



# Accuracy of school-based vision screening by teachers in Pakistan: A qualitative study

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## List of Abbreviations

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<b>CD</b>	Country Director
<b>CEO</b>	Chief Executive Officer
<b>E chart card</b>	Simplified 'E' optotype Snellen chart
<b>EDO</b>	Executive District Officer
<b>IAPB</b>	International Agency for the Prevention of Blindness
<b>LRBT</b>	Layton Rehmatulla Benevolent Trust (Pakistan)
<b>OPD</b>	Outpatient Department
<b>USAID</b>	United States Agency for International Development
<b>VA</b>	Visual acuity

# Executive Summary

## Background and Objectives

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Sightsavers has been working in Pakistan since 1985 to reduce avoidable visual impairment. The 'Giving Vision to Future Visionaries' project was funded by the United States Agency for International Development (USAID) and implemented by Sightsavers and its partners in Quetta district of Baluchistan Province between March 2016 and February 2018. The project focused on training teachers to screen primary school children for eye and vision problems and referring those identified as having issues for management and treatment at a nearby eye hospital. The project set out to train 2300 teachers from 845 schools (484 in the public sector and 361 in the private sector) to screen 100,000 children. By the end of the project, 2,374 teachers (1,109 males and 1,265 females) had been trained and 100,846 school children had been screened.

Half-way through project implementation, when 1,908 teachers had been trained from 159 schools (107 public sector schools and 52 private schools), analysis of routine programme data revealed a high false positive rate of 73% (and much higher) in some schools. False positives were increasing the workload of the ophthalmology team (mainly optometrists), the cost of the screening programme, and risked negatively impacting the confidence of the parents and children participating in the project.

This research study was designed to understand the factors that contributed to the inaccuracy of screening and subsequently high rates of false positive referrals. The specific objectives included:

1. To explore the knowledge and competencies of teachers in carrying out visual acuity testing.
2. To investigate how visual acuity testing practices (testing techniques, equipment and settings) were applied.
3. To determine teachers' motivations and attitudes towards carrying out school-based visual acuity testing.

## Methods

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This was a cross-sectional qualitative study that used in-depth interviews to collect data.

Schools with false positive rates of 70% (or higher) were identified from the programme database; and eight schools were purposefully selected to represent different types of schools and locations. Within each school, teachers with the highest proportion of false positives were identified and invited for an interview. In total, 14 teachers were interviewed. In addition, three optometrists, who had delivered the teacher training were also invited to participate and were interviewed. Interview guides were developed to guide the interviews. All participants provided written informed consent. Data was audio-recorded, transcribed verbatim and translated into English for thematic analysis.

The analysis was conducted using NVIVO software. Ethical approval for the study was granted by the Research Ethics Committee of the Layton Rehmatulla Benevolent Trust (LRBT)

## Summary of key findings

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Of the fourteen teachers who participated in the study, nine were male and five were female. Four teachers taught in private schools, and the rest worked in public sector schools.

The study found that the importance of vision screening was well understood and appreciated by the teachers; there was also a strong level of support to the school-based vision screening within the local education authorities and the participating schools. However, there were several issues undermining the quality of screening and subsequently the effectiveness and the efficiency of the programme.

The conceptual framework underpinning this study focused on three groups of factors that could potentially undermine the quality of the programme: teachers' competencies; tools and procedures used; and motivations and attitudes. We found that the factors undermining the quality of screening in this setting lay in all three domains.

First, the duration of the training programme was significantly reduced from the recommended five hours to no more than one to two and a half hours. As a result, the training was rushed; the concepts and procedures were not sufficiently explained, and the teachers did not have adequate time to practice their skills.

In addition, there was little supervision of the teachers by the optometrist teams. The supervisory visits were organised only six months after the training. By that time many teachers had lost some of the acquired skills or developed incorrect practices. Some specific difficulties experienced by the teachers included poor understanding of the distances required for visual screening, the use of the E chart card, confusions about distance vision and near vision screening and misunderstanding of how to complete the referral forms.

Similarly, there was no refresher training course planned within the programme and there were limited opportunities for teachers' feedback on their VA testing in practice.

It also appears that the trainers selected for the programme, although being competent in optometry, were not necessarily experienced trainers. As a result, while the content of the training appeared to be too basic and simple for the trainers, it was too complex and confusing for the trainees.

Furthermore, although the teachers recommended for the programme were selected on the basis of their interest and commitment, not everyone took this task seriously. The optometrists reported challenges while conducting the training in some schools. For example, low rates of participation, poor discipline and the lack of interest among some teachers.

In addition, many teachers were overburdened with other work, which affected both their levels of participation in the training and the time they gave to the screening. Some teachers delegated screening to students, while others did not follow all the procedures required by the guidelines.

Furthermore, the study did not get strong evidence that the teachers were using the guidelines provided during the training regularly. Some teachers said that the guidelines were stored somewhere in the school, but they were not sure where.

## Conclusions and implications of study findings

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In conclusion, although the school-based vision screening in Baluchistan has been well received and supported by the schools and health providers, limited time allocated for training and practice; limited supervision and the lack of refresher training; trainers insufficiently experienced in training non-health staff and teachers' workload and overburden with other school responsibilities have undermined the effectiveness and efficiency of the programme.

The study has a number of implications for future programmes:

1. Teachers should be trained over a sufficient period of time to allow for a detailed understanding of the procedures and for practising skills under the observation of the trainers;
2. Trainers carrying out the training should be experienced not only in optometry but also in training non-health professionals with limited knowledge of clinical practice. Programmes should develop a training manual for optometrists/trainers training non-health professionals on school screening/child eye health screening in schools to standardise the training;
3. Optometrists/trainers should carry out regular supervision visits to monitor how the teachers are carrying out the testing and if they follow the correct procedures. For those teachers identified not conducting the VA testing correctly, on-the-job training should be provided during the supervisory visits;

4. Programmes should also introduce feedback mechanisms to enable teachers to report back any challenges or experiences they encounter during the VA testing; but also, to enable optometry teams to feedback to the teachers on the accuracy of their testing in a respectful and confidential way. This is important because it can provide an opportunity for the programme to detect implementation gaps for corrective action or adjustments;
5. Refresher training should be carried out regularly for all teachers trained, irrespective of the accuracy of their screening;
6. Teachers should be encouraged to keep the VA testing guide together with their testing kits and consult it on a regular basis. Also, innovative ways to provide guidelines using digital technology, for example, should be explored;
7. It is important to reiterate to the teachers that only people adequately trained to do the VA testing should carry out the tests and that it is not appropriate to delegate these tasks to other staff or students;
8. It is important to develop strategies to motivate teachers to carry out these additional tasks by either compensating them for their time, introducing rewards or other incentives, or reducing their workload with other school responsibilities;
9. It is also important to note that this study only had information on false positives referred to the optometry teams. The project did not carry out any tests to verify the results of those children who were categorised as having normal vision. We therefore cannot estimate the number of false negatives and cannot fully assess the accuracy of the screening in this programme. Future programmes should introduce regular monitoring of both sensitivity (false negatives) and specificity (false positives) of the vision screening.

# Introduction

Visual impairment in children is a significant public health problem affecting 19 million children worldwide; 12 million of them are visually impaired due to uncorrected refractive errors (1). Corrective glasses contact lenses or refractive surgery can correct refractive errors and enable children to experience normal vision and participate fully in education and social activities alongside their peers.

In Pakistan, the prevalence of visual impairment among school-going children aged five to twenty years is estimated at 19.6 per cent and 2.3 per cent for severe visual impairment (2). Studies of refractive error prevalence in children show that refractive error in children in Pakistan are common and affect their day to day activities. In one study conducted in Lahore among school children aged 11 to 16 years, 19.8 per cent of children had a refractive error; and among them, 43.0 per cent had myopia; 21.5 per cent had hyperopia and 35.5 per cent had astigmatism (3). Another study conducted around the same time among school children aged four to fifteen years reported prevalence of refractive error of 5.3 per cent (4).

Visual impairment in childhood hinders education and development and subsequently future career opportunities and socio-economic well-being (5). Furthermore, children with unattended eye health problems have an increased risk of visual impairment or loss of vision in adulthood (6). For this reason, school eye health programmes are critical to detect and address eye health needs of children during their early years of life (7).

Vision screening of children in resource poor settings often takes place in schools, where it is more affordable and feasible. Several studies have shown that the use of teachers for vision screening including visual acuity (VA) testing, is a cost effective way to identify and treat eye health problems in children (8, 9). Teachers are usually trained to conduct vision screening in these settings, where there are too few trained ophthalmic professionals to screen every child, or when poor families cannot take their children to clinics for regular vision check-ups (8).

In order for school-based visual screening programmes to be effective, it is important to minimise errors which may include both false positives - where children with normal vision are identified as having abnormal vision, and false negatives, where children with abnormal vision are identified as having normal vision. While the latter means children in need of services go undetected for longer, the former may place an additional burden on the receiving eye care provider and therefore increase the cost of services. In addition, false positives may increase the anxiety of the children involved and their caretakers which may reduce their confidence in the programme (10). The effectiveness of vision screening by teachers depends on their motivation, competence, confidence, awareness of students examined, examination location, tools and referral system (10, 11).

Globally, 12 million children are visually impaired due to uncorrected refractive errors. With the correct glasses they would be able to see normally and not have any vision-related barriers to participating socially or in school.

Sightsavers has been working to reduce avoidable blindness and visual impairment in Pakistan since 1985. 'Giving Vision to Future Visionaries' was a project implemented by Sightsavers and their partners, in Quetta district of Baluchistan Province, with the funding from the United States Agency for International Development (USAID).

Among the four provinces of Pakistan, Baluchistan is the least developed in terms of social and economic indicators. Baluchistan has an estimated population of eight million people with two million children aged below 15 years (12). The estimated population of Quetta district is one million people, including 400,000 children.

The school eye health project was implemented in 159 schools (107 schools in public sector schools and 52 in private sector schools), providing school-based vision screening to children aged 14 years and under. Screening followed school eye health screening guidelines developed by the International Agency for the Prevention of Blindness (IAPB).

During the implementation of the project, routine data showed a high rate of false positive referrals of about 73 percent. This problem increased the workload of the ophthalmology team, as well as the cost of the screening programme, and negatively impacted the confidence and trust of programme participants.

## Research objectives

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The main objective of this study was to understand the factors that contribute to inaccuracies in vision screening by teachers and subsequent high rates of false positive referrals of pupils to specialist ophthalmic care, in a school based visual acuity testing programme in Quetta district, Baluchistan, Pakistan.

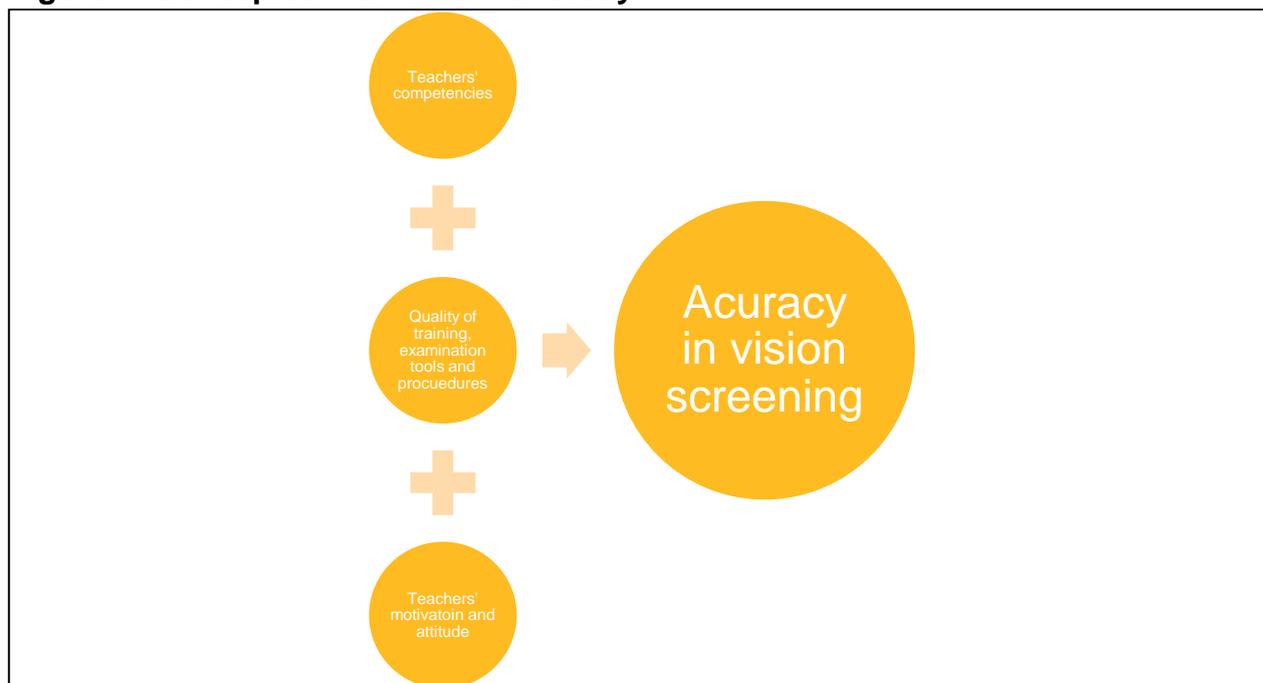
The specific objectives were as follows:

1. To explore the visual acuity testing knowledge among teachers participating in the Giving Vision to Visionaries project.
2. To investigate visual acuity testing practices such as testing techniques and settings among used by teachers.
3. To determine teachers' motivation and attitudes towards school based visual acuity testing.

## Conceptual framework

This study focused on the three possible factors that may contribute to the problem investigated here, i.e. teachers' competencies, the quality of training received by the teachers, examination tools and setting procedures, and teachers' motivation and attitudes (Figure 1). These factors were carefully evaluated to find out the reasons contributing to the high percentage of false positives in the project.

Figure 1: Conceptual framework of study



## Methods

### Study design

This was a cross-sectional qualitative study that used in-depth interviews to collect data. A qualitative approach was chosen for this study, as it was considered the most appropriate way in order to explore the perspectives of participants and gain their in-depth understanding of the issues. We chose in-depth interviews as this method allows the researcher to set the general agenda, while allowing room for the participants to develop their own account of issues important to them.

### Study population and sampling

Of the 159 schools in Quetta district that had received training at the time of the research (107 public sector schools, 52 private sector schools), eight schools were purposefully

selected for the study based on the proportion ( $\geq 70\%$ ) of false positives in these schools (see [Table 1](#)).

A maximum of two teachers from each of the selected schools were invited to participate in the study, and a total of 14 teachers were interviewed.

The three optometrists involved in teacher training and receiving referred students were also included as key informants in the study.

**Table 1: Selected schools**

School #	Total children (screened)	Children referred by teachers	Optometrist confirmed cases	False positive (Per cent)
1	117	54	2	96%
2	473	184	9	95%
3	1,583	631	75	88%
4	465	223	28	87%
5	764	207	50	76%
6	1029	203	52	74%
7	105	60	17	72%
8	643	145	45	69%
<b>Total</b>	<b>5,179</b>	<b>1,707</b>	<b>278</b>	<b>84%</b>

## Data collection

### Training of interviewers

Two interviewers, one male and one female, were recruited locally to collect the research data. They were provided with training about the research, its methodology, interview guidelines and techniques, and a detailed discussion about ethics, including the issue of confidentiality and informed written consent.

### Interview procedures

Following the training, the two interviewers interviewed the selected teachers in their schools; the selected optometrists were interviewed in the hospitals in which they worked. In all cases, the interviewers explained the purpose of the interview, the expected duration

of the interview, the use of the tape recorder and how the information would be kept confidential. All participants were asked to sign a consent form to indicate that they understood and consented to participate in the study. With participants' consent, the in-depth interviews were audio recorded.

Two semi-structured interview guidelines (one for teachers and one for optometrists) were developed to guide the interviews. The guidelines enabled the interviewers to conduct open conversations with participants, allowing them to express themselves fully and discuss issues of interest to them in detail, while ensuring all topics of interest to the researchers corresponding to the study objectives were covered. Demographic details were captured in a separate form. The guidelines were translated into Urdu. Where possible teachers were interviewed by interviewers of the same sex.

The main themes of the topic guideline for teacher interviews were: 1) the participants' background, training and experience, 2) the training received, 3) their practice of visual acuity testing and referral criteria, 4) their opinion on the accuracy of the school based visual acuity testing including factors that influenced accuracy 5) the impact they consider the training to have had on them and their practice, 6) the equipment and supplies available to them, and 6) how they recorded data and make referrals.

Further to the interviews, vignettes were developed to further investigate the knowledge and practices of the teachers interviewed. Vignettes are usually used in social science to present a hypothetical situation, to which research participants respond, thereby revealing their perceptions, values, social norms or impressions of events (13).

## Data analysis

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All interviews were audio-recorded, transcribed and translated into English for analysis. NVivo software (version 12) was used for organising and coding the data into a coding framework. Two research team members carried out open coding of the transcripts. The codes were descriptions or labels of specific ideas. Inter-related or similar codes were clustered into different categories, and the categories were subsequently grouped into specific themes. The themes were inductively and deductively developed. There was a constant interplay between data collection, analysis and theme development, with new and dominant ideas that emerged in earlier interviews explored deeper in subsequent and later interviews and discussions. Theme development was a joint effort by the core research team members.

## Ethical considerations and consent process

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The study protocol was reviewed and approved by the Research Ethical Committee of the Layton Rahmatulla Benevolent Trust (LRBT), Pakistan (ref: CO/OPS/1752). Additional permissions were also obtained from all the relevant education authorities such as the head teachers of the schools. All study participants were informed of the objectives of the study and the participant selection process, and informed consent was obtained for every

participant. Each interviewer signed a confidentiality agreement. All the interviews were conducted in private places and the collected data were handled in a way that ensured the highest degree of confidentiality.

## Results

### Participant characteristics

Of the fourteen teachers who participated in the study, nine were male and five were female. Four taught in private schools, and the rest were at government schools including one teacher who taught at a government school for children with special needs.

**Table 2: Study participant characteristics**

School type	Total number of teachers	Interviewed teachers		Interviewer
		Male	Female	
Private	14	1	1	Male
Government Boys	31	1	0	Male
Government Girls	31	0	2	Female
Government Girls	5	0	2	Female
Government School for Children with Special needs (Boys)	20	1	0	Male
Government Girls	36	0	2	Male
Government Boys	27	2	0	Male
Private	11	0	2	Male

All three optometrists were male and worked for Layton Rahmatulla Benevolent Trust (LRBT).

### Visual acuity testing knowledge among teachers

This section explores issues related to teachers' knowledge about eye health and vision screening, including their selection, training and support once in post after the training.

## Selection

The selection criteria for both vision screening trainers (optometrists) and trainees (teachers) were not well documented, but it was reported to be based on personal decisions made by the hospital (LRBT) and the school management respectively. The optometrists were selected based on their qualifications in optometry and being employed at LRBT. Two of the three optometrists said that they were recent graduates. Two of the three had been involved in previous projects with Sightsavers.

After the recruitment as trainers, the optometrists were briefed about the project, its general and specific objectives, planned activities and their role and responsibilities.

The optometrists contacted the school principals at each school and asked them to identify teachers to participate in the vision screening project. The school principals were requested to nominate committed teachers who were well known for their participation in social work, as one of the optometrists reported:

“We asked them [the principal] to give us teachers ... who are active, smart and social worker type teachers, who would cooperate with us and do all the work ... and they agreed to do so. So, we selected them with the help of the principal.” **Optometrist 1**

## Training of teachers

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### Format and content

Overall, the training for the teachers was shorter than planned with no opportunities for practical application of skills and there were insufficient opportunities to request guidance or support after the training although some guidance documents were provided.

The trainings for teachers were carried out in small groups within each school, and all of the trainings were gender segregated.

A pre-training assessment, referred to as the pre-test Performa, was administered to all teachers to measure their knowledge of eye health and vision screening prior to the training. The assessment covered issues such as setting up the overall environment for visual acuity testing, placement and proper usage of the testing instruments, distance between the E chart card and the student to effectively measure the visual acuity, instructions given to the student and compliance to the instruction, recording the result and recording the same on completing the referral form, if needed. A post-training assessment was also carried out to measure the effect of the training on the knowledge obtained. Optometrists reported great significant improvements in scores between the pre- and post-tests, but we do not have the data to verify this.

“When we gave them the pre-test Performa, then we came to learn how much they were aware of about ...our field and when we gave them the

post-test, then we saw the difference. It was much improved. We also asked them to rehearse in a group of three to four teachers, as to how to conduct the visual acuity testing.” **Optometrist 2**

The training content was designed based on IABP guidelines, to build the teacher’s capacities to carry out vision screening, including VA testing, accurately. Optometrists described the training content as follows:

“We told them the basics regarding the eye; what is an eye? Its importance and diseases related to it. After that we conducted an eye camp at the school. In this camp we examined the students... what sort of problems they had with their eyes. Is there a headache, allergy or any other major diseases?” **Optometrist 3**

“We also covered the questions in the Performa about visual acuity or distance. There were some questions regarding testing with or without glasses. There were distance related questions for visual acuity: how to fail a student, choosing right columns about the right or left eye failing. There was a point about other problems such as redness, swelling or allergy [in the eye] etc. It took a lot of time to explain them about it.”  
**Optometrist 1**

Each training was followed by a question and answer session. The emphasis was placed on how to accurately use the E chart card to test VA. The optometrists demonstrated visual acuity testing procedures on a few teachers. The teachers who were identified as having vision problems were provided with spectacles.

A review of project documents revealed that the training had a question and answer session to clarify the objectives of the project, the rationale for visual acuity testing in the school children, the role of the teachers, the basic equipment required for the visual acuity testing and the usage of the E chart card to do the visual acuity testing accurately.

Teachers corroborated that they were taught how to measure VA and how to use the E chart card for accurate results:

“They gave us cards and via demonstration explained how to carry out screening.

“They told us how to check the eyesight. What distance should we check it from? Left and right eye difference. Different teachers gave us the lecture.”

**Female teacher, Government school for girls**

Optometrists reported that teachers were asked to practice VA testing in small groups, however, the teachers reported not being given opportunities to practice the VA testing themselves in the presence of the trainer. Post training evaluation forms were not available to the research team for review to ascertain the nature and delivery of ‘practical sessions’.

Some teachers also contradicted the optometrists and reported that they received no training for either near or distance visual acuity testing at all, whereas some teachers displayed significant confusion about the correct procedures. The teachers' responses indicated that they had been using both sides of the E chart card to carry out the distance vision screening (the back side of the card is used for the near vision testing). It was also clear that the teachers were not sure of the exact distance needed between the student and the E chart card, giving a wide range of responses on the distance required for the visual acuity testing. The responses on the distance of the students from E chart card produced a variety of answer (ranging from three to ten feet for some, while three metres for others):

“We have to check both near vision and distance vision, but the trainers who gave us the training earlier did not teach us how to check near and distance vision. They only said that you will use the E chart card from the 3 metres distance.” **Female teacher, Private school, Quetta**

“No, I do not remember, it was written on the cards. Probably it was 10 feet.” **Male teacher, Government special boys' school, Quetta**

After the training, teachers were provided with the VA testing tool kit that contained all the items needed to enable them carry out the testing accurately, including an E chart card, a measuring tape to calculate the distance between the students and an E chart card and a VA testing guideline for teachers in Urdu Language.

## Opinions on training and participation

There were mixed opinions about the quality of the training among the teachers, as well as between them and the trainers interviewed.

Some of the teachers rated the training as very good and effective, whereas others reported that they were not fully satisfied with the quality of the training. Several teachers felt that the content of the training demanded more of their time and further discussions were needed to better understand the concepts, procedures and methodology of the VA testing.

“There should have been a proper training to make us understand. We needed more knowledge.” **Female teacher, Government school for girls, Quetta.**

“They satisfied us well and thoroughly explained everything to us.” **Female teacher, Government school for girls**

The optometrists on the other hand said that the training was good overall. They praised the participation of the teachers, especially the senior ones, despite noting that a few male teachers did not take the training seriously:

“It was very good. Some of them were cooperative, especially the senior staff, but some men were not serious.” **Male optometrist 3**

The opinions on the training of female teachers varied. While one trainer reported no issues with the participation of female teachers; the other two reported some challenges in ensuring active participation of the female teachers during in the training sessions:

“We had a very good experience with the females [teachers during the training].” **Optometrist 3**

“It was okay in the male schools, but in the female schools making teachers sit and ask them to attend the training seriously was a challenge. So, handling teachers in the female school was slightly challenging.”

**Optometrist 2**

## Training duration

The actual planned time for the training was five hours (0900-1400 hours). However, both the teachers and optometrists reported that the average duration of the training was between one and two and a half (2.5) hours at maximum.

“As long as the training is concerned, we usually spent one hour or [a bit] more duration in the training...” **Male optometrist 2**

The teachers reported that the time for the training was not sufficient to cover the range of all information they were required to learn. While on the other hand, the trainers (optometrists) believed that the training covered the basics and was sufficient.

A female teacher from a government girls’ school in Quetta described her experiences:

“In this case I am not satisfied because the training session was too short. I think it should be a three-day training session. The training was hardly for 60 to 90 min. So, we were not very clear.” **Female teacher, Government school for girls**

The teachers felt that more time in the training would have allowed them to better understand the screening procedures, answer their questions and practice the procedures fully. No post-training refresher sessions were provided, despite being planned for within the project.

The trainers reported numerous challenges in conducting the training, that they felt impacted on the duration and quality of the training. These included extreme weather conditions (temperatures in Quetta often fall below zero degree Celsius during winter) and limited transport options available to move between the schools for the training.

“First of all, we have only one vehicle to move. Since we have to meet the target, so we go to three places in a day and the same vehicle is used to drop one person and pick the other one, so that creates a complication

and challenge. Sometimes the bad weather is a challenge and another one is the holidays during the course of implementation, like vacation of Eid and other festivals, during summers and winter”. **Optometrist 2**

“We had conveyance ...delivery issues, there was only one car among three teams and two mobilisers. Secondly, we had to face the law and order situation in Quetta. The issue of the Census [national household and population survey] and harsh weather conditions in winter due to which we had one-month vacation.” **Optometrist 3**

The above quotes also illustrate aspects of project planning failure. While the project had to meet set targets, there are some difficulties with just chasing numbers for the sake of it. It is imperative that our programmes go beyond counting the numbers of individuals reached as success, and also ensure the interventions are being delivered in an appropriate and effective manner.

## Vision screening in practice

This section explores how teachers conducted vision screening among pupils once back in post in their schools, including the procedures they followed, the materials they used, as well as the support they received and their confidence to conduct the screening.

### Procedure

The teachers reported that the screening must be carried out in a well-lit, quiet and calm environment. Most of the teachers reported that they carried out the screening process in large halls, libraries and verandas, as these were the places where enough light was available. However, in schools, where the classrooms were well illuminated, the teachers conducted the screening in the classrooms.

“For examination, the room must be well illuminated. If we will do the screening in a dark room, then we won’t be able to get true results. Nice environments and friendly behaviours are required to make children comfortable and fearless. These things help to get better results from the screening. By giving respect and love we can know the students in a better way” ...” **Female teacher, Government school for girls, Quetta**

Most of the teachers reported that they followed the procedures they had learnt during the training.

“The main objective is that the room must not be very illuminated. Neither it (room) should be over illuminated nor should it be dark. And distance is the main issue. So, it should be conducted from the 6-meter distance. If the distance is not accurate, less or more, then the results will not be accurate.” **Optometrist 2**

Although most of the teachers reported that they followed the procedures they learnt during the training, some, were unable to clearly recall the correct procedure for VA testing. Several incorrectly reported the distance required for the VA testing between the student and E chart card, and how to identify short sighted and far sighted students.

“In this programme we did as per your [project team/trainer] instructions. They gave us cards and told to test children eyesight testing from 3 meters distance. There were children who could not do it successfully. And we told them that they can consult LRBT for further detailed check-up will be free in LRBT. We also told them that the spectacles will be provided free of cost, if recommended.” **Female teacher, Government school for girls, Quetta**

“My role was to test eyesight, mark them as pass or fail and then recommend them. That’s what I did. The children who failed were sent back to the hall and re-tested [by teachers as they are sent back to the school hall].” **Female teacher, Government school for girls, Quetta**

The teachers also knew the signs of a child experiencing vision issues in the classroom and were looking for these signs during the lessons:

“We will see if he is having difficulty in reading or putting pressure on his eyes. If the teacher notices, she will know that his eyesight is not fine. If he is making many mistakes in the materials he copied from the board or comes closer to read properly or asks us to be seated in front so she can read properly.... Then we know.” **Female teacher, Government girls’ school, Quetta**

The teachers were aware that the E chart card has had two sides to measure the short-sightedness and far-sightedness. They were also aware that the distance of the student from the card would vary to measure both types of visual acuity vision. However, some teachers were not sure about the exact distance; some reported incorrect distances and some were unable to clearly recall the correct procedure for the VA testing:

“There was a card given to us and we had to test children by showing the card from 3 meters or 3 centimetres distance. If the child’s eyes were weak then he was brought closer, say around 2 metres to see if he could see from this distance or not. Then you will check from 1 metre distance to see if he is near sighted or far sighted.” **Female teacher, Government school for girls, Quetta**

“They gave us two sided cards and told us that one side can be used to check the distance eyesight vision and from the other side we can check the near eyesight vision.” **Female teacher, Government school for girls, Quetta**

A key issue highlighted by the teachers was incorrect use of the E chart card by teachers. Despite being taught to rotate the card on its corners, none of the teachers interviewed reported doing so, which may have contributed to inaccurate results.

“The cards were shown to the students at a distance and asked questions to check their eyesight.... Sometimes the card was attached onto the board and sometimes I was holding it.” **Female teacher, government school for girls, Quetta**

Optometrists were aware of this issue and felt that the incorrect use of the E chart card was a leading contributor of inaccuracies and false positives in the project.

“The results for the false positives were high because the teachers did not check the vision properly or ... while using the E chart card, as I told you earlier, they failed the children on the E chart card screening. But once they were referred to us and we checked their vision, then we found them with having normal vision 6 by 6.” **Optometrist 2**

Teachers were provided with information about the referral process and were given referral forms during the training. Teachers were instructed to indicate on the forms whether the students passed or failed on the VA testing separately for the left eye and the right eye. The filled forms were used to refer the students to an optometrist at LRBT for examination, diagnosis, management and provision of medicines or eyeglasses depending on the need.

“They told us how to look after the children in our classroom, recognise which students were weak and record their names. Then we had to refer them to LRBT so they can take care of those children. Then they [optometrists], will check if these children need medicine or glasses and gave it to them.” **Female teacher, Government girls’ school, Quetta**

The interviews indicated that not all teachers had understood the purpose of the referral forms, how to mark the student as a pass or a fail, or that they needed to record the responses separately for each eye. This resulted in extra work for the optometrist to whom the child was referred. The same was noted by the optometrists interviewed. According to one of the optometrists:

“Yes, there is one more issue, with the form. We have made three columns on the form; the right eye, the left eye and other problems. So, the teachers who were sitting at the back. ...what they did... that the right eye or the left eye column was only for those children whose eyesight was weak. And the other eye problem (column) was for the children whose eyes have had some problems, like allergy or something else. So, they (teachers) mixed up these columns and marked them ‘fail’ in all the columns. So, we took much time to identify the problem (using these forms), and a lot of our time is was wasted in this regard.” **Optometrist 2**

## Testing kits and materials

The teachers were provided with testing kits that included an E chart card, a measuring tape, a VA testing Guide (booklet) and a pamphlet containing messages for preventing eyes from diseases and blindness. All teachers reported having and using these materials. The E chart card, measuring tape and booklet had high recall as the reference or testing material provided during the training. The teachers demonstrated a good understanding of the importance of the materials for accurate VA testing:

“Proper sets of instruments are required so that the children’s eyes could be tested as required. Whatever problems they have, they should be tested properly. The whole test cannot be conducted here obviously [with so many students], but whatever is possible. Otherwise the children can be referred to the LRBT for further extended testing.” **Male teacher, government School for boys, Quetta**

“We had a booklet in which all the information was given, and we had an E chart card and a tape along... In case if there is no tape, then we take three steps, as a measurement.” **Male teacher, Private school**

However, most teachers reported using the E chart card and the measuring tape only. The guidelines in most cases were placed in a school cupboard and forgotten. Several teachers did not know where they were stored.

“No, it [the booklet] was in the classroom. I don’t know what the kids did to them. I don’t have it with me now.” **Female teacher, Government school for girls**

Some teachers said that all their equipment was stored somewhere in the school:

“They have been provided us with the cards, booklets and the Performas. These materials may be present in our school with our madam [head teacher], but I do not have them.” **Male teacher, Government school for boys**

## Support for teachers

The trainer optometrists reported providing post-training support by sharing their contact details with the teachers. The contact details of the social mobilisers and master trainers were also shared with the teachers or examiners, so that they could seek any support or to clarify at any stage during the process of screening for VA and referring the students for the professional advice and referrals. This is what the optometrist had to say:

“Yes, they contacted me to clarify the issue of fail or pass in the form.”  
**Optometrist 3**

Despite being given the trainers' contact details, the majority of teachers had neither received, nor asked for any support after the training. Teachers reported that they would have liked for the optometrists to visit them once a month to monitor how they were carrying out the VA testing. Instead, the optometrists said that they visited the schools only six months after the training, which according to the teachers was too long a period. One of the teachers said:

“It is working fine but as I said earlier, it would be good to have them revisit once a month if only for 15 minutes. They are visiting after 6 months. This should not happen. They should visit at least once a month. This is a matter of eyes. There could be problems. The hospital is close to us.”

**Male Teacher, Private school, Quetta**

The majority of the teachers carried out VA testing screening by themselves, however, some of the teachers reported being busy with teaching and other assignments and therefore delegated screening to their students to carry out the VA testing in their place. One teacher even described that she saw her role in the process as to be more managerial, overseeing a 'team' of students who could conduct vision screening independently.

“My role was that I formed a team of students, LRBT had given them training and those students who had a visual problem in school... were identified through the selected ...team of students. I was monitoring the team and furthermore, these students also performed the testing outside the premises of the school, in the towns.” **Female teacher, Government school for girls**

Though the optometrists interviewed believed that in some schools the students may have been given orientation and had been trained to carry out screening, the use of students could contribute to inaccurate screening results: training by the teacher before doing this job, it may well have contributed to incorrect results, as reported by an optometrist:

“They were fifty-fifty (50/50). I mean some of them [teachers] were working very sincerely and seriously. But there are some teachers who have been trained but they asked their students to do the visual acuity testing job... So, some teachers were not serious.” **Optometrist 2**

“When we go for the screening, then we come to learn about it as we have been referred students with 6 by 6 normal vision. So, when we call the teachers that all the students have not been properly checked for visual acuity, then we come to learn that the teachers have conducted by herself or it was done by the students. Some teachers were non-serious.”

**Optometrist 2**

Both the teachers and the optometrists described the strong support they had from the school administration with the vision screening programme. In addition to nominating the

teachers to participate in the programme, the schools allowed time for the students to have their VA testing to identify refraction error and other eye ailments tested; they also provided transport to take the referred students to the LRBT for the referral and to get medicines and glasses. This is what some of the teachers had to say about the support they received from their school management:

“Yes, they were very supportive. Without Madam’s [head teacher] support we were would not be able to take the training and perform it with children [VA testing].” **Female teacher, Government school for girls, Quetta**

“They [school admin] were very helpful. They made arrangements to take children with poor eyesight to the LRBT. They helped us with the forms and records.” **Female teacher, Private school, Quetta**

“It’s been one and a half years but there hasn’t been an obstacle. We were always permitted to do it [visual acuity testing]. They never told us that it was useless or not needed. They always permitted us. We participated actively with students. If there was an issue, teachers won’t have cooperated.” **Male teacher, Private school, Quetta**

“Our principal stayed with us all the time during this programme. He was always there on all three sessions of the programme.” **Male teacher, Government school for boys, Quetta**

## Teachers’ Confidence

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Most of the teachers were confident that they have had acquired the skills to carry out VA testing, although the study findings suggest that many teachers may have overestimated their competence, as several teachers could not recall the basics. Some forgot how to use the E chart card, some did not remember the correct exact distances and confused distance of the student from the E chart card, and how to test near vision and far vision testing. These concerns were raised by the optometrist we interviewed. As shared by the optometrist:

“We taught them to rotate the E chart card in 4 quadrants, but some teachers placed it on the board or let the children hold it in one direction only. You could say that it influenced the test. Also, the students were already smart. They knew it was M, N or R.” **Optometrist 1**

“We taught them to test both the right eye and the left eye. We told them that during the test... the child should cover the other eye with his palm. Some teachers followed it, but others would just let the child close the eye with the fingers. Doing that makes the eye unable to see for a few seconds.” **Optometrist 1**

However, many teachers reported that they are equipped with the skills required for the visual testing. This overconfidence with lack of knowledge may lead to incorrect screening results and unnecessary referral.

“There was a card given to us and we had to test children by showing card from 3 metres or 3 cm distance. If the child’s eyes were weak, then he was brought closer, say around 2 metres to see if he could see from this distance or not. Then you will check from one metre distance if he is near sighted or far sighted.” **Female teacher, Government school for girls, Quetta**

On the other hand, some of the teachers reported low confidence in their skills to carry out an accurate VA testing. They felt that regular supervision was necessary to get the feedback that would allow them to improve their VA testing skills.

“If we are taking these [VA] tests, people from the hospital should visit to check how we are doing this testing. Is it better or not? If we are lacking something, then they should tell us. We are humans and can make mistakes. They should schedule a revisit in once a month or a month and a half.” **Male teacher, Private school, Quetta**

## Teachers’ motivation and attitudes

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This section explores teachers’ interests, attitudes and motivation for participating in school vision screening.

Over the course of the interviews, teachers demonstrated a good understanding about of the importance of vision for students in learning and everyday life. All participants were positive about the project and seemed satisfied with the overall progress and achievements in meeting its objectives.

“I think it is very important because eyesight is very valuable for school and otherwise; especially for school going children.” **Female teacher, Private school, Quetta**

“It is a nice programme related to students’ eye health ...because at times some parents show carelessness and children’s eyesight issues remain unattended. It’s good if these issues have been addressed in school. Many children benefitted from this programme.” **Female teacher, Private school, Quetta**

The teachers also discussed the importance of the medicines and glasses for students’ participation, both in terms of helping them participate in school and because they felt close to the students and wanted the best for them:

“Sir, of course first they use these [eye] drops, medicine, so they become comparatively better. Secondly, they were given glasses as well, they were asked to use them.” **Female teacher, Private school, Quetta**

“These students are like our children. Helping them is a source of blessing for us. We also value an outside organisation which did free eyesight tests for the children by visiting our school.” **Male teacher, Government school for boys, Quetta**

Both teachers and optometrists highlighted how the importance of the project was, especially for the children from poorer families. All study participants highly appreciated the support from the LRBT hospitals in providing free medicine and eyeglasses, as some teachers noted to the schoolchildren. The provision of free of charge eyeglasses was especially applauded for children from poor families who could not afford to buy a pair of eyeglasses. According to some of the teachers:

“It is very important and necessary, because many parents cannot afford to take children to hospital for check-up. And some were careless too, do not give due attention to children’s issue.... It is very necessary.” **Female teacher, Government school for girls, Quetta**

“The main benefits are for the students, they were... poor students... but they need glasses, and but they cannot afford to buy the eyeglasses. At the same time, they lack the awareness that they can get a pair of eyeglasses as recommended (after screening). So, this is very beneficial for the children who belong to the poor families.” **Optometrist 2**

“It’s much more beneficial for the poor people who cannot afford health facilities. We provided medicines and spectacles free of cost to them.” **Optometrist 3**

“Children got spectacles. In fact, one child received the wrong spectacles and a person [from LRBT] came back specially to drop off the correct ones. This happened when the given spectacles were not suitable for him.” **Female teacher, Government school for girls, Quetta**

“Last year they [LRBT] have given so many spectacles. All those who have any issue related to eyesight were given glasses. They were more than 100, somewhere between 100 and 150 children. Some of our teachers were also part of it. There were 15/16 teachers and rest were children.” **Male teacher, Government school for boys, Quetta**

The teachers also appreciated learning about visual acuity testing. They also learnt procedures and those with uncorrected refractive error appreciated receiving an eye test and free glasses themselves.

“Yes, I’m telling you about my own experience. Look at my glasses. This is why I think it should be done in schools from the beginning when a child enters class one. The problem should be treated there and then. It should be stopped. This is the age when treatment can show slow improvement. My age had increased so it can’t be cured.” **Female teacher, Government school for girls, Quetta**

The majority of teachers were generally very positive about the project and many recommended replicating the project in the future, with some adjustments or improvements. For example, they recommended carrying out refresher trainings and an increased number of more supervisory visits by the trainers, to minimise the mistakes they have been making during the project. One teacher suggested a designated role within schools for vision screening, due to its importance.

“I want to say that they should increase their visits to schools. Because these are issues, parents do not pay sufficient attention. They should have permanent teachers in schools. Many people are approachable via schools. If they can address the issue at a younger age, results will be more promising. There is less awareness. School should be focused.” **Female teacher, Government school for girls, Quetta**

Despite appreciating the objectives of the project, many teachers also reported that vision screening was an additional burden for them, adding more tasks to an already full workload:

“The difficulty was that it is time consuming and we have other tasks to complete at school as well. So yes, that is the issue I faced.” **Female teacher, Private school, Quetta**

## Discussion

This study aimed to investigate the factors contributing to inaccurate vision screening performed by the teachers in selected schools in Pakistan and specifically, the high number of false positives in a school-based vision screening programme in Quetta referred unnecessarily to hospitals for further examination and treatment.

The study found that the importance of vision screening was well understood and appreciated by the teachers; there was also a strong level of support to the school-based vision screening within the local education authorities and the participating schools. However, a number of issues undermining the quality of screening were identified that could be rectified, to improve the accuracy of teachers as vision screeners, and subsequently the effectiveness and the efficiency of the programme.

The conceptual framework underpinning this study focused on three groups of factors that could potentially undermine the quality of the programme, i.e. teachers’ competencies;

tools and procedures used; and motivations and attitudes. We found that the factors undermining the quality of screening in this setting lay in all three domains.

First, the duration of the training programme was significantly reduced from the recommended five hours to no more than one to two and a half (2.5) hours. This reduction was driven by high programme targets and limited number of vehicles. External factors such as poor weather and political unrest also impacted the amount of time available. As a result, the training was rushed; the concepts and procedures were not sufficiently explained, and the teachers did not have adequate time to practice their skills. Teachers complained that the time for the training was short and they did not have enough time to ask and get answers for their questions. There is no doubt that the time allocated for training has affected the teacher's learning and skills, especially if no time was allowed for practical experience of VA testing under the observation of the trainers.

In addition, there was little supervision of the teachers by the optometrist teams and although the contact details of the trainers had been provided in practice, very few teachers contacted the trainers. The supervisory visits were organised only six months after the training. By that time many teachers had lost some of the acquired skills or developed inaccurate and incorrect practices. It appears that specific difficulties experienced by the teachers included poor understanding of the distances required for visual screening, the use of the E chart card, confusions about distance vision and near vision screening, and misunderstanding of how to complete the referral forms. More frequent and regular supervisions could have mitigated against the reduced duration of the training and could have improved the VA testing skills of teachers.

In the first instance, the trainers must possess not only excellent optometry skills, but must also have experience and skill in training non-eye care staff in basic vision screening procedures. Issues the optometrists deemed to be 'simple' and 'quick' were completely new to the teachers, who may have required longer than the optometrists realised, to understand and process the new information they were being given.

Some of the teachers nominated by school principals were already overburdened with work and unable to participate fully, leading to poor quality screening or delegating to students. It is likely that teachers noted for their 'social conscience' are often given these extra tasks, instead of being spread evenly among staff. When recruiting teachers to these roles, the time required should be stressed to principals so it can be accounted for in decision making.

Similarly, a refresher training course could have helped to supplement the learning and address the issues that arose during the VA testing with the school children. Study participants themselves suggested that in the absence of resources to conduct a refreshers course, optometrists could engage teachers in the rescreening of referred students. This way, the optometrists could guide teachers to develop their VA testing skills without any additional cost within school premises.

Other literature suggests that regular refresher training is also key in ensuring that teachers develop interest in the programme and that they follow the correct procedures for VA testing, hence producing accurate results (14, 15).

It also appears that the trainers selected for the programme, although being competent in optometry, were not necessarily experienced trainers. As a result, while the content of the training appeared to be too basic and simple for the trainers, it was too complex and confusing for the trainees.

Furthermore, although the teachers recommended for the programme were selected on the basis of their interest and commitment, not everyone took this task seriously. The optometrists reported challenges while conducting the training in some schools, for example low rates of participation, poor discipline and the lack of interest among some of the teachers. These issues on the part of trainees may be linked with the quality of training in terms of communication skills, teaching methods and experience of the trainer.

In addition, many teachers were overburdened with other work, which affected both their levels of participation in the training and the time they gave to the screening. Although teachers understood and appreciated the project, the additional tasks on to their already heavy workload affected the motivation of many.

Some teachers delegated screening to other students, which may have also affected the accuracy of the testing. It is also possible that the teachers' existing workload and time pressures affected the way teachers conducted the test. For example, some teachers did not rotate the E chart card, as recommended in the guidelines; some asked students to hold it or just placed it on the board. In some settings, teachers did not follow the correct procedure for testing each eye. This is in line with the findings of another study in India which found that teacher's workload can affect the performance of VA testing. This Indian study recommended that the teachers' workload should be evaluated and a balance established between their routine teaching work and the VA testing for proper functioning of the programme (10). Some evidence also suggests that errors in the examination process and inaccuracy of testing can also affect the teachers' motivation to carry out the screening (15).

It is also possible that these additional tasks given to the trained teachers led to the unequal distribution of workload between the school staff, which further affected the morale and the relationships between the teachers. Such experiences have been previously documented in other settings in school-based deworming programmes (16).

The VA testing guidelines and procedure are also very crucial for accuracy in the VA testing and although many teachers spoke about this, we did not get strong evidence that the teachers were using them regularly in carrying out the VA testing, to ascertain that they carried the activity in the proper setting and environment. The fact that most teachers were unable to clearly recall the correct procedure for VA testing leads us to assume that they do not consult the guidelines, nor adhere to the correct procedure stipulated in the VA testing guidelines on a regular basis. Some teachers also said that the guidelines were

stored somewhere in the school, but they were not sure where. A study conducted in Kenya on factors affecting transfer of knowledge, found that if the trainer does not give adequate time to providing supportive guidance on applying the skills on the job, there is a likelihood of laxity in the procedures, leading to poor results (17).

## Study limitations

One limitation of this study is that there was no observation of the teachers carrying out the vision screening in order to ascertain if they were following the procedure provided to them during the training. This study only relied on what the teachers and the optometrists reported during the interviews.

Despite pre- and post- training tests of teachers, the scores weren't recorded so no quantitative data exists to verify the change in knowledge on the basis of the training provided.

This study was cross-sectional, providing data at only one point in time, towards the end of the project. The study design was unable to tell whether teachers trained at different points throughout the project received differential training, so as a result had maybe gained better skills than others.

It is also important to note that this study only had information on false positives referred to the optometry teams. The project did not carry out any tests to verify the results of those children who were categorised as having normal vision. We therefore cannot estimate the number of false negative in this programme and cannot fully assess the accuracy of screening.

## Conclusions and implications of the study findings

In conclusion, although the school-based vision programme in Baluchistan has been well received and supported by the schools and health providers, there are numerous issues that undermined the effectiveness and efficiency of the vision screening. These included the limited time allocated for training and practice, limited supervision and the lack of refresher training; trainers insufficiently experienced in training non-health staff; and teachers' workload and overburden with other school responsibilities.

The study has several implications for future programmes:

- Teachers should be trained over a sufficient period of time to allow for a detailed understanding of the procedures and for practicing skills under the observation of the trainers; effectively about VA testing of children and how to perform VA screening using clinical signs and symptoms, and a standardised procedure provided to guide them.
- Trainers carrying out the training should be experienced not only in optometry but also in training non-health professionals with limited knowledge of clinical practice. Programmes should develop a training manual for optometrists/trainers training non-

health professionals on child eye health screening in schools, in order to standardise the training;

- In such school-based VA testing programmes, optometrists/trainers should facilitate the arrangement of regular supervision visits, to monitor how the teachers are carrying out the testing and if they followed the correct procedures. For those teachers identified not conducting the VA testing correctly, on the job training should be provided during the supervisory visits.
- Programmes should also introduce feedback mechanisms to enable teachers to report back any challenges or experiences they encounter during the VA testing; but also, to enable optometry teams to feedback to the teachers on the accuracy of their testing in a respectful and confidential way. This is important because it can provide an opportunity for the programme to detect implementation gaps for corrective action or adjustments;
- Refresher training should be carried out regularly for all teachers trained, irrespective of the accuracy of their screening;
- Teachers should be encouraged to keep the VA testing guide together with their testing kits and consult it on a regular basis; innovative ways to provide guidelines through for example, digital technology, should be explored;
- It is important to reiterate to the teachers that only people adequately trained to do the VA testing should carry out the tests and that it is not appropriate to delegate these tasks to other staff or students;
- Other programmes should introduce regular monitoring of both sensitivity (false negatives) and specificity (false positives) of the vision screening;
- It is important for such programmes to come up with strategies to motivate teachers to carry out these additional tasks, either by compensating them for their time, reducing their workload or introducing rewards and special incentives, for those whose performance is good based on the visual acuity testing results

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