology equipment and infrastructure needed	Diagnostic equipment is available: Snellen distance visual acuity chart; near visual acuity chart, torches and batteries.	
		Adequate space to support the use of appropriate and standardized visual acuity charts.	
		Adequate space for counselling patients should be available.	
	Number of different types of equipment needed	The availability of one set of diagnostic equipment	
	Maintenance needed	An available system for the maintenance of facility equipment.	

Delivery characteristics			
Facilities	*First-level care*	The availability of eye care services to manage uncomplicated eye conditions.	Service delivery
Facilities	*Hospital care*	The availability of a referral hospital to manage complicated eye conditions.	
Human resources	*Skill level required for service provision*	Staff who are able to make a diagnosis (eliciting a history; measuring visual acuity; basic eye examination)	
		Staff who are able to manage some conditions e.g., eye irrigation; removal of foreign bodies; give IM injections (tetanus toxoid; antibiotics)	
		Staff who are able to identify which cases to refer and the level of urgency	
	Skill level required for staff supervision	PHC supervisors who are knowledgeable about eye conditions and their management.	Governance and leadership
		Supervisors who regularly supervise PHC activities and can supervise PEC activities	
	Intensity of professional services in terms of frequency or duration	Staff trained in PEC who are available continuously to manage eye conditions, especially emergencies.	Service delivery
	Management and planning requirements	Existing managerial facility staff who are able to manage the supply of consumables and plan purchasing.	Governance and leadership
		Existing managerial facility staff who are able to establish and maintain referral and feedback mechanisms between the PHC facility and eye department/clinic.	
		Existing managerial systems to coordinate staff rotations to ensure daily facility coverage by trained PEC staff.	
Communication and transport	*Dependence of delivery on communication and transport infrastructure*	Communication channels to maintain referral and feedback mechanisms between the PHC facility and the referral centre.	Infrastructure, technology etc
		Transport between the PHC facility and the referral centre.	
Government capacity requirements			
Regulation/legislation	*Need for regulation.*	Appropriate medication and equipment need to be on the national essential drug list to facilitate availability.	Governance and leadership
Management systems	*Need for sophisticated management systems*	A system that regulates drug prescription and dispensing by appropriate staff.	
		Communication channels to report measles outbreaks to relevant authorities.	
		Communication channels to report cases of ophthalmia neonatorum to relevant authorities	
		Existing managerial structures for PHC that can be used to manage PEC.	HMIS

Collaborative action	*Need for inter-sectoral action within government or partnership between government and external funding agencies.*	Availability of inter-sectoral action within government or partnerships between government and civil society.	Governance and leadership
Usage characteristics			
Ease of use	*Need for information and education/need for supervision*	Staff who are available to make supervisory home visits.	Governance and leadership
		Staff who are able to supervise referrals to secondary centres to ensure compliance.	
Pre-existing demand	*Need for promotion*	Staff who are able to engage in eye health promotion to target audience.	Service delivery
Black market risk	*Need to prevent resale/counterfeiting*	Staff who are able and willing to engage with traditional healers and train them to identify and refer eye conditions. A system that supports this training.	

DISCUSSION

Despite global and regional interest in PEC,(8, 10, 25, 26) insights into the technical complexity of PEC and the technical capacities required to deliver it within PHC in SSA are lacking. The technical complexity was assessed using the well-known framework devised by Gericke, which complements the notion of institutional capacity in determining the feasibility of implementing or scaling up an intervention. (16)

In this study we did not address other aspects of feasibility, such as legal and financial feasibility, and it may be argued that health financing is an important element to consider in low resource countries, particularly in SSA where less than half the countries have the minimum level of health financing of 44 United States Dollars per capita.(27) However, non-financial resources are considered to be the critical factor limiting the implementation of health interventions. (16)

To the best of our knowledge, this is the first Delphi exercise to explore the technical capacities needed to implement the WHO AFRO PEC package in sub-Saharan Africa. Our study complements a recent systematic review on health systems preparedness for integration of services at the PHC level,(28) and tools developed from our study will enable identification of elements of the health system at primary level which need to be strengthened to deliver PEC. This is important as the delivery of PEC can only be as effective as the PHC into which it is integrated.(11) Having said this, it is important to recognise that eye health needs to be integrated into all levels of the health system to achieve universal coverage for eye health.(10, 29)
Data to populate Gericke's framework were largely derived from a detailed review of the literature of PEC in SSA. Consensus on the capacities required to deliver PEC were reached after a two-round Delphi exercise by experts in public health for eye care in sub-Saharan Africa; researchers, clinicians, policy makers and administrators. The primary function of panel members was evenly distributed between these three categories, and as all had been involved in policy development and service delivery for eye care in the region, they were experienced in what was feasible and what was not.

The literature review and the high consensus from the panel of experts increase the validity of the findings. In the first round over four-fifths of the statements reached the predefined consensus, which implies that the majority of the technical complexities aligned with the views of the expert panel and their familiarity with the literature. In the second round, there was consensus on almost all the statements, with 100% consensus for almost two thirds.

This is to be expected, as the technical capacities were derived from the technical complexities. For example, one of the technical complexities was “hospital services are needed for referrals, severe cases, treatment failures, further investigations and management, as required” and the technical capacity derived was “the availability of a referral hospital to manage complicated eye conditions”.

The human resource elements of the delivery characteristics domain for health promotion and facility-based management had perfect consensus. Human resources for health (HRH) has been identified as a key component for the successful implementation of health interventions(30) which was emphasised in two review articles on PEC in SSA.(11, 20) Government support and strong partnerships are crucial for the success of PEC in terms of sustainability and scaling up, as advocated in the WHO Global Action Plan (2014-2019) and for regulatory activities.(10) Hence the majority of elements in this domain had near perfect consensus. All the elements in the usage characteristics domain for health promotion had perfect consensus in the final round, emphasizing the importance of creating demand (31) and reducing the impact of harmful traditional eye practices. (32)

The WHO Health systems building blocks were mapped unto appropriate elements of the final technical capacity profile for PEC. Adopting a health systems strengthening approach in which eye health is included in all the building blocks will amplify the benefits of the intervention(33) and promote sustainability.

The technical capacity frameworks for delivering the WHO AFRO PEC package were developed using data and experts from a range of SSA countries. However, caution is needed in extrapolating the findings from the Delphi exercise in this study to all WHO AFRO countries, as local adaptation of the WHO AFRO package may be required, and hence the capacities needed to address varying eye health needs in different settings and PHC contexts. For example, the cadres providing PHC are likely to vary, as is the availability of informal health providers.

There are several strengths and limitations of this study. The selection of the expert panel is a crucial part of the Delphi process as the output is based on their expert opinion.(34) Our expert panel was a non-random sample, and this may have led to hidden biases as the participants may not be representative of all the experts with the pre-determined inclusion criteria. Indeed, almost half of the participants were from West Africa, but the majority had worked in agencies that had oversight of sub-Saharan African eye health care. Another limitation is that although all panel members had relevant expertise and experience, primary

health care practitioners were not included, as the focus was on eye care which the majority of primary health care practitioners in Africa would have little experience of.

One of the disadvantages of the Delphi consensus is that it is provides low level evidence (expert opinion) (35) as randomised controlled trials provide the highest level evidence; only a few trials have been undertaken on PEC in low and middle income countries.(36) However, the Delphi method is useful when there are limited data to guide clinical practice. In this study, the framework for the questionnaires was a validated framework which has been used to assess the non-financial inputs needed to implement new interventions with a view to scaling up.(16) Our study used anonymity, which is an inherent strength of the Delphi process, which helped avoid undue influence by any members and the efficient harnessing of expert opinion from diversely geographically dispersed experts(37) (38) from East, West, Southern Africa and the United Kingdom. Another strength of our study is the low non-response bias. Although 12 experts were invited to participate, nine agreed and all completed both Delphi rounds.

This study has generated the first technical feasibility capacity profile for primary eye care to guide countries wishing to implement primary eye care, based on an internationally accepted feasibility framework, a review of the PEC literature and expert opinion. However, there was limited published evidence on PEC in SSA from which the technical capacities were derived. As more high-level evidence studies on PEC in SSA are conducted, the document will need to be revised.

Future research

Mixed-methods data collection tools for different participant groups (village health workers, PHC workers, heads of facilities, district supervisors) in Nigeria have been developed based on our capacity frameworks i.e., structured questionnaires, observational check lists and topic guides for in-depth interviews. A number of PHC facilities in Southeast Nigeria have been assessed using these tools and a gap analysis will be conducted. The capacity of PHC to deliver eye care has sparked passionate debates(29) and robust studies on the effectiveness of PEC will be needed in the future.

CONCLUSIONS

Consensus was reached on the technical capacities which need to be in place to deliver the WHO AFRO PEC package using a Delphi exercise. Based on this document, study tools have been developed to assess health system gaps in primary health care in Nigeria.

Countries or health units wishing to implement PEC using the WHO AFRO PEC package should address any capacity gaps before implementing or scaling up this intervention.

Abbreviations

HMIS	Health management information systems
IM	intramuscular
NGO	Non-Governmental Organisation
PEC	Primary Eye Care
PHC	Primary Health Care
SSA	Sub-Saharan Africa

Declarations

Ethics approval and consent to participate.

This was part of a wider study on PEC, and ethical approval was obtained from the Ethics Committees of the Federal Ministry of Health, Nigeria (NHREC Approval Number NHREC/01/01/2007-12/03/2018) and the London School of Hygiene & Tropical Medicine (LSHTM Ethics Ref: 14624).

Consent for publication

Not Applicable

Availability of data and materials

All data relevant to the study are included in the article or uploaded as supplementary information.

Competing interests

The authors declare that they have no competing interests

Author Contributions

AA, HB and CG were responsible for the design and conception of the work. AF, WM, HF, RU, FE, SI, FK, BW contributed to the acquisition of data. AA drafted the work. AA, HB and

CG substantially revised it. All authors made some input into the final version and have approved the submitted version.

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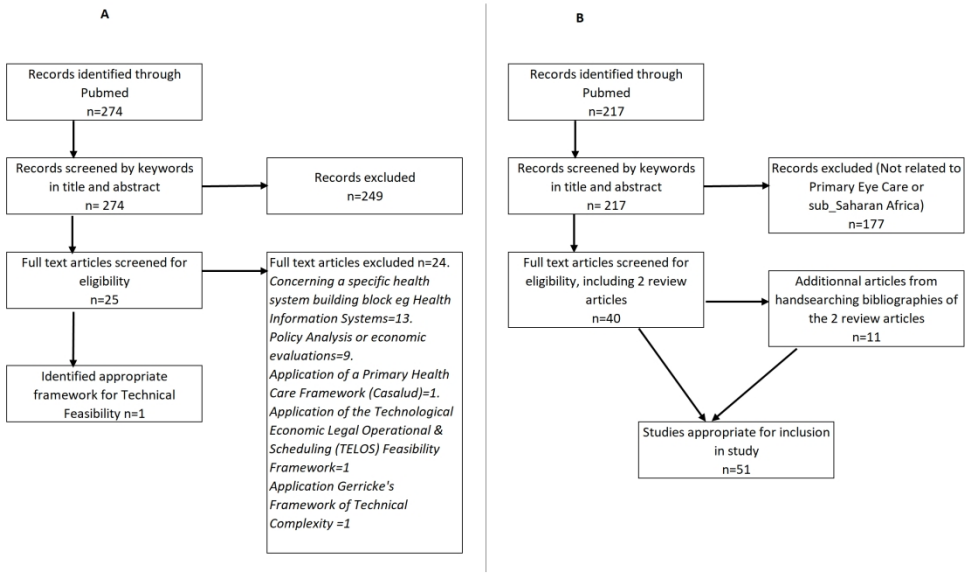

Figure 1 Literature searches for (A) Technical Feasibility Framework and (B) Primary Eye Care in sub_Saharan Africa.

Figure 1. Literature searches for A, technical feasibility framework, and B primary eye care in sub-Saharan Africa.

Appendix 1

Search Strategy for Technical Feasibility Frameworks

Search number	Query	Filters	Search Details	Results
3	(technical feasibility AND (2000/1/1:2018/4/30[pdat])) AND (framework* AND (2000/1/1:2018/4/30[pdat]))	from 2000/1/1 - 2018/4/30	("technical"[All Fields] OR "technicalities"[All Fields] OR "technicality"[All Fields] OR "technically"[All Fields]) AND ("feasibilities"[All Fields] OR "feasibility"[All Fields] OR "feasible"[All Fields] OR "feasiblity"[All Fields]) AND 2000/01/01:2018/04/30[Date - Publication] AND ("framework*"[All Fields] AND 2000/01/01:2018/04/30[Date - Publication])	274
2	framework*	from 2000/1/1 - 2018/4/30	"framework*"[All Fields]	192,596
1	technical feasibility	from 2000/1/1 - 2018/4/30	("technical"[All Fields] OR "technicalities"[All Fields] OR "technicality"[All Fields] OR "technically"[All Fields]) AND ("feasibilities"[All Fields] OR "feasibility"[All Fields] OR "feasible"[All Fields] OR "feasiblity"[All Fields])	16,587

Search Strategy for Primary Eye Care in sub-Saharan Africa

Search number	Query	Filters	Search Details	Results
5	((("primary eye care" AND ((humans[Filter]) AND (1980/1/1:2018/4/30[pdat]) AND (english[Filter]))) OR ((eye disease) AND (primary healthcare) AND ((humans[Filter]) AND (1980/1/1:2018/4/30[pdat]) AND (english[Filter])))) OR ((eye) AND (primary healthcare) AND ((humans[Filter]) AND (1980/1/1:2018/4/30[pdat]) AND (english[Filter])))) AND ((Africa) OR ("sub-Saharan Africa") AND ((humans[Filter]) AND (1980/1/1:2018/4/30[pdat]) AND (english[Filter])))	Humans, English, from 1980/1/1 - 2018/4/30	(("primary eye care"[All Fields] AND ("humans"[MeSH Terms] AND 1980/01/01:2018/04/30[Date - Publication] AND "english"[Language])) OR (("eye diseases"[MeSH Terms] OR ("eye"[All Fields] AND "diseases"[All Fields]) OR "eye diseases"[All Fields] OR ("eye"[All Fields] AND "disease"[All Fields]) OR "eye disease"[All Fields]) AND ("primary health care"[MeSH Terms] OR ("primary"[All Fields] AND "health"[All Fields] AND "care"[All Fields]) OR "primary health care"[All Fields] OR ("primary"[All Fields] AND "healthcare"[All Fields]) OR "primary healthcare"[All Fields]) AND ("humans"[MeSH Terms] AND 1980/01/01:2018/04/30[Date - Publication] AND "english"[Language])) OR (("eye"[MeSH Terms] OR "eye"[All Fields]) AND ("primary health care"[MeSH Terms] OR ("primary"[All Fields] AND "health"[All Fields] AND "care"[All Fields]) OR "primary health care"[All Fields] OR ("primary"[All Fields] AND "healthcare"[All Fields]) OR "primary healthcare"[All Fields]) AND ("humans"[MeSH Terms] AND 1980/01/01:2018/04/30[Date - Publication] AND "english"[Language]))) AND (("africa"[MeSH Terms] OR "africa"[All Fields] OR "africa s"[All Fields] OR "africas"[All Fields] OR "sub-Saharan Africa"[All Fields]) AND ("humans"[MeSH Terms] AND 1980/01/01:2018/04/30[Date - Publication] AND "english"[Language]))	217
4	(Africa) OR ("sub-Saharan Africa")	Humans, English, from 1980/1/1 - 2018/4/30	"africa"[MeSH Terms] OR "africa"[All Fields] OR "africa s"[All Fields] OR "africas"[All Fields] OR "sub-Saharan Africa"[All Fields]	194,607
3	(eye) AND (primary healthcare)	Humans, English, from 1980/1/1 - 2018/4/30	("eye"[MeSH Terms] OR "eye"[All Fields]) AND ("primary health care"[MeSH Terms] OR ("primary"[All Fields] AND "health"[All Fields] AND "care"[All Fields]) OR "primary health care"[All Fields] OR ("primary"[All Fields] AND "healthcare"[All Fields]) OR "primary healthcare"[All Fields])	2,330
2	(eye disease) AND (primary healthcare)	Humans, English, from 1980/1/1 - 2018/4/30	("eye diseases"[MeSH Terms] OR ("eye"[All Fields] AND "diseases"[All Fields]) OR "eye diseases"[All Fields] OR ("eye"[All Fields] AND "disease"[All Fields]) OR "eye disease"[All Fields]) AND ("primary health care"[MeSH Terms] OR ("primary"[All Fields] AND "health"[All Fields] AND "care"[All Fields]) OR "primary health care"[All Fields] OR ("primary"[All Fields] AND "healthcare"[All Fields]) OR "primary healthcare"[All Fields])	2,635
1	"primary eye care"	Humans, English, from 1980/1/1 - 2018/4/30	"primary eye care"[All Fields]	192

Appendix 2

Delphi Round 1 Health Promotion

Technical Complexity of community based interventions which comprises health promotion and prevention

Health promotion includes health messages for healthy people; health prevention comprises health messages for people at risk for eye diseases targeting children and their carers, those aged 40 years and above, people of all ages and those with diabetes.

Category	Criteria	Technical Complexity (Elements that need to be addressed)	Strongly Agree		Agree		Disagree		Strongly disagree	
Intervention characteristics			n	%	n	%	n	%	n	%
Basic product design	Stability: usable lifetime and risk of destruction	Posters for health Prevention and promotion are needed.	7	77.8	2	22.2	0	0	0	0.0
		Posters should be made durable by lamination.	5	55.6	2	22.2	2	22.2	0	0.0
	Standardizability: the degree to which an intervention can be standardized	The Posters should be standardised by having the same message per target group.	6	66.7	3	33.3	0	0	0	0.0
		This should be translated into the language of the community as is done for other health promotion posters.	7	77.8	2	22.2	0	0	0	0.0
	Safety profile of the intervention in terms of adverse effects, and risks associated with inappropriate use, e.g. from over-the-counter sales of prescription-only medications.	No risk of serious side effects.	5	55.6	1	11.1	2	22.2	1	11.1
		Messages should be clear, unambiguous and understandable displaying appropriate information.	8	88.9	1	11.1	0	0	0	0.0
	Ease of storage e.g. the need for refrigeration. Ease of transport	Health promotion materials do not have any specific requirements for storage and transportation.	4	44.4	4	44.4	1	11.1	0	0.0
Supplies	Need for regular supplies, and the number and types of different supplies needed. Ease of acquisition.	No requirements for regular supplies.	2	22.2	6	66.7	1	11.1	0	0.0
		Different types of posters are be needed for different target groups, e.g. diabetics, the elderly, carers of young children.	7	77.8	2	22.2	0	0	0	0.0
Equipment	High-technology equipment and infrastructure needed. Ease of acquisition.	High technological equipment not required.	4	44.4	4	44.4	1	11.1	0	0.0
	Number of different types of equipment needed. Maintenance needed.	Low maintenance.	6	66.7	3	33.3	0	0	0	0.0
		Health promotion materials relatively easy to acquire.	3	33.3	4	44.4	2	22.2	0	0.0
Delivery characteristics			Strongly Agree		Agree		Disagree		Strongly disagree	
			n	%	n	%	n	%	n	%
Facilities	Retail sector, Outreach services, First-level care, Hospital care	Should be delivered in the community through outreach services for diabetics, carers of young children during maternal and child health activities.	3	33.3	4	44.4	2	22.2	0	0.0
		Should be delivered to specific **groups** that attend the primary health facility e.g. people over 40 years,	4	44.4	1	11.1	4	44.4	0	0.0
		Should be delivered to specific **people** that attend the primary health facility e.g. people over 40 years,	4	44.4	1	11.1	3	33.3	1	11.1
Human resources	Skill level required for service provision	Low skill requirement.	2	22.2	3	33.3	1	11.1	3	33.3
		Will require knowledge about community, eye diseases and where to access care.	6	66.7	2	22.2	1	11.1	0	0.0
		Village Health Workers who live in the community should be trained to deliver health promotion in the communities.	6	66.7	3	33.3	0	0	0	0.0
		Facility based workers should deliver health prevention to groups/individuals in the facility.	2	22.2	6	66.7	1	11.1	0	0.0
		Development of the health promotion materials and staff training will require professional instruction.	5	55.6	4	44.4	0	0	0	0.0
	Skill level required for staff supervision. Degree of supervision required.	Mid-level skill required to supervise health promotion/prevention activities.	3	33.3	5	55.6	0	0	0	0.0
	Intensity of professional services in terms of frequency or duration e.g. on schedule/periodic or continuous to	Health Promotion and prevention activities should be delivered on schedule.	6	66.7	3	33.3	0	0	0	0.0
	Need for managerial staff: Management and planning requirements.	Planning will be required to organise target audience to be sensitised in appropriate locations e.g. Mothers or care givers of young children.	7	77.8	2	22.2	0	0	0	0.0
Communication and transport	Dependence of delivery on communication and transport infrastructure: roads, telephones, need for substantial exchange of information between different sectors or levels of care.	Local transport infrastructure will be needed to visit communities.	4	44.4	3	33.3	2	22.2	0	0.0
		Communication between the communities and the Front Line Health Facilities required.	7	77.8	2	22.2	0	0	0	0.0
		Communication in local language required.	7	77.8	2	22.2	0	0	0	0.0
Government capacity requirements			Strongly Agree		Agree		Disagree		Strongly disagree	
			n	%	n	%	n	%	n	%
Regulation/legislation	Need for legislation/regulation, monitoring regulatory measures. Need for enforcement of regulation.	No special legislation required.	3	33.3	3	33.3	1	11.1	2	22.2
		A national prevention of blindness strategy will be ideal as is advocated in the Global Action Plan.	7	77.8	2	22.2	0	0	0	0.0
Management systems	Need for sophisticated management systems. Need for managerial staff. Level of management and planning requirements.	No need for sophisticated management systems.	2	22.2	6	66.7	1	11.1	0	0.0
		Health Promotion logistics should be managed by managerial structure at frontline health facilities.	5	55.6	2	22.2	1	11.1	1	11.1
Collaborative action	Need for inter-sectoral action within government. Need for partnership between government and civil society. Need for partnership between government and external funding agencies	There is need for intersectoral action within government in trachoma endemic areas to implement water sanitation and hygiene programmes.	8	88.9	1	11.1	0	0	0	0.0
		Eye health promotion could be effectively done in schools.	6	66.7	3	33.3	0	0	0	0.0
		Health Promotion will require collaboration with NGOs.	4	44.4	4	44.4	1	11.1	0	0.0
		Collaboration between communities and Front Line Health Facilities is required.	7	77.8	2	22.2	0	0	0	0.0
Usage characteristics			Strongly Agree		Agree		Disagree		Strongly disagree	
			n	%	n	%	n	%	n	%
Ease of use	Need for information and education	Information and education of the target population in the community is necessary.	7	77.8	1	11.1	1	11.1	0	0.0
	Need for supervision	Supervision of the Village Health Workers is important.	8	88.9	1	11.1	0	0	0	0.0
Pre-existing demand	Need for promotion	The burden of ocular morbidity/BL/VI has been established in many setting in LMICs, but the demand for eye care services is low. Significant level of health promotion needed.	7	77.8	1	11.1	1	11.1	0	0.0
Black market risk	Need to prevent resale/counterfeiting	In some communities, itinerant couchers and traditional healers may compete with orthodox eye care practionners for the patients. Need to limit harmful practices of traditional eye healers by engaging them in eye health prevention activities.	4	44.4	4	44.4	1	11.1	0	0.0

Delphi Round 1 Facility Case Management

Technical Complexity of facility-based intervention

Category	Criteria	**Technical Complexity** (elements that need to be addressed)	Strongly Agree		Agree		Disagree		Strongly disagree	
Intervention characteristics			n	%	n	%	n	%	n	%
Basic product design	Stability/ease of storage/ease of transport	Batteries for torches are not stable in hot climates. Will require frequent replacement.	1	11.1	2	22.2	5	55.6	2	22.2
		Eye drops will require cool storage.	1	11.1	5	55.6	2	22.2	1	11.1
		Tetanus toxoid will require cold storage (refridgeration)	6	66.7	1	11.1	1	11.1	0	0.0
		Topical antibiotic ointment does not need cold storage	4	44.4	4	44.4	1	11.1	0	0.0
		Injectable antibiotics for ophthalmia neonatorum will require cold storage	2	22.2	4	44.4	1	11.1	1	11.1
		Sterile saline solution for eye irrigation is needed and is stable	6	66.7	3	33.3	0	0	0	0.0
		High dose vitamin A is needed and is stable	4	44.4	5	55.6	0	0	0	0.0
		All the above consummables will be transported by pre existing PHC transport channels	8	88.9	1	11.1	0	0	0	0.0
	Standardizability	The WHO AFROC PEC package as 5 algorithms for facility-based care with 12 protocols and 7 standards. Hence the intervention is standardized.	6	66.7	3	33.3	0	0	0	0.0
	Safety profile	None of the products cause any harm, if delivered correctly	4	44.4	4	44.4	1	11.1	0	0.0
Supplies	Need for regular supplies	Regular supplies of eye medication are needed.	8	88.9	1	11.1	0	0	0	0.0
Equipment	High-technology equipment and infrastructure needed	Diagnostic equipment needed: Snellen distance visual acuity chart; near visual acuity chart, torches and batteries.	6	66.7	3	33.3	0	0	0	0.0
		Infrastructure: 6m distance to measure visual acuity.	1	11.1	4	44.4	3	33.3	1	11.1
		Space for counselling required.	4	44.4	5	55.6	0	0	0	0.0
	Number of different types of equipment needed	One set of diagnostic equipment per facility is needed	3	33.3	5	55.6	1	11.1	0	0.0
	Maintenance needed	Torch batteries will need to be changed.	2	22.2	5	55.6	0	0	1	11.1
Delivery characteristics			Strongly Agree		Agree		Disagree		Strongly disagree	
			n	%	n	%	n	%		%
Human resources	Retail sector	Not applicable	0	0	1	11.1	6	66.7	2	22.2
	Outreach services	None (see health promotion framework)	1	11.1	0	0.0	5	55.6	3	22.2
	First-level care	Diagnoses of management of uncomplicated cases can be delivered in Primary Health Centres and Health Posts.	5	55.6	4	44.4	0	0	0	0
	Hospital care	Hospital services are needed for referrals, severe cases and treatment failures, further investigations and management, as required.	7	77.8	2	22.2	0	0	0	0
	Skill level required for service provision	Mid-level skill is required to make a diagnosis (eliciting a history; measuring visual acuity; basic eye examination)	7	77.8	1	11.1	0	0	0	0
		Mid-level skill is required for management of some conditions e.g., eye irrigation; removal of foreign bodies; giving intramuscular injections (tetanus toxoid; antibiotics)	5	55.6	2	22.2	0	0	1	11.1
		Mid-level skill is required for identifying which cases to refer and the level of urgency	5	55.6	2	22.2	0	0	0	0.0
	Skill level required for staff supervision. Degree of supervision required.	Primary Health Care supervisors need a good level of knowledge of eye conditions and their management and be skilled in the above. activity needed.	5	55.6	3	33.3	0	0	1	11.1
		Regular supervision of PEC required.	8	88.9	1	11.1	0	0	0	0
	Intensity of professional services in terms of frequency or duration. e.g. on schedule /periodic or continuous to accommodate emergencies.	Primary Health Care workers trained in eye care should be available continuously to manage emergencies	7	77.8	2	22.2	0	0	0	0
	Management and planning requirements. Need for managerial staff	Managerial staff needed to manage supplies of consumables and plan purchasing	3	33.3	5	55.6	1	11.1	0	0
		Managerial staff needed to establish and maintain referral and feedback mechanisms between the PH centre and eye department/clinic.	4	44.4	2	22.2	3	33.3	0	0
		Managerial systems to coordinate staff rotations to ensure daily facility coverage by trained PEC staff.	5	55.6	3	33.3	1	11.1	0	0
Communication and Transport	Depends on delivery of communication and transport infrastructure	Depends on communication to establish and maintain referral and feedback mechanisms between PH centres and eye department/clinic. Respond to feedback from referrals.	7	77.8	2	22.2	0	0	0	0
		Transportation between PH Centre and referral centre imperative.	6	66.7	2	22.2	1	11.1	0	0
Government capacity requirements			Strongly Agree		Agree		Disagree		Strongly disagree	
			n	%	n	%	n	%	n	%
Regulation/legislation	Need for regulation.	Appropriate medication & equipment need to be on the national essential drug list to facilitate availability.	8	88.9	1	11.1	0	0	0	0
	Need for monitoring regulatory measures. Need for enforcement of regulation.	There is need for regulation of drug prescription and dispensing by appropriate staff.	7	77.8	2	22.2	0	0	0	0
		Measles is a notifiable condition and should be reported to appropriate regulatory authorities.	8	88.9	0	0.0	1	11.1	0	0
		Ophthalmia neonatorum is a notifiable condition and should be reported	6	66.7	1	11.1	2	22.2	0	0
Management systems	Need for sophisticated management systems	No need for sophisticated management systems	2	22.2	5	55.6	2	22.2	0	0
Collaborative action	Need for inter-sectoral action within government. Need for partnership between government and civil society.	Intersectoral action withingovernment or partnerships between government and civil society are desirable but not mandatory.	4	44.4	4	44.4	1	11.1	0	0
	Need for partnership between government and external funding agencies	Need for partnerships between governments and NGOs.	4	44.4	5	55.6	0	0	0	0
		NGOs are responsible for the bulk of eye care in LMICs.	2	22.2	5	55.6	2	22.2	0	0
Usage characteristics			Strongly Agree		Agree		Disagree		Strongly disagree	
	XXXXXXnEED FOR INFORMATION		n	%	n	%	n	%	n	%
Ease of use	Need for supervision	Outcomes of consultation at the PH Centre will be reassurance, treatment (and) or referral. At this level, prescribed treatments may not require supervision at home.	3	33.3	3	33.3	3	33.3	0	0
		Referrals to secondary centres may require supervision to ensure compliance and may have to be supported.	7	77.8	2	22.2	0	0	0	0
Pre-existing demand	Need for promotion	The burden of ocular morbidity/BL/VI has been established in many setting in LMICs but the demand for eye care services is low. Significant level of health promotion needed.	7	77.8	2	22.2	0	0	0	0
Black market risk	Need to prevent resale/counterfeiting	Need to limit harmful practices of traditional eye healers by training them to identify and refer eye conditions.	6	66.7	3	33.3	0	0	0	0

Appendix 3

Modifications made in the technical complexity requirements after Delphi round 1

Gericke's Framework Dimensions	WHO AFRO PEC Package Component	
	Health Promotion and Prevention	Case Facility Management
	Statements Modified	
Intervention Characteristics		
Basic Product Design	Community Health Workers should be instructed on the potential side effects of any health Promotion materials.	Torches can be solar- powered and are stable. Appropriate and secure storage for drugs and consummables should be available. Eye drops that do not require cool storage should be stocked. Injectable antibiotics for ophthalmia neonatorum may require cool storage but should be available to treat other conditions.
Equipment		Adequate space to support the use of appropriate and standardized visual acuity charts.eg 3m or 6m
Delivery Characteristics		
Type of Facility needed	Availability of community leaders to deliver eye health promotion when required Opportunistic eye health promotion can be delivered to groups in the facility Opportunistic health promotion can be delivered to individual people in the facility- if time permits.	
Human Resource Requirement Communication and Transport		Existing managerial facility staff should be able to establish and maintain referral and feedback mechanisms between the PH centre
Government Capacity Requirements		
Regulation/Legislation	Health promotion materials should be approved and endorsed by local regulatory authorities. Eye health promotion activities should be recorded and monitored.	
Usage Characteristics		
Ease of use& Need for Supervision		Staff who are available to make supervisory home visits.

Appendix 4

Delphi Round 2 Health Promotion

Technical Capacity for community based interventions which comprises health promotion and prevention

Category	Criteria	Technical Complexity (Elements that need to be addressed)	Technical Capacity needed (Elements that need to be available)	Strongly Agree n	Strongly Agree %	Agree n	Agree %	Disagree n	Disagree %	Strongly disagree n	Strongly disagree %
Intervention characteristics											
	Stability: usable lifetime and risk of destruction	Posters for health Prevention and promotion are needed.	Posters that promote eye health should be available.	7	77.8	2	22.2	0	0	0	0
		Posters should be made durable by lamination.	The availability of durable posters.	4	44.4	5	55.6	0	0	0	0
	Standardizability: the degree to which an intervention can be standardized	The Posters should be standardised by having the same message per target group.	The availability of standardized posters, delivering the same message per target group.	5	55.6	4	44.4	0	0	0	0
		This should be translated into the language of the community as is done for other health promotion posters.	Available posters should be in the language of the community.	6	66.7	1	11.1	2	22.2	0	0
Basic product design	Safety profile of the intervention in terms of adverse effects, and risks associated with inappropriate use, e.g. from over-the-counter sales of prescription-only medications.	No risk of serious side effects.	Community Health Workers should be instructed on the potential dangers, such as fire, of wall posters of any health Promotion materials. Mechanisms for the proper disposal of old posters should be in place.	3	33.3	3	33.3	2	22.2	1	11.1
		Messages should be clear, unambiguous and understandable displaying appropriate information.	Posters with self expanatory graphics should be available to accommodate the illiterate.	8	88.9	1	11.1	0	0	0	0
	Ease of storage e.g. the need for refrigeration. Ease of transport	Health promotion materials do not have any specific requirements for storage and transportation.	NA								
	Need for regular supplies, and the number and types of different supplies needed. Ease of acquisition.	No requirements for regular supplies.	NA								
Supplies		Different types of posters are be needed for different target groups, e.g. diabetics, the elderly, carers of young children.	Availability of different types of posters for different target groups which are appropriately displayed.	5	55.6	3	33.3	1	11.1	0	0
	High-technology equipment and infrastructure needed. Ease of acquisition.	High technological equipment not required.	NA								
Equipment	Number of different types of equipment needed. Maintenance needed.	Low maintenance.	The availability of health promotion materials that are easy to maintain.	5	55.6	4	44.4	0	0	0	0
		Health promotion materials relatively easy to acquire.	A system for the easy procurement of health promotion materials.	6	66.7	3	33.3	0	0	0	0
Delivery characteristics				Strongly Agree n	Strongly Agree %	Agree n	Agree %	Disagree n	Disagree %	Strongly disagree n	Strongly disagree %
	Retail sector, Outreach services, First-level care, Hospital care	Should be delivered in the community through outreach services for diabetics, carers of young children during maternal and child health activities.	Availability of health promotion in the community that includes young children and their carers, diabetics and the elderly as their target audience.	4	44.4	5	55.6	0	0	0	0
			Availability of community leaders to deliver eye health promotion when required	3	33.3	2	22.2	3	33.3	1	11.1
Facilities		Should be delivered to specific **groups** that attend the primary health facility e.g. people over 40 years,	The availability of time, space and willingness to deliver opportunistic eye health promotion to groups in the facility	7	77.8	1	11.1	1	11.1	0	0
		Should be delivered to specific **people** that attend the primary health facility e.g. people over 40 years,	The availability of time and the willingness to deliver opportunistic eye health promotion to targeted individuals in the facility e.g. diabetics.	5	55.6	2	22.2	2	22.2	0	0
	Skill level required for service provision	Low skill requirement.	Availability of staff skilled in communicating with community members	7	77.8	2	22.2	0	0	0	0
		Will require knowledge about community, eye diseases and where to access care.	Availability of staff who are knowledgeable about community, eye diseases and where to access care	7	77.8	2	22.2	0	0	0	0
		Village Health Workers who live in the community should be trained to deliver health promotion in the communities.	Availability of village health workers resident in the community who are able to deliver health promotion.	6	66.7	3	33.3	0	0	0	0
Human resources		Facility based workers should deliver health prevention to groups/individuals in the facility.	Facility based staff who are able to deliver health promotion.	5	55.6	4	44.4	0	0	0	0
		Development of the health promotion materials and staff training will require professional instruction.	Availability of professionals to train staff on eye health promotion and develop health promotion materials.	9	100	0	0	0	0	0	0
	Skill level required for staff supervision. Degree of supervision required.	Mid-level skill required to supervise health promotion/prevention activities.	Availability of supervisors who are able to supervise health promotion activities including eye health.	7	77.8	2	22.2	0	0	0	0
	Intensity of professional services in terms of frequency or duration e.g. on schedule/periodic or continuous to	Health Promotion and prevention activities should be delivered on schedule.	Availability of staff who regularly deliver health promotion on schedule.	7	77.8	2	22.2	0	0	0	0
	Need for managerial staff: Management and planning requirements.	Planning will be required to organise target audience to be sensitised in appropriate locations e.g. Mothers or care givers of young children.	Availability of existing managerial staff who plan and organise target audience to be sensitised in appropriate locationes e.g. carers of young children.	5	55.6	4	44.4	0	0	0	0
Communication and transport	Dependence of delivery on communication and transport infrastructure: roads, telephones, need for substantial exchange of information between different sectors or levels of care.	Local transport infrastructure will be needed to visit communities.	The availability of local transport infrastructure to visit communities.	6	66.7	1	11.1	2	22.2	0	0
		Communication between the communities and the Front Line Health Facilities required.	The availability of appropriate communication channels between the community and frontline health facilities.	8	88.9	1	11.1	0	0	0	0
		Communication in local language required.	The availability of staff who are able to communicate in the local language.	9	100	0	0	0	0	0	0
Government capacity requirements				Strongly Agree n	Strongly Agree %	Agree n	Agree %	Disagree n	Disagree %	Strongly disagree n	Strongly disagree %
Regulation/legislation	Need for legislation/regulation, monitoring regulatory measures. Need for enforcement of regulation.	No special legislation required.	Health promotion materials which have been approved and endorsed by local regulatory autorities.	5	55.6	3	33.3	1	11.1	0	0
			Eye health promotion activities that are recorded and monitored.	4	44.4	3	33.3	1	11.1	0	0
		A national prevention of blindness strategy will be ideal as is advocated in the Global Action Plan.	Availability of a national blindness prevention strategy that incoporates eye health promotion.	8	88.9		0	1	11.1	0	0
Management systems	Need for sophisticated management systems. Need for managerial staff. Level of management and planning requirements.	No need for sophisticated management systems.	NA								
		Health Promotion logistics should be managed by managerial structure at frontline health facilities.	Availability of existing managerial structures for Health Promotion that can be used to manage eye health promotion.	4	44.4	3	33.3	1	11.1	1	11.1
Collaborative action	Need for inter-sectoral action within government. Need for partnership between government and civil society. Need for partnership between government and external funding agencies	There is need for intersectoral action within government in trachoma endemic areas to implement water sanitation and hygiene programmes.	Availability of intersectoral activities within government or partnerships between government and civil society.	6	66.7	3	33.3	0	0	0	0
		Eye health promotion could be effectively done in schools.	The availability of existing school health programmes.	3	33.3	4	44.4	1	11.1	1	11.1
		Health Promotion will require collaboration with NGOs.	The availability of collaborations with NGOs to provide health promotion	1	11.1	6	66.7	2	22.2	0	0
		Collaboration between communities and Front Line Health Facilities is required.	Availability of collaboration between communities and frontline health communities is required.	7	77.8	2	22.2	0	0	0	0
Usage characteristics				Strongly Agree n	Strongly Agree %	Agree n	Agree %	Disagree n	Disagree %	Strongly disagree n	Strongly disagree %
Ease of use	Need for information and education	Information and education of the target population in the community is necessary.	Communicaton channels with community that are available to inform target population	8	88.9	1	11.1	0	0	0	0
	Need for supervision	Supervision of the Village Health Workers is important.	Staff who are available to to supervise health promotion activities.	8	88.9	1	11.1	0	0	0	0
Pre-existing demand	Need for promotion	The burden of ocular morbidity/BL/VI has been established in many setting in LMICs, but the demand for eye care services is low. Significant level of health promotion needed.	Staff who are able to engage in health promotion which includes the uptake of eye care when required.	8	88.9	1	11.1	0	0	0	0
Black market risk	Need to prevent resale/counterfeiting	In some communities, itinerant couchers and traditional healers may compete with orthodox eye care practionners for the patients. Need to limit harmful practices of traditional eye healers by engaging them in eye health prevention activities.	Staff who are able and willing to engage with traditional healers and train them to identify and refer eye conditions. A system that supports this training.	7	77.8	2	22.2	0	0	0	0

Delphi Round 2 Facility Case Management

Technical Capacity for facility-based intervention

Category	Criteria	Technical Complexity (elements that need to be addressed)	Technical Capacities (elements that need to be assessed)	Strongly Agree		Agree		Disagree		Strongly disagree	
Intervention characteristics				n	%	n	%	n	%	n	%
		Batteries for torches are not stable in hot climates. Will require frequent replacement.	Torches can be solar powered and are stable. They should be available.	6	66.67	3	33.3	0	0	0	0
			Appropriate and secure storage for drugs and consummables should be available.	8	88.89	1	11.1	0	0	0	0
		Eye drops will require cool storage.	Eye drops that do not require cool storage should be stocked	5	55.56	3	33.3	0	0	0	0
		Tetanus toxoid will require cold storage (refridgeration)	Tetanus toxoid will require cool storage and should be available from the facility childhood immunisation activities	6	66.67	2	22.2	0	0	0	0
	Stability/ease of storage/ease of transport	Topical antibiotic ointment does not need cold storage	Topical antibiotic ointment does not require cold storage and should be available.	6	66.67	2	22.2	0	0	0	0
		Injectable antibiotics for ophthalmia neonatorum will require cold storage	Injectable antibiotics for ophthalmia neonatorum may require cool storage but should be available to treat other conditions.	4	44.44	3	33.3	1	11.1	0	0
Basic product design		Sterile saline solution for eye irrigation is needed and is stable	Sterile saline solution for eye irrigation is stable and should be available	4	44.44	3	33.3	1	11.1	0	0
		High dose vitamin A is needed and is stable	High dose vitamin A is stable and should be available from Maternall and Child health activities.	5	55.56	4	44.4	0	0	0	0
		All the above consummables will be transported by pre existing PHC transport channels	Pre existing PHC transport channels should be available to transport PEC consummables.	7	77.78	2	22.2	0	0	0	0
	Standardizability	The WHO AFROC PEC package as 5 algorithms for facility-based care with 12 protocols and 7 standards. Hence the intervention is standardized.	The WHO AFRO PEC Package is standardized and can be available in all Primary Care facilities	6	66.67	3	33.3	0	0	0	0
	Safety profile	None of the products cause any harm, if delivered correctly	Available staff who are trained/can be trained to deliver the intervention correctly so as not to cause harm.	8	88.89	1	11.1	0	0	0	0
Supplies	Need for regular supplies	Regular supplies of eye medication are needed.	A medication supply system that can support the regular supply of eye medications and consummables	8	88.89	1	11.1	0	0	0	0
	High-technology equipment and infrastructure needed	Diagnostic equipment needed: Snellen distance visual acuity chart; near visual acuity chart, torches and batteries.	Diagnostic equipment is available: Snellen distance visual acuity chart; near visual acuity chart, torches and batteries.	7	77.78	2	22.2	0	0	0	0
		Infrastructure: 6m distance to measure visual acuity.	Adequate space to support the use of appropriate and standardized visual acuity charts.	6	66.67	2	22.2	0	0	0	0
Equipment		Space for counselling required.	Adequate space for counselling patients should be available.	8	88.89	1	11.1	0	0	0	0
	Number of different types of equipment needed	One set of diagnostic equipment per facility is needed	The availability of one set of diagnostic equipment.	6	66.67	2	22.2	1	11.1	0	0
	Maintenance needed	Torch batteries will need to be changed.	An available system for the maintenace of facility equipment.	5	55.56	4	44.4	0	0	0	0
Delivery characteristics				**Strongly Agree**		**Agree**		**Disagree**		**Strongly disagree**	
				n	%	n	%	n	%	n	%
	First-level care	Diagnoses of management of uncomplicated cases can be delivered in Primary Health Centres and Health Posts.	The availability of eye care services to manage uncomplicated eye conditions.	6	66.67	3	33.3	0	0	0	0
	Hospital care	Hospital services are needed for referrals, severe cases and treatment failures, further investigations and management, as required.	The availability of a referral hospital to manage complicated eye conditions.	8	88.89	1	11.1	0	0	0	0
		Mid-level skill is required to make a diagnosis (eliciting a history; measuring visual acuity; basic eye examination)	Staff who are able to make a diagnosis (eliciting a history; measuring visual acuity; basic eye examination)	8	88.89	1	11.1	0	0	0	0
	Skill level required for service provision	Mid-level skill is required for management of some conditions e.g., eye irrigation; removal of foreign bodies; giving intramuscular injections (tetanus toxoid; antibiotics)	Staff who are able to manage some conditions e.g., eye irrigation; removal of foreign bodies; giving intramuscular injections (tetanus toxoid; antibiotics)	8	88.89	1	11.1	0	0	0	0
		Mid-level skill is required for identifying which cases to refer and the level of urgency	Staff who are able to identify which cases to refer and the level of urgency	8	88.89	1	11.1	0	0	0	0
	Skill level required for staff supervision. Degree of supervision required.	Primary Health Care supervisors need a good level of knowledge of eye conditions and their management and be skilled in the above. activity needed.	Primary Health Care supervisors who are knowledge of eye conditions and their management.	6	66.67	3	33.3	0	0	0	0
Human resources		Regular supervision of PEC required.	Supervisors who regularly supervise PHC activities and can supervie PEC activities	6	66.67	3	33.3	0	0	0	0
	Intensity of professional services in terms of frequency or duration. e.g. on schedule /periodic or continuous to accommodate emergencies.	Primary Health Care workers trained in eye care should be available continuously to manage emergencies	Staff trained in PEC who are available continuosly to manage eye conditions, especially emergencies.	8	88.89	1	11.1	0	0	0	0
		Managerial staff needed to manage supplies of consumables and plan purchasing	Existing managerial facility staff who are able to manage the supply of consummables and plan purchasing.	6	66.67	3	33.3	0	0	0	0
	Management and planning requirements. Need for managerial staff	Managerial staff needed to establish and maintain referral and feedback mechanisms between the PH centre and eye department/clinic.	Existing managerial facility staff who are able to establish and maintain referral and feedback mechanisms between the PH centre and eye department/clinic.	5	55.56	2	22.2	1	11.1	0	0
		Managerial systems to coordinate staff rotations to ensure daily facility coverage by trained PEC staff.	Existing managerial systems to coordinate staff rotations to ensure daily facility coverage by trained PEC staff.	7	77.78	2	22.2	0	0	0	0
Communication and Transport	Depends on delivery of communication and transport infrastructure	Depends on communication to establish and maintain referral and feedback mechanisms between PH centres and eye department/clinic. Respond to feedback from referrals.	The availability of communication channels to maintain referral and feedback mechanisms between the primary health facility and the referral centre.	6	66.67	3	33.3	0	0	0	0
		Transportation between PH Centre and referral centre imperative.	The availability of transportation between the Primary health facility and the referral centre.	3	33.33	4	44.4	1	11.1	0	0
Government capacity requirements				**Strongly Agree**		**Agree**		**Disagree**		**Strongly disagree**	
				n	%	n	%	n	%	n	%
	Need for regulation.	Appropriate medication & equipment need to be on the national essential drug list to facilitate availability.	The inclusion of appropriate medication & equipment need to be on the national essential drug list to facilitate availability.	6	66.67	2	22.2	0	0	0	0
Regulation/legislation	Need for monitoring regulatory measures. Need for enforcement of regulation.	There is need for regulation of drug prescription and dispensing by appropriate staff.	A system that regulates drug prescription and dispensing by appropriate staff.	7	77.78	2	22.2	0	0	0	0
		Measles is a notifiable condition and should be reported to appropriate regulatory authorities.	The availability of communication channels to report measles outbreaks to relevant authorities.	9	100	0	0	0	0	0	0
		Ophthalmia neonatorum is a notifiable condition and should be reported	The availability of communication channels to report outbreaks of ophthalmia neonatorum to relevant authorities.	7	77.78	2	22.2	0	0	0	0
Management systems	Need for sophisticated management systems	No need for sophisticated management systems	Existing managerial structures for Primary Health Care that can be used to manage PEC.	7	77.78	2	22.2	0	0	0	0
	Need for inter-sectoral action within government. Need for partnership between government and civil society.	Intersectoral action withingovernment or partnerships between government and civil society are desirable but not mandatory.	Availability of intersectoral action within government or partnerships between government and civil society.	6	66.67	3	33.3	0	0	0	0
Collaborative action	Need for partnership between government and external funding agencies	Need for partnerships between governments and NGOs.	Availability of health care NGOs in the community.	0	0	5	55.6	4	44.4	0	0
		NGOs are responsible for the bulk of eye care in LMICs.	Availability of eye care NGOs in the community.	1	11.11	5	55.6	2	22.2	1	11.1
Usage characteristics				**Strongly Agree**		**Agree**		**Disagree**		**Strongly disagree**	
				n	%	n	%	n	%	n	%
	Need for supervision	Outcomes of consultation at the PH Centre will be reassurance, treatment (and) or referral. At this level, prescribed treatments may not require supervision at home.	Staff who are available to make supervisory home visits.	5	55.56	2	22.2	2	22.2	0	0
		Referrals to secondary centres may require supervision to ensure compliance and may have to be supported.	Staff who are able to supervise referrals to secondary centres to ensure compliance.	4	44.44	4	44.4	1	11.1	0	0
Pre-existing demand	Need for promotion	The burden of ocular morbidity/BL/VI has been established in many setting in LMICs but the demand for eye care services is low. Significant level of health promotion needed.	Staff who are able to engage in eye health promotion to target audience.	4	44.44	4	44.4	1	11.1	0	0
Black market risk	Need to prevent resale/counterfeiting	Need to limit harmful practices of traditional eye healers by training them to identify and refer eye conditions.	Staff who are able and willing to engage with traditional healers and train them to identify and refer eye conditions. A system that supports this training.	6	66.67	2	22.2	1	11.1	0	0

Reporting checklist for quality improvement study.

Based on the SQUIRE guidelines.

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Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

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	Reporting Item	Page Number
Title		
#1	Indicate that the manuscript concerns an initiative to improve healthcare (broadly defined to include the quality, safety, effectiveness, patientcenteredness, timeliness, cost, efficiency, and equity of healthcare)	1

Abstract			
	#02a	Provide adequate information to aid in searching and indexing	2
	#02b	Summarize all key information from various sections of the text using the abstract format of the intended publication or a structured summary such as: background, local problem, methods, interventions, results, conclusions	2
Introduction			
Problem description	#3	Nature and significance of the local problem	3
Available knowledge	#4	Summary of what is currently known about the problem, including relevant previous studies	3
Rationale	#5	Informal or formal frameworks, models, concepts, and / or theories used to explain the problem, any reasons or assumptions that were used to develop the intervention(s), and reasons why the intervention(s) was expected to work	3
Specific aims	#6	Purpose of the project and of this report	4
Methods			
Context	#7	Contextual elements considered important at the outset of introducing the intervention(s)	4
Intervention(s)	#08a	Description of the intervention(s) in sufficient detail that others could reproduce it	4-8
Intervention(s)	#08b	Specifics of the team involved in the work	4,6,8

Study of the Intervention(s)	#09a	Approach chosen for assessing the impact of the intervention(s)	'n/a'
Study of the Intervention(s)	#09b	Approach used to establish whether the observed outcomes were due to the intervention(s)	'n/a'
Measures	#10a	Measures chosen for studying processes and outcomes of the intervention(s), including rationale for choosing them, their operational definitions, and their validity and reliability	4
Measures	#10b	Description of the approach to the ongoing assessment of contextual elements that contributed to the success, failure, efficiency, and cost	5-6
Measures	#10c	Methods employed for assessing completeness and accuracy of data	7
Analysis	#11a	Qualitative and quantitative methods used to draw inferences from the data	7
Analysis	#11b	Methods for understanding variation within the data, including the effects of time as a variable	'n/a'
Ethical considerations	#12	Ethical aspects of implementing and studying the intervention(s) and how they were addressed, including, but not limited to, formal ethics review and potential conflict(s) of interest	7, 23

Results

	#13a	Initial steps of the intervention(s) and their evolution over time (e.g., time-line diagram, flow chart, or table), including modifications made to the intervention during the project	9-10
	#13b	Details of the process measures and outcome	11-20
	#13c	Contextual elements that interacted with the intervention(s)	'n/a'
	#13d	Observed associations between outcomes, interventions, and relevant contextual elements	'n/a'
	#13e	Unintended consequences such as unexpected benefits, problems, failures, or costs associated with the intervention(s).	'n/a'
	#13f	Details about missing data	'n/a'
Discussion			
Summary	#14a	Key findings, including relevance to the rationale and specific aims	20-22
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Interpretation	#15d	Reasons for any differences between observed and anticipated outcomes, including the influence of context	'n/a'

Interpretation	#15e	Costs and strategic trade-offs, including opportunity costs	'n/a'
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