BMJ Open Ophthalmology

Impact of personal protective equipment on the clarity of vision among trachoma survey graders and trichiasis surgeons in the context of COVID-19

Ehtisham Ul Hassan ,[1] Sue-Chen Apadinuwe,[2] Donal Bisanzio,[3] Michael Dejene,[4] Philip Downs ,[1,5] Emma M Harding-Esch,[6] Cristina Jimenez,[1] George Kabona,[7] Biruck Negash Kebede,[8] Michaela Kelly,[1] Peter Kivumbi,[9] Tom Millar,[1] Aryc W Mosher,[10] Caleb Mpyet,[11] Harran Mkocha,[12] Jeremiah M Ngondi,[3] Nicholas Olobio,[13] Stephanie Palmer,[14] Wamyil-Mshelia Teyil,[15] Paul Courtright[16]

To cite: Ul Hassan E, Apadinuwe S-C, Bisanzio D, *et al*. Impact of personal protective equipment on the clarity of vision among trachoma survey graders and trichiasis surgeons in the context of COVID-19. *BMJ Open Ophthalmology* 2023;**8**:e001255. doi:10.1136/bmjophth-2023-001255

► Additional supplemental material is published online only. To view, please visit the journal online (http://dx.doi.org/10.1136/bmjophth-2023-001255).

Received 30 January 2023
Accepted 20 May 2023

For numbered affiliations see end of article.

Correspondence to
Dr Philip Downs; pdowns@sightsavers.org

ABSTRACT

Background/aims The COVID-19 pandemic necessitated the use of personal protective equipment for those involved in trachoma survey grading and trichiasis surgery. We sought to determine which configuration of a face shield would be less likely to impact grading accuracy and ability to conduct trichiasis surgery. The research also included assessment of comfort, ease of cleaning and robustness.

Methods There were three research phases. In phase 1, assessment of four potential face shield configurations was undertaken with principal trachoma graders and trichiasis surgeon trainers to decide which two options should undergo further testing. In phase 2, clarity of vision and comfort (in a classroom environment) of the two configurations were assessed compared with no face shield (control), while grading trachomatous inflammation—follicular (TF). The second phase also included the assessment of impact of the configurations while performing trichiasis surgery using a training model. In phase 3, face shield ease of use was evaluated during routine surgical programmes.

Results In phase 2, 124 trachoma graders and 28 trichiasis surgeons evaluated the 2 face shield configurations selected in phase 1. TF agreement was high (kappa=0.83 and 0.82) for both configurations compared with not wearing a face shield. Comfort was reported as good by 51% and 32% of graders using the two configurations. Trichiasis skill scores were similar for both configurations.

Conclusion The face shield configuration that includes a cut-out for mounting the 2.5× magnifying loupes does not appear to impact the ability or comfort of trachoma graders or trichiasis surgeons to carry out their work.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The COVID-19 pandemic posed challenges to healthcare workers and patients, necessitating the use of personal protective equipment (PPE), despite a gap in scientific knowledge regarding the impact of face shields on performance during trachoma survey grading and trichiasis surgery; specifically, the impact of different face shield configurations on the clarity of vision, accuracy of grading and trichiasis surgical performance.

WHAT THIS STUDY ADDS

⇒ As a result of this study, the scientific community now knows that certain face shield configurations offer good visibility and comfort while maintaining accuracy in trachoma grading and surgical skills, and the importance of considering factors such as comfort, wearability and decontamination in the selection and use of PPE.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The study's findings can inform guidelines and policies regarding the use of PPE in ophthalmic healthcare settings and contribute to the development of standardised protocols for trachoma elimination programmes worldwide. The study provides evidence that the use of face shields can be integrated into trachoma survey grading and trichiasis surgery protocols.

BACKGROUND

Trachoma is the leading infectious cause of blindness and remains a public health problem in 44 countries, primarily in Africa.[1 2] Prior to the pandemic, in 2019, 92 622 trachomatous trichiasis (TT) surgeries were conducted to realign the eyelid to prevent eyelashes from touching the eyeball.[3–5] With the onset of the COVID-19 pandemic, mitigation efforts to protect healthcare workers and patients became a priority.[6] Population-based surveys are used to determine if trachoma is a public health problem and if implementation of trachoma elimination activities is required to reach WHO-defined targets for elimination.[7 8] In 2019, there were at least 624 trachoma surveys undertaken globally with

Tropical Data support (a global initiative that supports health ministries to conduct high-quality prevalence surveys).[9 10] To complete them, at least 330 trachoma graders were either trained or retrained.

The causative agent of COVID-19, SARS-CoV-2, spreads from infected people via respiratory droplets and aerosols. There is no direct evidence that eye protection equipment (a face shield or the equivalent) prevents transmission of SARS-CoV-2.[11 12] However, during eye examination, such as that required during surveys to estimate trachoma prevalence, or surgeries for treatment of TT, it is impossible to maintain physical distancing, and some form of eye protection has been routinely used by ophthalmic personnel since the onset of COVID-19.

To participate in trachoma surveys, graders must undergo a multistage training in which the rationale for and optimal conduct of each component of the survey participant encounter is broken down and practised, including the use of 2.5× binocular loupes for magnification and prevention of carry-over contamination between successive participants.[13] The goal of training is to ensure a high degree of accuracy and reproducibility in the diagnosis of trachomatous inflammation—follicular (TF), the primary sign to determine if active trachoma is a public health problem in the district.

Though individual TT operations take a relatively short time, surgery is typically undertaken on an outreach basis, in sessions completed over a 6–8-hour day for 1–5 successive days. This entails extended face-to-face exposure between surgeons and a sequence of patients. To prepare for service, trichiasis surgeon trainees participate in theoretical teaching, simulator-based training[3] and supervised practice on real patients.

It is unknown if face shields, a form of personal protective equipment (PPE), when used with 2.5× magnifying loupes, change the visual acuity or dexterity of health workers during trachoma grading or trichiasis surgery. In this study, we aimed to test the use of a face shield during trachoma survey grader training and TT surgery training. The focus of our investigation was which types and combinations provide the clearest view (no distortion to visualising the eye for grading or surgery) and which are the most practical (such as comfort and cleaning). After a preliminary assessment of user requirements, participants either performed simulated eye surgery on Hazardous Environment Adapted for Development of Surgical Training And Readiness Techniques (HEAD START) mannequins or TF grading on photos of everted eyelids with or without TF using two different face shield configurations as well as no face shield (control). HEAD START uses mannequins to provide a safe and controlled environment for surgical training in a hazardous area of the body, such as the eye.[3 14]

METHODS

There were three research phases. Phase 1 was a preliminary assessment of user requirements. In phase 2, we evaluated the accuracy of trachoma survey grading and the quality of TT surgery, while in phase 3, we investigated comfort, wearability, decontamination and reuse of face shields by trichiasis surgeons during their routine work.

In phase 1, a scoping review of four different configurations of face shields with medical masks (online supplemental figure) was conducted with 16 grader trainers and trichiasis surgeon trainers, selected from a convenience sample of trainers known through Tropical Data (service that is primarily used to support health ministries with trachoma prevalence survey design, planning, training, data collection, management and analysis).[7 10] The four different configurations were based on recommendations from WHO and the Centers for Disease Control and Prevention for healthcare workers to wear eye protection, including goggles or face shields in addition to face masks if in close contact with patients with COVID-19 or when performing aerosol-generating procedures. Most participants assessed the face shields inside their offices in controlled temperatures or outside in the shade. Assessment involved rating seven different parameters: visibility, misting, convenience, comfort, cleaning, size and functionality, and robustness. To narrow down the configurations on which to conduct more extensive testing in phase 2, responses were collected using a three-point Likert scale: good, moderate or poor. For the purposes of analysis, 'good' included both good and moderate, while 'poor' was stand-alone. Participants were encouraged to test all four configurations; however, it was not a requirement in phase 1 to do so; some participants were unable to procure goggles or unable to modify the face shield by cutting a hole into the shield in order to mount the loupes.

As a result of the exploratory assessment, two face shield configurations (options 1 and 2) were identified as the most desirable PPE candidates for further testing. Option 1 involved the loupes being mounted on a clear face shield, with a rectangular cut-out providing space for the loupe housing to sit in the correct position in front of the eyes, while in option 2, loupes were worn in front and mounted onto the face shield without a cut-out. Both options in phase 2 also required the use of a medical grade mask.

During phase 2, trachoma grader trainees who were involved in routine Tropical Data refresher trainings (Nigeria and Ethiopia) or a stand-alone grading activity (Nauru and the United Republic of Tanzania) were invited to participate in the study. As per standard trachoma grader training practice,[13] photos of everted eyelids with or without TF were uploaded onto mobile hand-held devices to simulate the scale and distance that graders use when examining eyes in the field. Participants were asked to grade TF as 'present' (defined as the presence of five or more follicles, each at least 0.5 mm in diameter, in the central part of the upper tarsal conjunctiva)[15] or 'absent' in a series of 150 images (3 sets of 50 images each). Participants conducted this assessment three times, once without a face shield (control), once

with option 1 and once with option 2. The order of the photos was rotated, with the sequence of the options used (1, 2, control) being randomised by individuals to minimise potential bias. Graders were assessed against the unanimous reference grading previously conducted by five international trachoma grading experts.[13] A kappa score was calculated to assess graders' diagnoses against the reference. Each grader generated nine kappa scores (three options times three image sets) and for analysis, a mean of the kappa scores for each option was calculated. As Tropical Data uses a kappa score of ≥0.7 for determining if a grader qualifies as a survey grader, our analysis used the same cut-off. Graders were also asked to complete a questionnaire (phase 2 questionnaire is provided in online supplemental material) to share their feedback on the use of face shields during trachoma grading.

To assess the impact of face shields on trichiasis surgery, certified Nigerian trichiasis surgeons were recruited. Participants performed simulated eye surgery using the HEAD START mannequin with option 1, option 2 or no face shield (control). The option order was randomised to avoid potential bias. Surgeon trainers observed surgery and used a 5-point scale (ranging from 1 'poor' to 5 'excellent') to score each surgeon in 10 skill areas. The overall skill score for each option was calculated by summing the product of the number of surgeons who scored each question by the score.

Trichiasis surgeons were also tested for near vision acuity using a single optotype near vision test, binocularly at 40 cm, using the tumbling E near vision chart.[16] This was conducted three times, once for each option (1, 2, no face shield), following the same randomised order used for the simulated eye surgery. Findings for options 1 and 2 were compared with the near vision level achieved while not wearing any face shield (control). Near vision was assessed with the N6 line as cut-off (pass/fail) considering 50% or more of the optotypes correctly identified.

Trichiasis surgeons were also asked to complete a questionnaire (phase 2 questionnaire is provided in online supplemental material) to provide feedback on various characteristics associated with using and cleaning the two face shield options.

Phase 2 results indicated that option 1 was the preferred choice. In phase 3, a second group of trichiasis surgeons in Nigeria were asked, after training, to use option 1 while they conducted routine trichiasis surgeries at their respective surgical sites and to provide feedback, via a questionnaire (phase 3 questionnaire is provided in online supplemental material), on comfort, wearability, decontamination and reuse.

The research was carried out from August 2021 to March 2022 (phase 1 from August to September 2021, phase 2 from October 2021 to January 2022 and phase 3 during March 2022).

Table 1 Principal trachoma graders and principal trichiasis trainers' feedback on four face shield configuration options (phase 1)

Summary of moderate-to-good responses								
Configuration options	**1. Visibility % moderate–good**	**1a. Visibility after using 1 hour % moderate–good**	**2. Misting % moderate–good**	**3. Convenience % moderate–good**	**4. Comfort % moderate–good**	**5. Cleaning % moderate–good**	**6. Size and Functionality % moderate–good**	**7. Robustness % moderate–good**
Option 1: Loupes worn through rectangular cut-out and mounted on face shield w/mask	80%	80%	80%	80%	80%	60%	80%	20%
Option 2: Loupes worn in front and mounted on face shield w/mask	69%	69%	38%	54%	46%	33%	38%	17%
Option 3: Loupes worn behind face shield w/mask	50%	40%	43%	29%	33%	67%	50%	17%
Option 4: Loupes worn in front of face shield w/mask	64%	64%	70%	60%	18%	82%	45%	40%

Table 2 Comparison of kappa score for detecting trachomatous inflammation—follicular (TF) correctly between no face shield (control) and various face shield options (option 1 and option 2)

	Option 1			Option 2		
No face shield	Kappa≥0.7	Kappa<0.7	Total	Kappa≥0.7	Kappa<0.7	Total
Kappa≥0.7	86 (91%)	9 (9%)	95 (77%)	87 (92%)	8 (8%)	95 (77%)
Kappa<0.7	8 (28%)	21 (72%)	29 (23%)	16 (17%)	13 (14%)	29 (23%)
Total	94 (76%)	30 (24%)	124	103 (83%)	21 (17%)	124

To check if the number of people included in phase 2 was enough to identify differences among the three configurations, we conducted post hoc power analyses with power (1–β) set at 0.80 and α=0.05, two tailed for cross-over study. The power analyses were performed for a non-inferiority test with a difference threshold set to 0.05 for the mean. The results of the power analyses showed that the estimated sample sizes for our study needed to be 61 individuals. Thus, given the power analysis results, the number of people included in the study was enough to compare the three configurations.

The score obtained by people using the three configurations was compared using Wilcoxon's rank test. The agreement of scores of each person obtained using the three configurations was evaluated using Kendall's concordance test. We considered Kendall's W<0.7 as low agreement, ≥0.7 and <0.8 as good agreement and ≥0.8 as high agreement when comparing grades.[17]

RESULTS

During the scoping review (phase 1), four participants tested all four options, one tested three options, five tested two options and six tested one option. In total, 35 assessments were undertaken, 26 (74%) of which were of off-the-shelf face shields. While testing different face shield configurations, 26 assessments used medical masks, 7 used N95 masks and 1 used a cloth mask (all participants were given options to choose the face masks). Phase 1 of the research identified two options (option 1 and option 2) for further testing to determine the potential impact on clarity of vision of trachoma graders and trichiasis surgeons. This conclusion was drawn based on the higher percentage of respondents reporting that visibility and comfort were moderate to good for option 1 and option 2 compared with option 3 and option 4 (table 1).

For phase 2, 124 grader trainees and 28 surgeons were enrolled. Among the 124 grader trainees, 95 (77%) achieved a kappa of ≥0.7 without wearing a face shield (table 2). The majority of grader trainees had kappa scores ≥0.7 using both options 1 and 2, with option 1 associated with a slightly better response. Among grader trainees that would be deployed for survey work (kappa ≥0.70 using no face shield), sensitivity analysis of both options revealed good results for both face shield options (table 3). Among graders who achieved a kappa of ≥0.7, 24 of 94 (26%) reported that face shield option 1 negatively impacted their ability to grade TF, compared with 49 of 103 (48%) using option 2.

Comfort was reported as moderate to good by 109 (89%) graders for option 1 and by 92 (74%) graders for option 2. Graders reported multiple reasons for poor comfort while wearing face shields, with option 1 reported to press on their chest whereas for option 2, graders reported a need to touch the face shield frequently. Ease of cleaning was reported by virtually all graders for both options 1 and 2.

All 28 trichiasis surgeons were assessed for near vision, and there was no difference at the N6 line using the two different face shield options. Compared with not using a face shield, 89.3% of surgeons had the same near vision using option 1 and 92.9% of surgeons had the same near vision score using option 2.

Among the 27 trichiasis surgeons who provided feedback on both face shields, 19 (70%) reported that they did not feel safe to undertake surgery without a face shield. Three surgeons reported that option 2 negatively affected their surgical ability, their dexterity handling sutures or ability to see clearly due to fogging.

Among surgeons reporting discomfort with option 1, the most frequently reported reason was due to the face shield pressing on their chest during surgery (n=13), poor ventilation (n=2) and sweating (n=3). Among surgeons reporting discomfort with option 2, the most frequently reported discomfort was due to breathing difficulties (n=4), feeling hot (n=2) and fog obscuring their view (n=2).

Independent assessment of surgeons by surgeon trainers revealed that, without a face shield, surgeons

Table 3 Sensitivity analysis of trachoma survey grader trainees using the two face shield options

	Face shield option 1	Face shield option 2
Sensitivity	0.91 (95% CI: 0.85 to 0.97)	0.87 (95% CI: 0.80 to 0.94)
Specificity	0.72 (95% CI: 0.56 to 0.88)	0.79 (95% CI: 0.64 to 0.94)
Positive predictive value	0.91 (95% CI: 0.85 to 0.97)	0.93 (95% CI: 0.88 to 0.98)
Negative predictive value	0.70 (95% CI: 0.54 to 0.86)	0.66 (95% CI: 0.50 to 0.82)

Table 4 Skill score for 10 different measures of trichiasis surgery

Variable (assessed by surgeon supervisor)	Score (maximum for each=150)		
	No face shield	Option 1	Option 2
Maintain sterile field	95	92	93
Identify and quickly select instrument from tray	110	114	111
Accurately draw liquid with syringe required	115	116	114
Put surgical blade onto the blade holder	117	115	115
Correctly place traction sutures	101	85	93
Correctly place the Trabut plate and evert the eyelid	98	93	93
Make a straight incision	98	98	89
Appropriately take suture bites required	88	88	82
Regularly space sutures required	83	86	76
Appropriately align the sutures required	79	82	75
Total	984	969	941

achieved an overall score of 984 out of 1500, lowest for alignment of sutures and spacing of sutures (table 4). Using option 1, the overall score was 969, while for option 2 the overall score was 941.

Twenty-three surgeons were enrolled in phase 3 of the work in Nigeria. As a group, they carried out a total of 119 surgeries, ranging from 1 to 12 per surgeon, all using the option 1 face shield. The most common reported challenges using the face shield included surgery taking longer with than without a face shield and that it hindered communication with the rest of the surgical team (table 5). Seven surgeons reported that they had to pause the procedure at some point while wearing the face shield due to breathing difficulties. Three of the nine who said they could not do so reported that the face shield was too long, and bumped on their chest; others reported fogging and difficulty breathing.

DISCUSSION

Some trachoma elimination activities paused temporarily during the early part of the COVID-19 pandemic, but were quickly resumed in adapted form. These activities including mass drug administration of an antibiotic, azithromycin, and efforts to encourage facial cleanliness and environmental improvement. Because of close contact between graders or surgeons and members of the public, specific safeguards were needed to reduce the risk of SARS-CoV-2 transmission from patient to provider or vice versa. We set out to identify the most appropriate face shield that could be used easily with 2.5× magnifying loupes. Ideally, it would not hinder the quality of the work, would be comfortable to wear and would be acceptable by users and community members. Finally, for logistical reasons, the ideal face shield configuration would be readily available and easily adaptable, robust, easy to clean and at a cost that programmes could afford.

Our findings suggest that neither of the face shields that we tested led to inaccurate grading of TF. Further, agreement was strongest among grader trainees who passed their initial intergrader agreement test by demonstrating a kappa of ≥0.70; those not passing this initial test would not proceed to field work. We suggest that since option 1 was generally preferable to wear compared with option 2, there is a greater likelihood it would be worn in the field for grading trachoma.

The surgeon trainers' assessments of trichiasis surgeon skills suggested that option 1 was a slightly better choice than option 2. Regardless of whether a face shield was worn or not, spacing and alignment of sutures was less than ideal, indicating a need to strengthen existing surgical training programmes and supervision. Measures related to comfort, wearability, fogging and cleaning were slightly better for option 1, with the notable exception of discomfort associated with the

Table 5 Reports of comfort and wearability by 23 surgeons in Nigeria after completing 1–12 surgeries each

	Yes	No
Was the communication between you and other team members affected by wearing the face shield?	11 (48%)	12 (52%)
Did you have any difficulty in breathing while wearing the face shield?	9 (39%)	14 (61%)
Did you have a problem with the face mask fogging?	1 (4%)	22 (96%)
While doing surgery, did the face shield bump against anything?	6 (26%)	17 (74%)
Did you have any difficulty picking up instruments or sutures because of the face shield?	4 (17%)	19 (83%)
Did surgery take longer to do because of the face shield?	13 (57%)	10 (43%)

face shield pressing on the chest. There may be value in finding ways to reduce this discomfort. Few surgeons had difficulties wearing it over extended periods of time in the field, and routine use is indicated as a COVID-19 mitigation measure.

There are limitations to our study. We could not test the use of face shields in all environments (climatic conditions, etc) in which trachoma surveys and trichiasis surgery are undertaken. Long-term viability could not be assessed; it is unclear, for example, how long a face shield will remain intact and functional after repeated use. However, we have collected feedback of graders from different geographical conditions (Nauru, Nigeria, Ethiopia, United Republic of Tanzania), to increase the generalisability of our results.

Since the completion of this study, face shields have been adopted for use by graders and trichiasis surgeons.[18] The face shields are generally inexpensive (about US$9 each), but this still represents an additional expense which needs to be included in budgets and procurement for surveys and surgery. Protecting healthcare workers and the populations they look after is of utmost concern and the likelihood of future waves of COVID-19, and potentially other infectious diseases, suggests that face shields may be indicated for years to come.

Author affiliations
[1]Neglected Tropical Diseases, Sightsavers, Haywards Heath, UK
[2]Ministry of Health and Medical Services, Yaren, Nauru
[3]Research Triangle Park, Research Triangle Institute, Durham, North Carolina, USA
[4]Public Health Consultancy Services, Addis Ababa, Ethiopia
[5]Neglected Tropical Diseases, Sightsavers, Durham, North Carolina, USA
[6]Department of Clinical Research, London School of Hygiene & Tropical Medicine, London, UK
[7]Union Government of Tanzania Ministry of Health Community Development Gender Elderly Children, Dar es Salaam, Tanzania, United Republic of
[8]Neglected Tropical Diseases, Sightsavers, Addis Ababa, Ethiopia
[9]Sightsavers, Dar es Salaam, United Republic of Tanzania
[10]United States Agency for International Development, Washington, DC, USA
[11]Neglected Tropical Diseases, Sightsavers, Kaduna, Nigeria
[12]Microbiology and Immunology, Kongwa Trachoma Project, Kongwa, Tanzania, United Republic of
[13]Nigeria Federal Ministry of Health, Abuja, Nigeria
[14]FHI 360, Durham, North Carolina, USA
[15]Neglected Tropical Diseases, Sightsavers, Abuja, Nigeria
[16]Kilimanjaro Centre for Community Ophthalmology, University of Cape Town, Observatory, South Africa

Twitter Wamyil-Mshelia Teyil @Teewams

Acknowledgements The primary data collection for this research was supported through Tropical Data and the Accelerate Programme. Core Tropical Data funding is provided by the International Trachoma Initiative; Sightsavers; and RTI International through the United States Agency for International Development (USAID) Act to End NTDs | East program. Accelerate is funded by a consortium of donors including the Bill and Melinda Gates Foundation, CIFF, ELMA and Virgin. We are grateful for the support provided by the health ministries, implementation partners, trachoma graders and trichiasis surgeons from Ethiopia, Nauru, Nigeria and the United Republic of Tanzania.

Contributors The research was designed by EUH, PD, EMH, MK, JMN, SP, AM, TM and PC. Field work was carried out and supported by EUH, SA, MD, CJ, GK, BNK, PK, CM, HM, JMN, WMT and NO. Analaysis conducted by EUH, PC, EMH, and DB. Guarantor PC. All authors contributed to the drafting of the manuscript.

Funding EMH-E receives salary support from the International Trachoma Initiative, which receives an operating budget and research funds from Pfizer, the manufacturers of Zithromax (azithromycin).

Disclaimer The authors alone are responsible for the views expressed in this article and they do not necessarily represent the views, decisions or policies of the institutions with which they are affiliated.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Consent obtained directly from patient(s).

Ethics approval Formal ethics approval was collected from in-country research ethics committees including the Ministry of Health and Medical Services of Nauru, the National Institute for Medical Research (NIMR) of the United Republic of Tanzania, the National Health Research Ethics Committee (NHREC) of Nigeria and the office of the secretariat for the institutional review board of Ethiopian Public Health Institute (EPHI) of Ethiopia. Tanzania: NIMR/HQ/R.8a/Vol.IX/3696. Nigeria: NHREC/01/01/2007-08/06/2021; NHREC/01/01/2007-10/12/2020.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request.

ORCID iDs
Ehtisham Ul Hassan http://orcid.org/0000-0002-1631-6128
Philip Downs http://orcid.org/0000-0002-5960-973X

REFERENCES

1 Weekly Epidemiological record (WER). 2021;96:353–64. Available: http://www.who.int/wer
2 Flaxman SR, Bourne RRA, Resnikoff S, *et al*. Global causes of blindness and distance vision impairment 1990-2020: a systematic review and meta-analysis. *Lancet Glob Health* 2017;5:e1221–34.
3 Tadesse D, Montgomery I, Sankar G. HEAD START - an innovative training approach for life-long learning. *Community Eye Health* 2017;30:14.
4 Gower EW, Kello AB, Kollmann KM. Training Trichiasis Surgeons: ensuring quality. *Community Eye Health* 2014;27:58.
5 World Health Organization. WHO Alliance for the global elimination of Trachoma by 2020: progress report on elimination of Trachoma, 2020. *Weekly Epidemiol Rec* 2021;96:353–64.
6 Institute of Medicine. Preparing for an influenza pandemic: personal protective equipment for Healthcare workers. Washington, DC: The National Academies Press, 2008.
7 Solomon AW, Pavluck AL, Courtright P, *et al*. The global trachoma mapping project: methodology of a 34-country population-based study. *Ophthalmic Epidemiol* 2015;22:214–25.
8 Courtright P, Rotondo LA, MacArthur C, *et al*. Strengthening the links between mapping, planning and global engagement for disease elimination: lessons learnt from Trachoma. *Br J Ophthalmol* 2018;102:1324–7.
9 Solomon AW, Burton MJ, Gower EW, *et al*. Trachoma. *Nat Rev Dis Primers* 2022;8:32.
10 Solomon AW, Hooper PJ, Bangert M, *et al*. The importance of failure: how doing impact surveys that fail saves Trachoma programs money. *Am J Trop Med Hyg* 2020;103:2481–7.
11 World Health Organization. *COVID-19: WHO issues interim guidance for implementation of NTD programmes. Geneva: World Health*

Organization, WHO reference number: WHO-2019-nCoV-neglected-tropical-diseases-2020-1. 2020.
12 Khunti K, Trish G. What is the efficacy of eye protection equipment compared to no eye protection equipment in preventing transmission of COVID-19 type illnesses. *CEBM* 2020.
13 Courtright P, MacArthur C, Macleod CK, *et al*. *Tropical data: training system for Trachoma prevalence surveys*. London: International Coalition for Trachoma Control, 2019. Available: https://tropicaldata.knowledgeowl.com/help/training-system-for-trachoma-prevalence-surveys
14 Soparkar CNS, Patrinely JR. The eye examination in facial trauma for the plastic surgeon. *Plast Reconstr Surg* 2007;120:49S–56S.
15 Thylefors B, Dawson CR, Jones BR, *et al*. A simple system for the assessment of Trachoma and its complications. *Br J Ophthalmol* 1987;65:477.
16 Radner W. Near vision examination in Presbyopia patients: do we need good Homologated near vision charts? *Eye Vis (Lond)* 2016;3:29.
17 Cicchetti DV. Guidelines, criteria, and rules of thumb for evaluating Normed and standardized assessment instruments in psychology. *Psychological Assessment* 1994;6:284–90.
18 Ngondi J. Adapting in a pandemic: simple innovations for big impact in Trachoma elimination. n.d. Available: https://www.rti.org/insights/loupes-face-shield-innovation-trachoma-elimination-covid-19