# A Report on:

# Technology and task reallocation to improve access to quality refractive error services: Exploring the feasibility, acceptability, and cost implications

## Submitted to: Nepal Health Research Council

## Submitted by:


Dr. Raba Thapa (Principal Investigator)

Purushottam Dhungana (Co-investigator)

Manish Poudel (Co-investigator)

Pratibha Neupane (Co-investigator)

Pradeep Banjara (Co-investigator)

Ravi Gautam (Co-investigator)

Nabin Kumar Rai (Co-investigator)

Mohan Krishna Shrestha(Co-investigator)

Amanda Davis(Co-investigator)

Suit May Ho (Co-investigator)

Reshma Dabideen (Co-investigator)



**Special contribution and support for the study**

Shivang R. Dave

Eduardo Lage



**Tilganga Institute of Ophthalmology, Kathmandu, Nepal**


**Date: April, 2025**

**Field Research Optometrists:**

Pushpa Watankachhi

Rina Chaudhary

Pratibha Giri

**Field Planning and monitoring**

Dr. Raba Thapa

Pradeep Banjara

**Data Entry:**

Pushpa Watankachhi

Rina Chaudhary

Pratibha Giri

**Data clean and analysis**

Manish P. Poudel

Pushpa Watankachhi

Rina Chaudhary

Pratibha Giri

**Report Writing:**

Study Team

**Published By:**

Tilganga Institute of Ophthalmology
Kathmandu, Nepal
Tel+977 1 4493775
Email: tio@tilganga.org
Website: www.tilganga.org

## ABSTRACT

**Aim:** The aim of this study is to explore the accuracy, feasibility, acceptability and cost implications of refractive error screening and diagnosis by personnel in basic health service centers and rural eye centers using a commercially available, handheld and portable technology.

**Method**: This cross sectional study was implemented in the rural municipality of Dhading and Lalitpur district of Bagmati province across 5 basic health service centers and 5 rural eye health centers. The 5 basic health service centers were Ruby Valley Basic Hospital, Semjong Health Post, Mahadevbeshi Health Post, Thangsingtar Hospital, Sankhu Health Post and 5 rural eye health centers were Jwalamukhi Rural Eye Center, Gangajamuna Rural Eye Center, Khaniyabas Rural Eye Center, Gajuri Urban Eye Clinic, Mahankal Rural Eye Center. 100 participants were selected from each site. Quantitative data was collected to assess the accuracy, cost implications, acceptability and feasibility of autorefractometer.

**Results:** Out of 1000 enrolled participants, 624 (62.4%) were female and 376 (37.6%) were male. The mean age ± SD of the participants was 53.2 ± 15.9 years, ranged from 19 to 95 years. More than half of the participants (53.6%) were literate, with 41.6% having attained secondary education. Regarding employment, 304 participants (30.4%) were employed, and farming was the primary occupation for 507 individuals (50. 7%). Approximately half of the participants 499 (49.9%) were Hindu while 418 (41.8%) were Buddhist.

The overall agreement on BCVA (within the 6/6 or 6/9 range) between the optometrist (as a gold standard) and auto-refractometer readings was 71.6% (95% CI: 69.6% to 73.6%). This agreement operated by eye health worker was higher compared to allied health personnel at 78.7% (95% CI: 75.8–81.6), compared to 64.5% (95% CI: 60.8–68.2), which was statistically significant. P<0.001. Overall, around, 532 (92.8%) participants found that the autorefractometer acceptable and satisfied to use. Additionally among 84 responses, 78 (96.9%) indicated agreement that the autorefractometer is feasible to use, while 6 (7.1%) responses were neutral.

Among 420 participants who had previously been prescribed spectacles, 51 (12.1%) did not make them. Similarly, out of the 369 who made spectacles, 247 (66.9%) did not use them.

**Conclusion:** Autorefractometer showed highly accurate measurement within ±1D Spherical Equivalent. Additionally, acceptance and the practicality of autorefractometer technology were also found very high. Also, more than 1 out of 10 people do not make spectacles even when prescribed. Additionally, more than two-thirds of those who make spectacle do not use them.

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Warm regards,

Investigator team

## ABBREVIATIONS / ACRONYMS

| Abbreviation | Full form |
|---|---|
| ANM | Nurse and Midwife |
| BCVA | Best corrected visual acuity |
| CI | Confidence Interval |
| D | Diopter |
| HA | Health Assistant |
| NHRC | Nepal Health Research Council |
| PVA | Presenting visual acuity |
| SD | Standard Deviation |
| SE | Spherical Equivalent |
| URE | Unaddressed refractive errors |
| VA | Visual Acuity |
| WHO | World Health Organization |

# Chapter 1 INTRODUCTION

## 1.1. Background

Over 1.1 billion people globally have vision loss. Of these 826 million have unaddressed near vision impairment and 124 million have unaddressed distance vision impairment. A recent comprehensive analysis assessed the prevalence of total refractive errors in Nepalese children to be 8.4%. Refractive errors, uncorrected refractive errors, and uncorrected presbyopia were found in 11.2%, 7.3%, and 78.9% of adults, respectively.(1)

In response to the growing demand for health care and persistent shortages of health work force, the World Health Organization (WHO) has encouraged the adoption of a task-shifting/reallocation strategy.(2)

Task reallocation is increasingly being used as a way to increase access to health services, particularly in low-resource settings where shortages and uneven distribution of health workers hinders service delivery. Task reallocation can be done through delegation or a changing of the distribution of tasks and responsibilities among health workers. Training and appropriately equipping people who do not normally have the competencies for specific tasks and then allowing them to deliver particular activities can result in improved health system performance through increased availability of services and more efficient use of resources, as well as create an environment of easier access and availability of services for the patient. Indeed, a recent review across low- and middle-income countries found evidence of cost savings and efficiency improvements from task reallocation, especially at the primary health care and community levels.(3)

Technological solutions are tools that can be used to increase access and availability of eye health services. Combining technological solutions with task reallocation could yield scalable solutions that improve accessibility of quality refractive error screening and diagnosis. Technologies to perform accurate refraction exists, but there has been very little systematic uptake and integration into service delivery, in part due to the cost and the limited number of health workers trained in the accurate use of the technology.

For this study, we have chosen to use the PlenOptika QuickSee Free autorefractometer which is a commercially available, handheld portable wavefront autorefractor that meets regulatory standards and has been tested, validated and used in a number of settings.

**Literature Review**

In nations with low or middle incomes, task shifting is a potential strategy for reducing health-care costs.(3) The rural population continues to be denied basic eye care services because primary health care professionals are not qualified to provide eye care.(4) Shifting responsibility for HIV patient management from doctors to adequately trained and supported nurses or community health workers does not reduce the quality of care and, in the case of nurse-initiated care, may reduce the number of patients lost to follow-up.(5) Transferring the management of severe medication responses and antiretroviral drug regimen adjustments from physicians to other clinical officials does not result in a substantial change in the 2-year treatment success rate or ART expenses.(6) If supported by health system re-structuring, task-shifting from physicians to NPHWs is a potentially successful and cost-efficient technique for enhancing NCD access to healthcare.(7)

QuickSee is a low-cost, long-lasting handheld autorefractor that may be used in and out of clinical settings to achieve accurate objective refraction comparable to the gold standard of refractive error.(8) There is a considerable ophthalmologist shortage in developing countries. Furthermore, while the number of practitioners in industrialized countries is increasing, the population aged 60 and up is growing at twice the rate of the profession.(9) Eyeglasses prescribed by subjective refraction versus a novel autorefractor shows a slight benefit(10, 11). However, when compared to subjective refraction, the training necessary for autorefraction is far shorter.(12) The three most significant constraints to providing refractive eye care in low-resource settings are (a) awareness of and/or desire to correct impaired vision, (b) the cost of diagnosis and treatment, and (c) access to professional eye care. To effectively reduce URE in low-resource situations, we need innovative technologies that are accurate, simple to use, low-cost, rapid, and resilient all at the same time.(13) Uncorrected refractive is a major contributor of vision impairment worldwide.(14)

## 1.2. Rationale of study

Despite the efforts of governments and eye health sector stakeholders, there are millions of people across the globe that have unaddressed refractive errors (URE) and do not have access to appropriate treatment. Population growth, urbanization, increased time spent indoors and doing near work are expected to increase the number of people with myopia in the coming years. Increasing the accessibility, availability, and affordability of inclusive refractive services and products will be critical to address the growing burden of refractive errors. However, this can only be done if measures are taken to overcome the shortage of competent eye health workforce to provide primary eye care, refractive and optical services.

Technological solutions are tools that can be used to increase access and availability of eye health services. Combining technological solutions with task reallocation could yield scalable solutions that improve accessibility of quality refractive error screening and diagnosis. Technologies to perform accurate refraction exists, but there has been very little systematic uptake and integration into service delivery, in part due to the cost and the limited number of health workers trained in the accurate use of the technology.

## 1.3. Objectives

**General:**

• To explore the accuracy, feasibility, acceptability and cost implications of refractive error screening and diagnosis by personnel in Basic health service centers and rural eye centers using a commercially available, handheld and portable technology

**Specific:**

• To assess the accuracy ~~(sensitivity and specificity)~~ of screening by primary care and basic health services personnel using the chosen technology

• To understand the experiences of using the technology by primary care and basic health services including the patient's willingness to undertake screening and the interventions that can help to ensure task reallocation is feasible and provides quality screening and diagnosis of refractive errors

• To assess the acceptability of the technology and task reallocation by providers and patients including the uptake of screening and referral

• To understand the cost implications of task reallocation from trained optometrists to trained non-traditional workers in pharmacies and health workers in primary healthcare settings.

- To assess the increase in utilization of services through this approach
- To understand the benefits of this approach for increasing eye health seeking behavior.
- To assess the spectacle compliance among study participants

# CHAPTER 2: METHODOLOGY

## 2.1. Study method

Quantitative method was used.

## 2.2. Study design

Cross sectional study design was used.

## 2.3. Study area:

The project was implemented in the Dhading and Lalitpur district of Bagmati province across 5 basic health service centre and 5 rural eye health centres.

## 2.4. Study population

Community people of Lalitpur and Dhading District at the age 19 years and above with refractive error.

## 2.5. Sample size

**One of the objectives in this study was to see the acceptability of the device.**

Assuming 90% acceptability of the device with 2% error, with 95% confidence level, the total sample size was 900. With 10% non-response, the total sample size for the study was 990. Overall, 200 participants (total 1000) were enrolled.

The formula for the sample size calculation be:

$n= [Z^2 p(1-p)]/d^2$

Also, another objective of the study was agreement between device and optometrist value. We will assess the device's feasibility from the service providers. We have 10 study sites, with certain locations have up to 2 service providers. We will take 14

service providers and ask feasibility questions. At least one service provider from each of the ten locations will participate.

### 2.6. Sampling method

All consecutive cases will be taken until the sample size reached.

### 2.7. Training of field workers

Three research optometrist were trained about study process, refraction and use of autorefractometer. Training included introduction of the project, presentation and demonstration on handling PlenOptika QuickSee Free Autorefractometer and data entry in tablet based application. The training was conducted online through two video calls. The first was about 1.5 hour and the second was held after a few weeks, lasted for 30 minutes.

Before starting fieldwork, all these focal persons of concerned health service centres attended a comprehensive two days' long training run by these trained research optometrists. These four focal persons have a background in health professions including Auxiliary Nurse and Midwife (ANM), Optometry, Ophthalmic Science, Health Assistant (HA), and Nursing.

### 2.8. Inclusion and exclusion criteria:

**Inclusion criteria:** patients over the age of 18 years and within the refractive error range of the autorefractor, as determined by subjective refraction

**Exclusion criteria:** all children aged 0-18 years old; the presence of any visible eye illness; and patients with astigmatisms of 1.00 D and greater (identified by initial auto refraction). Excluded patients were referred to an appropriate eye health professional.

### 2.9. Data management

All the data were entered in CommCare software. Data was exported to Microsoft Excel were data cleaning, coding decoding were performed. The cleaned data were exported to IBM SPSS Version 20 for statistical analysis. All the data are kept in password protected computer.

### 2.10. Statistical Analysis

For the descriptive analysis mean, standard deviation numbers, percentages were calculated. Pie chart, bar diagram was prepared for graphical representation of the data. Spherical Equivalent (SE) was calculated using the formula Spherical value +(cylinder value/2). Agreement analysis was done to see the amount of matched spherical equivalent values from optometrist and refractometer device. P value less than 0.05 was considered as statistical significance.

### 2.11. Ethical consideration

The study was conducted after the ethical approval of the study by the Ethical Review Board of Nepal Health Research Council (NHRC) Protocol Registration Number 491/2023 in 11th December 2023. Written informed consent was taken before collecting data from participants.

## CHAPTER 3 RESULTS

A total of 1,000 participants were included in the study. The study was conducted across ten sites, with 100 participants recruited from each site. The lists of basic health service centres and rural eye health centers are listed below.

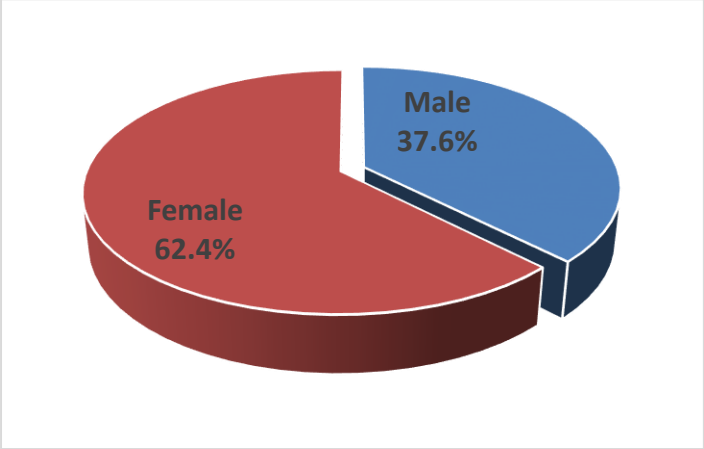
| SN | Basic health service centers | Rural eye health centers |
|---|---|---|
| 1 | Ruby Valley Basic Hospital | Jwalamukhi Rural Eye Center |
| 2 | Semjong Health Post | Gangajamuna Rural Eye Center |
| 3 | Mahadevbeshi Health Post | Khaniyabas Rural Eye Center |
| 4 | Thangsingtar Hospital | Gajuri Urban Eye Clinic |
| 5 | Sankhu Health Post | Mahankal Rural Eye Center |

**DEMOGRAPHICS**

**Gender wise distribution of participants**

The majority of participants in this study were female, comprising 624 individuals (62.4%), while 376 participants (37.6%) were male.

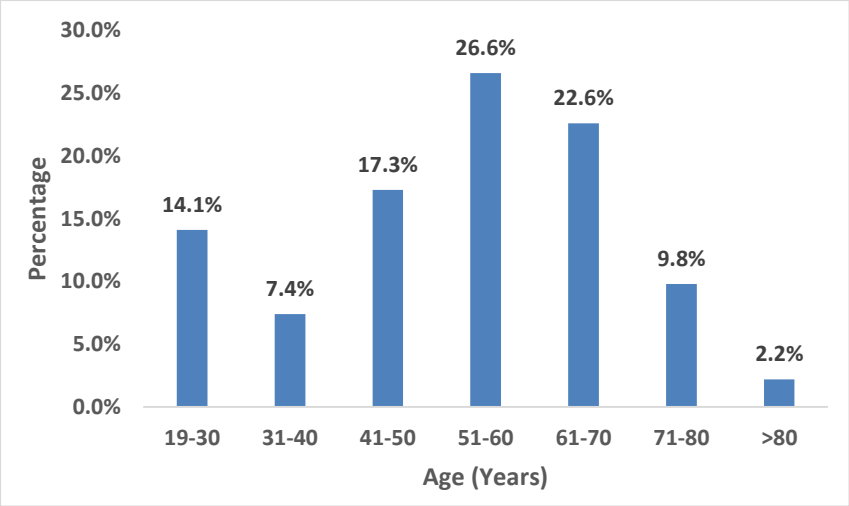
**Figure 1: Gender wise distribution of participants**




**Age wise distribution of participants:**

Among the study participants, mean age ± SD of the age was 53.2 ± 15.9 years, ranged from 19 to 95 years. 266 (26.6%) belonged to the age group of 51 to 60 years, followed by 226 (22.6%) in the 61 to 70 age group. A smaller proportion, 22 participants (2.2%), were aged 81 years and older.

**Figure 2: Age wise distribution of participants**




**Other demographic profile of participants:**

In terms of literacy, more than half of the participants, 536 (53.6%), were literate. Among them, 223 (41.6%) had completed secondary education. Regarding employment, 304 participants (30.4%) were employed, and farming was the primary occupation for 507 individuals (50. 7%). Religious affiliation revealed that approximately half of the participants, 499 (49.9%), identified as Hindu, while 418 (41.8%) followed Buddhism.

**Table 1: Other demographic profile of participants**

| Description | Frequency | Percentage |
|---|---|---|
| **Education** | | |
| Illiterate | 464 | 46.4 |
| Primary | 171 | 31.9 |
| Secondary | 223 | 41.6 |
| Bachelor | 51 | 9.51 |
| Masters | 13 | 2.4 |
| Informal | 78 | 14.5 |
| **Employment Status** | | |
| Not employed | 696 | 69.6 |
| Employed | 304 | 30.4 |
| **Occupation** | | |
| Unemployed/ student/ other | 121 | 12.1 |
| Subsistence farming | 507 | 50.7 |
| Commercial farming | 1 | .1 |
| Market/ stall vendor | 31 | 3.1 |
| Domestic work | 181 | 18.1 |
| Casual labour | 24 | 2.4 |
| Government worker | 77 | 7.7 |
| Professional | 29 | 2.9 |
| Other | 29 | 2.9 |
| **Religion** | | |
| Hinduism | 499 | 49.9 |
| Buddhism | 418 | 41.8 |
| Christian | 82 | 8.2 |
| Muslim | 1 | 0.1 |

## OCULAR HISTORY OF STUDY PARTICIPANTS

### Chief complaint of study participants

Out of 1000 participants, 916 (91.6%) complained of blurring of vision followed by 42 (4.2%) were asymptomatic and only 1 (0.1%) complained of loss of vision.

**Table 2: Ocular history of participants**

| Chief complaint | Frequency | Percent |
|---|---|---|
| Blurred vision | 916 | 91.6 |
| Eye fatigue | 3 | .3 |
| Eye pain / Sore eyes | 2 | .2 |
| Loss of vision | 1 | .1 |
| Others | 36 | 3.6 |
| None | 42 | 4.2 |

**Previous history of eye checkup:**

Out of the 585 (58.5%) participants who underwent eye checkup previously, 309 (30.9%) visited to clinic, and 206 (20.6%) visited to hospital. About 33 (5.6%) participants travelled even more than 10 hours (>600 minute) for eye checkup whereas few number of participants i.e 6 (1%) spent more than Rs 5000 for eye checkup.

**Figure 3: Description of previous eye checkup (n=1000)**

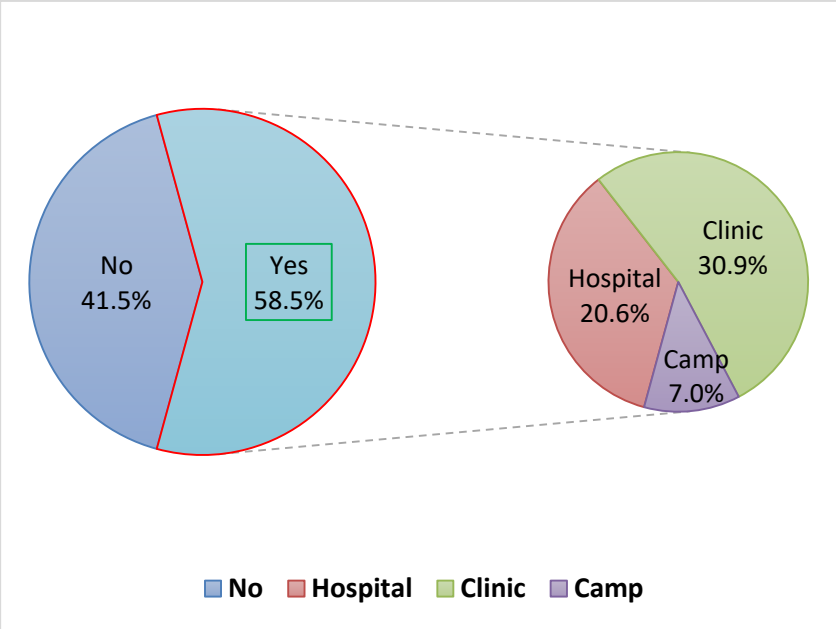


Table 3: Travel time and travel cost during previous eye checkup

| Travel time (minutes) to reach previous health service center n=585 | | |
|---|---|---|
| | **n** | **%** |
| 1-30 | 196 | 33.5 |
| 30-120 | 144 | 24.6 |
| 120-600 | 210 | 35.8 |
| >600 | 33 | 5.6 |
| Do not know | 2 | 0.3 |
| **Travel cost (NPR) to reach previous health service center n=585** | | |
| 0 | 143 | 24.4 |
| 10-50 | 43 | 7.3 |
| 51-100 | 9 | 1.5 |
| 101-500 | 204 | 34.8 |
| 501-1000 | 104 | 17.7 |
| 1001-5000 | 72 | 12.3 |
| >5000 | 6 | 1.0 |
| Do not know | 4 | 0.6 |

**Spectacle usage history of participants:**

About 122 (12.2%) participants were spectacle users, among them more than half of participants 70 (57.3%) used distance correction, 17 (13.9%) used near correction whereas 35 (28.7%) used both distance and near correction.

**Table 4:Spectacle history of participants**

| Did the patient wear spectacles on site? | | |
|---|---|---|
| | **n** | **%** |
| Yes | 122 | 12.2 |
| No | 878 | 87.8 |
| **Type of Spectacles Used n=122** | | |
| | Frequency | Percent |
| Distance correction | 70 | 57.3 |
| Both distance and near correction | 35 | 28.7 |
| Near correction | 17 | 13.9 |

**Systemic history of participants**

A total of 52 (5.2%) participants had some type of systemic illness in which most of the participants were hypertensive 39 (75.0%), followed by diabetic 17 (32.7%) and very few 4 (7.7%) had thyroid dysfunction.

**Table 5: Systemic history of participants**

| Systemic illness | Frequency | Percent |
|---|---|---|
| Yes | 52 | 5.2 |
| No | 948 | 94.8 |
| **Types of Disorder (multiple response) n=52** | | |
| Abnormal lipids (Cholesterol) | 5 | 9.6 |
| Thyroid | 4 | 7.7 |
| Diabetes | 17 | 32.7 |
| Hypertension | 39 | 75.0 |

## VISUAL ACUITY EXAMINATION

### Presenting visual acuity of study participants

In both the spectacle user group and non-user group, majority of participants had presenting vision worse than 6/9 in both the eyes.

**Table 6:Presenting visual acuity (PVA) of participants**

| Presenting Visual Acuity | Spectacle wearing participants n=122 | Non spectacle wearing participants n=878 | Total |
|---|---|---|---|
| | Number (%) | Number (%) | Number (%) |
| 6/6 | 5 (2) | 30 (1.7) | 35 (1.8) |
| 6/9 | 10 (4.1) | 65 (3.7) | 75 (3.8) |
| 6/12 | 156 (63.9) | 594 (33.8) | 750 (37.5) |
| 6/18 | 53 (21.7) | 550 (31.3) | 603 (30.2) |
| 6/24 | 13 (5.3) | 266 (15.1) | 279 (14) |
| 6/36 | 5 (2) | 144 (8.2) | 149 (7.5) |
| 6/60 | 2 (0.8) | 104 (5.9) | 106 (5.3) |
| 3/60 | 0 (0) | 1 (0.1) | 1 (0.1) |
| CF | 0 (0) | 2 (0.1) | 2 (0.1) |
| Total | 244 (100) | 1756 (100) | 2000 (100) |

## Best corrected visual acuity (BCVA) by optometrist refraction

All the participant retained 6/6 or 6/9 visual acuity after subjective refraction by optometrist.

**Table 7: BCVA after refraction by optometrist**

| BCVA | Frequency | Percent |
|---|---|---|
| 6/6 | 1381 | 69.1 |
| 6/9 | 619 | 31.0 |
| Total | 2000 | 100.0 |

**Best corrected visual acuity (BCVA) by Autorefractometer values:**

~~subjective refraction~~ Out of the 2000 eyes tested, 1432 (71.6%) achieved 6/9 or better with the refraction provided by the device i.e no subjective refraction.

**Table 8: BCVA by Autorefractometer values (Eyes)**

| BCVA | Frequency | Percent |
|---|---|---|
| 6/6 | 800 | 40.0 |
| 6/9 | 632 | 31.6 |
| 6/12 | 390 | 19.5 |
| 6/18 | 137 | 6.9 |
| 6/24 | 32 | 1.6 |
| 6/36 | 8 | 0.4 |
| 6/60 | 1 | 0.1 |
| Total | 2000 | 100.0 |

Among 2000 eyes of total participants, 1432 (71.6%, 95% CI: 69.6% to 73.6%) eyes with either 6/6 or 6/9 vision matched from both the autorefractometer values and optometrist refraction.

**Table 9: a Refraction matched Optometrist and Autorefractometer (Eyes)**

| BCVA matched Optometrist and Autorefractometer (Eyes) | Number | Percent (95% CI) |
|---|---|---|
| Matched 6/6 only | 784 | 39.2 (37.2 to 41.5) |
| Matched 6/9 only | 250 | 12.8 (11.0 to 13.9) |
| Matched Overall (6/6 to 6/9) | 1432 | 71.6 (69.6 to 73.6) |

CI: Confidence Interval, BCVA: Best Corrected Visual Acuity

| BCVA matched Optometrist and Auto-refractometer (Eyes) | Eye related filed workers | | Allied medical personnel | |
|---|---|---|---|---|
| | Count | Percent (95% CI) | Count | Percent (95% CI) |
| Matched 6/6 only | 276 | 27.6 (22.3 - 32.9) | 508 | 50.8 (46.5 - 55.1) |
| Matched 6/9 only | 137 | 13.7 (7.9 - 19.5) | 113 | 11.3 (5.5 - 17.1) |
| Matched Overall (6/6 or 6/9) | 645 | 64.5 (60.8 - 68.2) | 787 | 78.7 (75.8 - 81.6) |

CI: Confidence Interval, BCVA: Best Corrected Visual Acuity

This table shows the visual acuity agreement measurements between an optometrist (a gold standard) and an auto refractometer operated by two different groups; eye-related field workers (e.g., ophthalmic assistants) and allied health personnel. The overall agreement on BCVA between the optometrist and auto-refractometer readings operated by eye health worker (within the 6/6 or 6/9 range) was higher compared to allied health personnel at 78.7% (95% CI: 75.8–81.6), compared to 64.5% (95% CI: 60.8–68.2).

Table 10: Spherical equivalent agreement optometrist versus autorefractometer

| Single Measures | ICC | 95% CI | P value |
|---|---|---|---|
| Total | 0.85 | 0.76 to 0.90 | <0.001 |
| Eye related Personnel | 0.82 | 0.63 to 0.89 | <0.001 |
| Allied medical personnel | 0.90 | 0.86 to 0.92 | <0.001 |

The agreement indicated by the Intraclass Correlation Coefficient (ICC) was 0.85 (95% CI: 0.76 to 0.90), signifying substantial accuracy with p <0.001. The Infraclass correlation in Eye related Personnel and Allied medical personnel were 0.82 (95% CI: 0.63 to 0.89) and 0.9 (95% CI: 0.86 to 0.92) respectively. The results indicated a strong agreement between the device and the optometrist, showing autorefractometer accuracy in quantifying spherical equivalent.

Table 11: Difference (Spherical Equivalent)

| Category | Negative | | Positive | | Total | | Cumulate percent |
|---|---|---|---|---|---|---|---|
| | Number | % | Number | % | Number | % | |
| Matched | | | | | 390 | 19.5 | 13.5 |
| Within 0.25 | 298 | 23.5 | 211 | 45.4 | 509 | 25.5 | 38.9 |
| >0.25 to 0.5 | 303 | 23.9 | 132 | 28.4 | 435 | 21.8 | 60.7 |
| >0.5 to 1 | 413 | 32.6 | 90 | 19.4 | 503 | 25.2 | 85.8 |
| >1 | 252 | 19.9 | 32 | 6.9 | 284 | 14.2 | 100.0 |
| Total | 1266 | 100 | 465 | 100 | 2000 | 100 | |

**Difference = Optometrist-Auto refractometer, Spherical Equivalent = Sph+(Cyl/2)**

The table shows the differences in spherical equivalent measurements obtained from an optometrist and auto-refractometer. Almost 20% of the spherical equivalent value of eyes were totally matched, 38.9% were within ± 0.25D, 60.7% were within ±0.5 D and 85.8% were within ±1D. Fourteen percent of the spherical equivalent value of eyes were more than ±1D.

Table 12: Differences in Spherical Equivalent Between Eye-Related Job Holders and allied medical personnel

| | Eye related personnel | Allied medical personnel | p value |
|---|---|---|---|

| SE difference by optometrist and Auto refractometer | Number | Percent | Number | Percent | |
|---|---|---|---|---|---|
| **Matched** | 79 | 7.9 | 190 | 19.0 | <0.001 |
| **Within 0.25** | 206 | 20.6 | 303 | 30.3 | |
| **>0.25 to 0.5** | 208 | 20.8 | 227 | 22.7 | |
| **>0.5 to 1** | 292 | 29.2 | 211 | 21.1 | |
| **>1** | 215 | 21.5 | 69 | 6.9 | |
| **Total** | 1000 | 100 | 1000 | 100.0 | |

The table shows the differences in spherical equivalent measurements obtained from an optometrist and auto-refractometer between eye health experts and allied medical personnel. Nineteen percent of the difference was matched in health worker whereas it was just 7.9% matched in eye health worker. The proportion of the difference of Spherical equivalent in both eye health related individual and other health personnel is statistically different, $p<0.001$.

**Acceptability**

A significant majority of participants reported positive feedback throughout the 10 questionnaires, choosing agree or strongly agree about the PlenOptika *QuickSee Free* was satisfied to use. Ninety-eight percent of respondents were overall satisfied with the service and 1.7% were neutral. Significant acceptance was found on the clarity of information about the test and equipment, the comfort of the equipment, acceptable waiting and testing times, confidence in the test results, and overall satisfaction with the service. A significant proportion of participants reported their willingness to share the service to others. The overall findings show consistent and significant acceptance of the service among participants.

**Table 13: Statement related to the acceptability and satisfaction of the equipment**

| Statement | Strongly Agree, n (%) | Agree, n (%) | Neutral, n (%) | Disagree, n (%) | Strongly disagree, n (%) |
|---|---|---|---|---|---|
| I came in because I heard that eye testing is available | 735(73.5) | 170(17.0) | 10(1.0) | 10(1.0) | 75(7.5) |
| I came in to get something from the pharmacy and saw the availability to have an eye test | 308(30.8) | 239(23.9) | 204(20.4) | 40(4.0) | 209(20.9) |

| | | | | | |
|---|---|---|---|---|---|
| I was provided good information about what would happen during the test | 517(51.7) | 464(46.4) | 19(1.9) | - | - |
| I was provided good information about the equipment used during the test | 502(50.2) | 480(48.0) | 18(1.8) | - | - |
| The equipment used was comfortable | 505(50.5) | 465(46.5) | 28(2.8) | 2(.2) | - |
| The time I waited before speaking to the provider was acceptable | 508(50.8) | 462(46.2) | 30(3.0) | - | - |
| The time taken to carry out the test was acceptable | 513(51.3) | 459(45.9) | 28(2.8) | - | - |
| I am confident about the test result | 547(54.7) | 433(43.3) | 20(2.0) | - | - |
| I will tell other about the service available | 627(62.7) | 358(35.8) | 15(1.5) | - | - |
| **Overall I am satisfied with the service** | **555(55.5)** | **428(42.8)** | **17(1.7)** | - | - |

**Description of journey of participating in the study**

Of the 1000 participants surveyed, 539 (53.9%) indicated that they attended the eye checkup alone. The remaining 461 (46.1%) were accompanied by either family members, relatives, friends, or neighbors.

**Table 14:** Companion during the journey of eye checkup

**Description of journey following the eye checkup**

| Description | Frequency | Percentage |
|---|---|---|
| Accompanied by family member | 216 | 21.6 |
| Accompanied by friend | 194 | 19.4 |
| Accompanied by relative | 47 | 4.7 |
| Accompanied by neighbor | 4 | .4 |
| Accompanied by none | 539 | 53.9 |

**Travel time from home to study site:**

Majority of the participants i.e. 679 (67.9%) had to travel less than 30 minutes to reach the site of study while only 1(0.1%) participant had to travel for more than 10 hours. Regarding the cost to reach the study site, most of the participants i.e 875(87.5%) didn't pay any cost while 23 (2.3%) participants paid between Rs 100-500.

Table 15: Travel time and cost to reach the study site

| **Travel time from home to study site** | | |
|---|---|---|
| | **Frequency** | **Percent** |
| 0-30 minutes | 679 | 67.9 |
| 30 minutes to 2 hour | 289 | 28.9 |
| 2 hour to 10 hours | 31 | 3.1 |
| More than 10 hours | 1 | .1 |
| **Travel cost from home to study site (NPR)** | | |
| 0 | 875 | 87.5 |
| 10-50 | 89 | 8.9 |
| 60-100 | 13 | 1.3 |
| 100-500 | 23 | 2.3 |

**Alternate health service center preference and cost to reach sites**

The majority of participants 793(79.3%), indicated a preference for hospitals as their alternative site for eye checkups. A small percentage 39 (3.9%), did not express a preference. Only 17 (1.7%) of participants chose an alternative site within 0.1 to 1 km, while 212 (21.2%) opted for a site more than 120 km away. Regarding the cost of reaching the alternative site, over half of the participants, 570 (57.0%), indicated a cost of up to Rs 500. Only 10 (1%) of the sites had a cost exceeding Rs 5000 to reach.

**Table 16: Alternate site preference, distance and cost**

| **Alternate site for eye checkup** | | |
|---|---|---|
| Hospital | 793 | 79.3 |
| Clinic | 168 | 16.8 |

| | | |
|---|---|---|
| Don’t Know | 39 | 3.9 |
| Total | 1000 | 100.0 |
| **Alternate site distance in km** | | |
| Don’t know | 265 | 26.5 |
| 0.1-1 | 17 | 1.7 |
| >1-10 | 38 | 3.8 |
| 11-30 | 56 | 5.6 |
| 31-60 | 217 | 21.7 |
| 61-120 | 195 | 19.5 |
| >120 | 212 | 21.2 |
| **Travel cost of alternate site (NPR)** | | |
| Don’t know | 42 | 4.2 |
| 0 | 22 | 2.2 |
| 1-500 | 570 | 57.0 |
| 501-1000 | 261 | 26.1 |
| 1001-5000 | 95 | 9.5 |
| >5000 | 10 | 1.0 |

**Spectacle compliance:**

Of the total enrolled 1000 participants, 540 (54%) participants had previously undergone eye checkups. Among them 420 (77.8%) were prescribed spectacles. Among spectacle prescribed, 369 (87.9%) procured it, while 51 (12.1%) did not make spectacles due to perceived unnecessity, social stigma, or financial constraints.

Regarding the cost of spectacles, nearly half of the participants, 197 (53.3%), reported a cost of up to Rs 1500, while only 18 (4.8%) reported a cost exceeding Rs 3000.

Among the participants who procured spectacles, approximately one-third, 122 (33.1%), were consistently using them. However, more than half, 247 (66.9%), were not using the spectacles due to various reasons, including breakage, financial constraints, inaccessibility, cosmetic concerns, and lack of awareness.

**Table 17: Spectacle compliance**

| **Previous eye check up** | | |
|---|---|---|
| **Category** | **Number** | **Percent** |

| | | |
|---|---|---|
| Yes | 540 | 54.0 |
| No | 460 | 46.0 |
| **If yes, spectacles prescribed (n=540)** | | |
| Yes | 420 | 77.8 |
| No | 165 | 30.6 |
| **If prescribed, made spectacles (n=420)** | | |
| Yes | 369 | 87.9 |
| No | 51 | 12.1 |
| **Reason for not making Spectacles (n=51)** | | |
| Financial Reason | 7 | 13.7 |
| Not felt necessary | 28 | 54.9 |
| Not accessible | 6 | 11.8 |
| Social stigma | 9 | 17.6 |
| Others | 1 | 2 |
| **If spectacles made, its cost (n=369)** | | |
| Don't know | 4 | 1.1 |
| 0 | 25 | 6.8 |
| 1-1500 | 197 | 53.3 |
| 1501-3000 | 125 | 33.8 |
| >3000 | 18 | 4.8 |
| Total | 369 | 100.0 |
| **If spectacles made, use it (n=369)** | | |
| Yes | 122 | 33.1 |
| No | 247 | 66.9 |
| **Reason for not using Spectacle (n=247)** | | |
| Financial Reason | 2 | 0.8 |
| Not accessible | 2 | 0.8 |
| Not comfortable | 58 | 23.4 |
| Cosmetic blemish | 9 | 3.6 |
| Broken | 117 | 47.3 |
| Not aware of the need to use | 32 | 13 |
| Social stigma | 20 | 8 |
| Others | 7 | 2.8 |

**Service Provider Perspective:**

Table 18:Demographic information of service provider (n=14)

| Variables | Number | Percent |
|---|---|---|
| **Age in Years, (Mean ± sd = 25.6 ± 2.9)** | | |
| 21 to 25 | 7 | 50.0 |
| 26 to 32 | 7 | 50.0 |

| | | |
|---|---|---|
| **Gender** | | |
| Male | 3 | 21.4 |
| Female | 11 | 78.6 |
| **District** | | |
| Lalitpur | 4 | 28.6 |
| Dhading | 10 | 71.4 |
| **Religion** | | |
| Christian | 2 | 14.3 |
| Buddhist | 1 | 7.1 |
| Hindu | 11 | 78.6 |
| **Education** | | |
| ANM | 1 | 7.1 |
| Bachelor Optometry | 2 | 14.3 |
| Diploma in ophthalmic science | 3 | 21.4 |
| H.A | 6 | 42.9 |
| Proficiency Certificate Level Nursing | 2 | 14.3 |

**HA= Health assistant, ANM= Auxiliary Nurse Midwives**

Among the total service providers, 11 (78.6%) were female while 3 (21.4%) were male. The mean age ± SD was 25.6 ± 2.9 years. Fifty percent of the service providers are aged 21 to 25 years, while the remaining fifty percent are aged 26 to 32 years. A significant proportion of the service providers 10 (71.4%) are located in Dhading district, while the remaining 4 (28.6%) are in Lalitpur district. Eleven (78.6%) of the service providers are Hindu.

## Feasibility

One third (35.7%) of service providers provided the screening and diagnosis of refractive errors with the help of retinoscope before they had access to PlenOptika Autorefractor. The remaining 9 out of 14 i.e 64.3% did not provide the services. Among those who did not provide the services, reason for non-providing screening and diagnosis of refractive error was asked. Among the total barriers, Lack of necessary equipment was 57.1 %, not trained was 35.75 and lack of demand from patients was 7.1%.

Table 19:Feasibility of PlenOptika Autorefractometer to service provider

| **Before access to the PlenOptika Autorefractor, did they provide screening and diagnosis of refractive errors? (n=14)** | | |
|---|---|---|
| **Description** | **Frequency** | **Percentage** |
| Yes (Retinoscopy) | 5 | 35.7 |
| No | 9 | 64.3 |
| **Reason for not providing screening and diagnosis of refractive error n=9 (multiple response)** | | |

| | | |
|---|---|---|
| Not trained to provide screening | 5 | 35.71 |
| No equipment to provide screening | 8 | 57.14 |
| No demand from customers for screening | 1 | 7.14 |

**Quality of the training:**

Approximately 6 (42.9 %) of service providers rated the training provided on PlenOptika as excellent or very good in each group. And followed by minimum proportions 2(14.3%) rated it as good. Regarding the time taken to gain confidence in using the equipment, 5 (35.7%) of service providers reported requiring 1-3 days, while 3 (21.4%) reported needing 5-10 hours and more than a week.

**Table 20:Description of the training received by service providers**

| **Quality of the training** | | |
|---|---|---|
| **Description** | **Frequency** | **Percentage** |
| Excellent | 6 | 42.9 |
| Very good | 6 | 42.9 |
| Good | 2 | 14.3 |
| Total | 14 | 100.0 |
| **Time to get confident to use the equipment** | | |
| 1-5 hours | 1 | 7.1 |
| 5-10 hours | 3 | 21.4 |
| 1-3 days | 5 | 35.7 |
| 3-5 days | 2 | 14.3 |
| More than a week | 3 | 21.4 |
| | 14 | 100.0 |

**Statement regarding the feasibility of the device:t**

When asked whether our health professionals found PlenOptika QuickSee Free easier to use, more than 2/3rd 10(71.4%) strongly agreed. While 6(42.9%) out of 14 strongly agreed followed by 7(50%) when they were asked if they have screened and diagnose quickly and accurately. 2/3rd of the service providers agreed when asked if Autorefractometer made their job skillful, efficient and useful. Overall among 84 responses, 32 (96.9%) were strongly agree, 46 (54.8%) were agreed, while 6 (7.1%) responses were neutral.

Table 21:Statement about feasibility of the device (n=14)

| Statement | strongly agree n(%) | Agree n(%) | Neutral n(%) | Disagree n(%) | Strongly disagree n(%) |
|---|---|---|---|---|---|
| I find the PlenOptika QuickSee easy to use | 10 (71.4%) | 4(28.6%) | - | - | - |
| Using the PlenOptika QuickSee, I find I can screen and diagnose refractive errors quickly. | 6(42.9%) | 7(50%) | 1(7.1%) | - | - |
| Using the PlenOptika QuickSee, I find I can screen and diagnose refractive errors accurately | 2(14.3%) | 9(64.3%) | 3(21.4%) | - | - |
| Using the PlenOptika QuickSee, makes me efficient at screening and diagnosing refractive errors | 4(28.6%) | 9(64.3%) | 1(7.1%) | - | - |
| I find the PlenOptika QuickSee is useful in my job | 3(21.4%) | 10(71.4%) | 1(7.1%) | - | - |
| It was easy for me to become skillful at using the PlenOptika Quicksee. | 7(50%) | 7(50%) | - | - | - |
| **Total (84 Responses)** | 32 (38.1%) | 46 (54.8%) | 6 (7.1%) | - | - |

**Service Utilization:**

Table 22: Patients flow comparison before and during the study

| Study Sites | Number of patient before study (one month) | No of patients during study (one month) | Difference | Increase/Decrease % |
|---|---|---|---|---|
| Khaniyabas Rural Eye Center | 91 | 359 | 268 | 293.1% ↑ |
| Gangajamuna Rural Eye Center | 57 | 310 | 253 | 443.9%↑ |
| Gajuri Urban Eye Clinic | 247 | 563 | 316 | 128.2% ↑ |
| Mahankal Rural Eye Center | 26 | 88 | 62 | 234.2% ↑ |
| Jwalamukhi Rural Eye Center | 83 | 265 | 182 | 218.0% ↑ |
| Shemjong Health Post | 400 | 450 | 50 | 12.5% ↑ |
| Ruby Valley Basic Hospital | 557 | 314 | -243 | 43.6% ↓ |
| Sankhu Health Post | 397 | 325 | -72 | 18.1% ↓ |
| Thangsingtar Hospital | 196 | 176 | -20 | 10.4% ↓ |
| Mahadevbeshi Health Post | 1600 | 850 | -750 | 46.9% ↓ |
| **Total** | **3654** | **3700** | 46 | 1.3% ↑ |

Overall, there was 1.3% increment of patients during the study period compared with record of previous month. Five study sites observed a substantial rise in patient flow, each showing an increase more than 100%. One study site had a modest increase (12.5%) indicating stable patients flow. However, four locations showed a reduction in patient flow, indicating variation across sites.

Table 23: Cost distribution for conducting the study in the field

| Health Post/REC | Room Rent | Electricity | WiFi | Water | Total |
|---|---|---|---|---|---|
| Khaniyabas Rural Eye Center | 3000 | 1000 | 1000 | 0 | 5000 |
| Gangajamuna Rural Eye Center | 3000 | 1000 | 1000 | 0 | 5000 |
| Gajuri Urban Eye Clinic | 7000 | 2000 | 2000 | 500 | 11500 |
| Mahankal Rural Eye Center | 4000 | 1000 | 1000 | 1000 | 7000 |
| Jwalamukhi Rural Eye Center | 12000 | 1000 | 1000 | 1000 | 15000 |
| Shemjong Health Post | 0 | 2000 | 1500 | 300 | 3800 |
| Ruby Valley Basic Hospital | 2000 | 1000 | 1000 | 0 | 4000 |
| Sankhu Health Post | 4000 | 500 | 1000 | 250 | 5750 |
| Thangsingtar Hospital | 3000 | 500 | 1000 | 500 | 5000 |
| Mahadevbeshi Health Post | 0 | 2000 | 1000 | 600 | 3600 |

This table 23 shows the financial requirement at various study sites during the field word in a month. The cost includes room rent, electricity, WiFi, and water in each study site. The total cost ranges from NPR 3600 to NPR 15000 per month.

**Benefits of this approach for increasing eye health seeking behavior.**

Table 24: Number of distance spectacles distribution in study sites

| Study sites | Spectacles Distributed |
|---|---|
| Khaniyabas Rural Eye Center | 73 |
| Gangajamuna Rural Eye Center | 43 |
| Gajuri Urban Eye Clinic | 84 |
| Mahankal Rural Eye Center | 68 |
| Jwalamukhi Rural Eye Center | 100 |
| Shemjong Health Post | 79 |
| Ruby Valley Basic Hospital | 93 |
| Sankhu Health Post | 31 |
| Thangsingtar Hospital | 100 |
| Mahadevbeshi Health Post | 60 |
| **Total** | **731** |

A total of 731 distance spectacles were distributed across the 10 study sites ranging from 31 to 100 spectacles per site. The distribution was relatively balanced, with the highest number of spectacles distributed at Jwalamukhi REC (100 spectacles) and Thangsingtar Hospital (100 spectacles), and the lowest was at Sankhu Health Post (31 spectacles).

This approach showed several benefits for increasing eye health-seeking behavior during the study period.

**Immediate Impact:** Many study participants got instant vision improvement and felt happy.

**Increased Awareness:** Spectacles distribution along with such program in the community helped to raise awareness on the importance of eye health.

**Trust Building:** Such accessible services have built trust in the local community level. They encourage for the follow up of this service and work.

**Preventive Eye Health Behavior:** Once people experience the improved vision easily in their community, they refer others too for the eye health care as well.

**Key points observed according to Objectives:**

**To assess the accuracy of screening by primary care and basic health services personnel using the chosen technology**

- The overall agreement on BCVA (within the 6/6 or 6/9 range) between the optometrist (as a gold standard) and auto-refractometer readings was 71.6% (95% CI: 69.6% to 73.6%).
- This agreement operated by eye health worker was higher compared to allied health personnel at 78.7% (95% CI: 75.8–81.6), compared to 64.5% (95% CI: 60.8–68.2), which was statistically significant. P<0.001.
- 71.6% (95% CI: 69.6% to 73.6%) eyes with either 6/6 or 6/9 vision matched from both the optometry and auto refractometer refraction values.

**To understand the experiences of using the technology by primary care and basic health services including the patient's willingness to undertake screening and the interventions that can help to ensure task reallocation is feasible and provides quality screening and diagnosis of refractive errors**

- Ninety-three percent of the service providers were agreed that the PlenOptika QuickSee is feasible to use while 7% were neutral.
- All service providers were agreed that the device is easy to use.

**To assess the acceptability of the technology and task reallocation by providers and patients including the uptake of screening and referral**

- Ninety-eight percent of respondents were overall satisfied with the service and 1.7% were neutral
- Ninety-seven percent of respondents were overall agreed that the device was comfortable, 2.8% were neutral and 0.2% were disagreed.
- Ninety-eight percent of respondents were confident about the device results.
- Ninety-eight percent of respondents said they will tell other people about this service available.

**To understand the cost implications of task reallocation from trained optometrists to trained non-traditional workers in pharmacies and health workers in primary healthcare settings.**

- Approximately 9% of participants paid a travel cost ranging from NPR 10 to NPR 50, while 1.3% paid up to NPR 100, and 2.3% spent travel expenses between NPR 100 to NPR 500 to access the services.
- The total cost of room rent, electricity, wifi, water to run this project in the study sites ranges from NPR 3600 to NPR 15000 per month.

**To assess the increase in utilization of services through this approach**

- Overall, there was 1.3% increment of patients during the study period compared with record of previous month.
- Five study sites observed a substantial rise in patient flow, each showing an increase more than 100%.

**To understand the benefits of this approach for increasing eye health seeking behavior.**

- A total of 731 distance spectacles were distributed across the 10 study sites ranging from 31 to 100 spectacles per site.

- Ninety-eight percent of respondents said they will tell other people about this service available.

**To assess the spectacle compliance among study participants**

- People who had previously been prescribed spectacles, around 12% did not make them.
- Among the people who made spectacles, more than 65% did not use them.

## Chapter 4: DISCUSSION

This study was conducted to explore technology and task reallocation to improve access to quality refractive error services in 10 different rural municipalities of Dhading and Lalitpur districts of Bagmati province. In this study the number of male and female participation was 38% and 62% respectively. The highest number of participants belonged to the age group of

51-60 years and more than half of participants 53.6% were literate, with 41.6% completing secondary education. A total of 30.4% participants were employed with maximum participants having farming as their major occupation. By religion 49.9% of participants were Hindu followed by 41.8% Buddhist.

Out of 1000 participants, 91.6% had blurring of vision as their chief complain whereas 4.2% were asymptomatic. A totally different finding was reported by a school based screening conducted by Dhulikhel hospital where only 2.5% of children reported blurring of vision.(15) The reason behind such difference could be study population where only children of age 5-19 years were included in Dhulikhel hospital study but in task reallocation study, all the participant were above 18 years old.

**Previous history of eye checkup:**

Out of the 58.5% participants who underwent eye check-up previously, 30.9% visited clinic, and 20.6% visited hospital. About 5.6% participants had travelled even more than 10 hours (>600 minute) for eye checkup whereas 1% spent more than Rs 5000 for eye checkup.
A similar kind of result was reported by a community school adolescents based study where 47.3% of participants had history of utilization of eye health services previously.(16) About half proportion of the participants in both the study didn't underwent for eye checkup previously due to lack of availability of eye service nearby and cost related to eye services.

**Systemic history of participants**

A total of 52(5.2%) participants had some type of systemic illness in which most of the participants were hypertensive 39(3.9%), followed by diabetes17(1.7%) and raised cholesterol 5(0.5%) and very few 4(0.4%) had thyroid dysfunction. The findings differed from the study that was carried out in Nepal, which found that 25.2% of people in Bagmati province had hypertension, 4.1% were diabetic, 8.2% had raised cholesterol level.(16) The lower prevalence level in this study may be due to the fact that this study was conducted in rural area where most of the participant were engaged in agriculture sector resulting in healthy active lifestyle.

**Visual acuity of study participants**

About 57% of study participants had presenting visual acuity worse than 6/12 in combining both the spectacle user and non-spectacle user group. Prevalence of vision worse than 6/12 in Bagmati province was 15% according to a RAAB survey.(17) The findings of RAAB survey

differed from this study as the main inclusion criteria was involvement of participant with vision worse than 6/9.

In subjective refraction with AR values ,71.6 % of eyes retained visual acuity of 6/9 or better than that while during subjective refraction by optometrist all of them retained visual acuity 6/9 or better than that.

**Accuracy**

In the study, 784 eyes with 6/6 vision and 250 eyes with 6/9 vision were among the 71.6% of eyes with matched visual acuity from both QS refraction and optometrist refraction. Dave et al(10) observed a strong agreement between the prescriptions from SR and AR, and eyeglasses prescribed using SR (50.5 %) and AR (49.5%) were equally preferred by patients. Wider use of prescribing based on AR alone in resource-limited settings was supported by these findings. The agreement indicated by the Intraclass Correlation Coefficient (ICC) was 0.843 (95% CI: 0.719 to 0.901), signifying substantial accuracy with $p < 0.001$. The results indicated a strong agreement between the device and the optometrist, showing autorefractometer accuracy in quantifying spherical equivalent.

**Acceptability**

The finding of our study shows 92.8% acceptability of the participants in all the aspect of task reallocation from qualified optometrist to health service provider regarding the use of PlenOptika QuickSee Free autorefractometer. Similarly, in Australian based study of evaluation of cost and wait time of a task sharing model of care for diabetic eye care, there was improved access and reduced cost due to better task allocation through greater utilisation of primary eye care professionals to provide services for low-risk patients. Likewise, Kengne et al(7) reported task-shifting from physicians to NPHWs, if accompanied by health system re-structuring is a potentially effective and affordable strategy for improving access to healthcare for NCDs.

**Feasibility:**

All the respondents were feasible about the training and uses of the device PlenOptika QuickSee Free autorefractometer for screening and diagnosis of refractive error.

Use of autorefractometer can significantly abate both travel time and cost for refractive error screening, particularly in remote areas. With the help of basic health services and primary care personnel, such device can enhance the accessibility for the screening. long distance travel

and expenses can also be minimized, resulting this technology as a cost-effective solution for improving access to refractive error screening.

**Spectacle compliance:**

Total of 540 participants who underwent eye checkup previously, majority of them 42.0% were prescribed spectacles and most of them 36.9% made spectacles as prescribed. On the other hand, 5.1% did not make spectacles because they didn't felt necessary or due to social stigma or financial reasons.

Out of the patients who made spectacles about 12.2% of them were using spectacles but more than half 24.7% of the patients did not use spectacles because of reasons such as spectacles broken, financial reason, inaccessibility, cosmetic blemish and ignorance.

There are multiple reasons for not being compliant with spectacles wear even after having the spectacle ~~which was~~ prescribed which was similar in the Dahbi et al(18) study, participants reported various reasons for not adhering to the recommended use of spectacles, with the most common being forgetfulness, perceiving improved vision without spectacle, discomfort while wearing spectacle, difficulty adapting to spectacle, and loss of spectacle.

**Limitation**

This study was conducted in some specific places of two districts: Dhading and Lalitpur only, which may not represent the entire population. The device maintenance issue was not explored in this study that may also have impact on the service delivery.

## CHAPTER 5 CONCLUSION

Autorefractometer showed highly accurate measurement of Spherical Equivalent. Additionally, acceptance and the practicality of auto-refractometer technology were also found very high. This indicated that basic health services as well as primary care staff can use this technology to screen for refractive error. The willingness to participate and positive responses regarding this technology indicated that non eye health professional can proficiently engage in these tasks, which may ultimately improve service utilization and eye health-seeking behavior. The research indicated that PlenOptika autorefractometer enhances ocular health and service accessibility in primary care, especially in remote regions.

Also, more than 1 out of 10 people do not make spectacles even when prescribed. Additionally, more than two-thirds of those who make spectacle do not use them. The three main reasons for not wearing glasses were broken, not feeling comfortable and ignorance.

## CHAPTER 6 RECOMMENDATION

**Positive:**

1. This task-shifting approach found to be feasible, accurate and reliable and no need eye health specialist to use. This method is more applicable in rural areas, specially where refractive error screening is challenging.
2. Enhance community engagement is crucial to make it popular in remote areas where refractive error treatment or screening is hard.
3. If the device will be affordable, some non-eye health personnel can use it for the refractive error screening in a small health post. This method is beneficial for income generation without extra burden to the service provider

**Challenges:**

1. The cost of the device is very high and hard to afford to purchase in many places in Nepal.
2. Another challenge is maintenance of the device. If the device need any replacement or maintenance, it has to be sent to abroad, which seems not feasible to all. However, this issue is common in new medical devices in Nepal, since there are no any local service centres or maintenance experts available.

Overall,

this task-shifting approach seems feasible, reliable, accurate, and suitable for rural areas especially where refractive error screening is challenging. However, the cost of the device, maintenance issue and replication challenges makes it difficult in the areas like Nepal.

## CHAPTER 7 REFERENCES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## CHAPTER 8 ANNEX

**Fig: bland Altman Plot OF Spherical Equivalent between Optometrist value and Panoptical value**

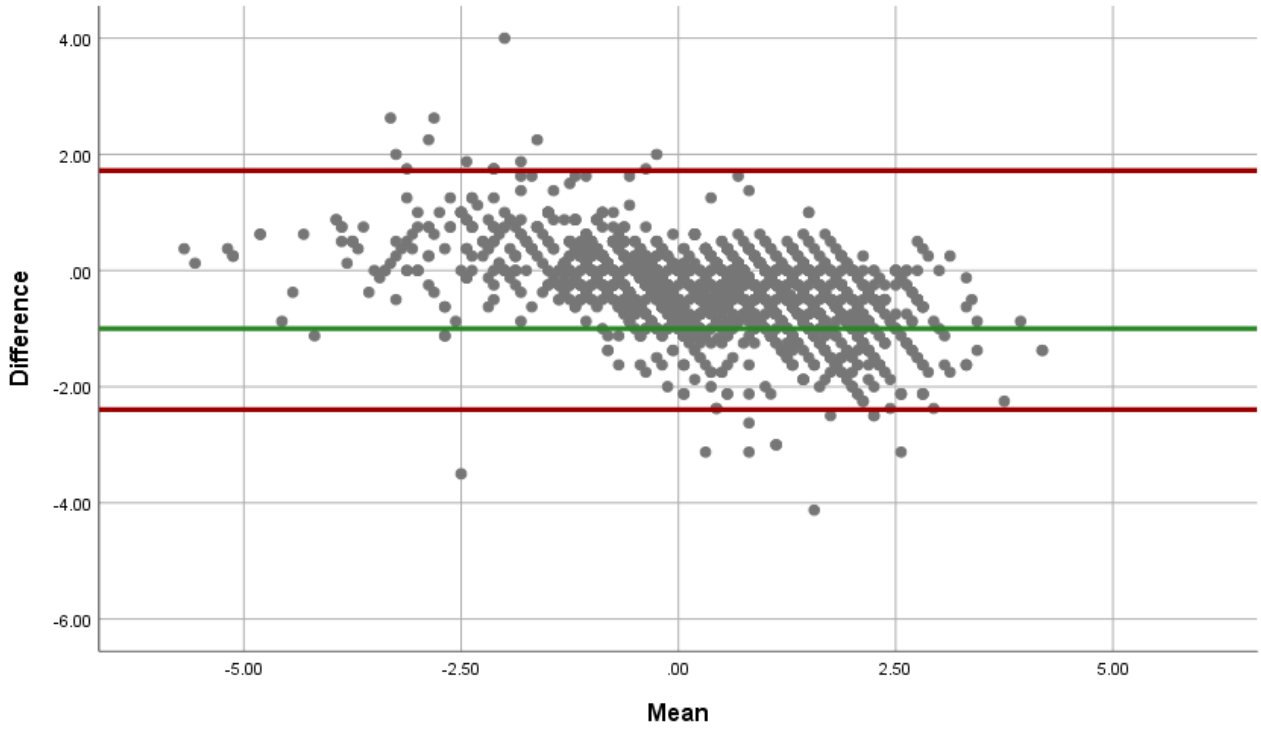
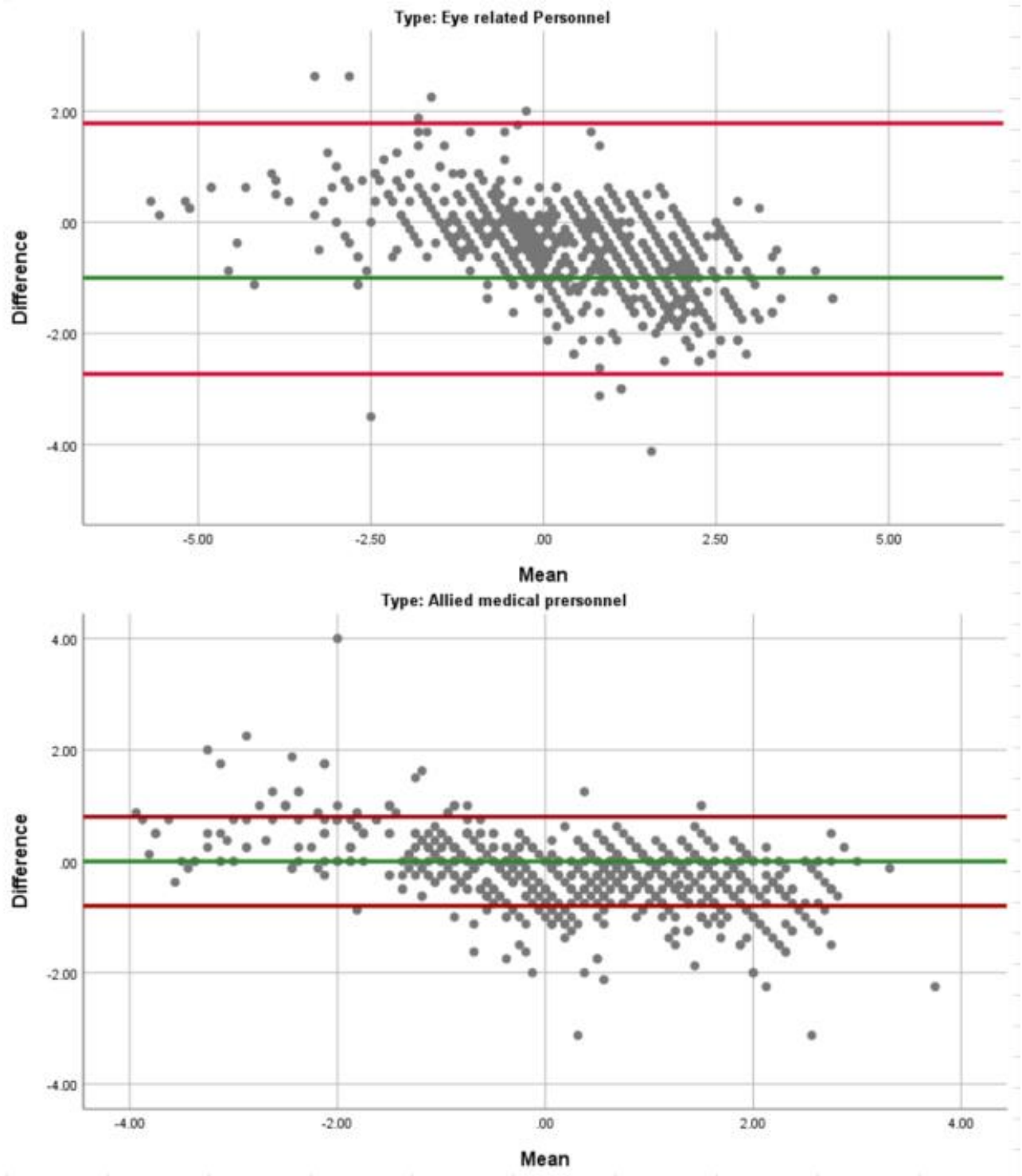


**Fig: bland Altman Plot OF Spherical Equivalent between Optometrist value and Panoptical value**



## QUESTIONNAIRE FORM

**PROFORMA (PATIENT DATA)**

**Nepal Eye Program**

**Tilganga Institute of Ophthalmology**

Gaushala, Kathmandu

**Research Department**

**Assessment of Accuracy, Feasibility, Acceptability and Cost Implications for Enhancing Access to Refractive Error Services through Technology and task reallocation in Lalitpur and Dhading district in Nepal**

*Trained Service provider (Eye health worker/ Basic health worker)*

*Optometrist*

***Demographic Information:***

1.S.N: _____ 2. Date: _____

3.Name of health Centre: _____

4.Address of health Centre: _____

5.Name: _____ 6.Age: _____

7.Gender: Male Female

8.Address: _____ 9.Education: _____

10.Religion: _____ 11.Occupation: _____

12.Contact number: _____

**13.HISTORY**

| Chief complaint | Yes | No | Duration |
|---|---|---|---|
| DOV for distance | | | |
| DOV for near | | | |
| Headache | | | |

| | | | |
|---|---|---|---|
| **Dizziness** | | | |
| **Itching** | | | |
| **Photophobia** | | | |
| **Squinting of eye** | | | |
| **Others, specify** | | | |

## 14.Visual acuity

| **Visual acuity** | **OD** | **OS** |
|---|---|---|
| **Uncorrected distance visual acuity(UCVA)** | | |
| **Presenting distance visual acuity(PVA)** | | |
| **Pinhole** | | |
| **Uncorrected Near (UCNVA)** | | |
| **Presenting Near (PNVA)** | | |

## 15.Objective Findings:

| OD | | | | OS | | |
|---|---|---|---|---|---|---|
| Method | SPH | CYL | AXIS | SPH | CYL | AXIS |
| Autorefraction | | | | | | |
| Retinoscopy | | | | | | |

## 16.Subjective Findings

| | SPH | CYL | AXIS | BCDVA | ADD | BCNVA |
|---|---|---|---|---|---|---|
| OD | | | | | | |
| OS | | | | | | |

**17.**Others eye findings(Specify): _____

**18**. Previous History of Eye testing Yes No

If yes,

**18.1**. Where you examined your eye? _____

**18.2**. How much time does it take to go for eye examination? _____

**18.3.** How much cost does it take to go for eye examination? _____

**19.** Spectacles Prescribed: Yes No

If yes,

**19.1**.Did you make spectacles as prescribed? Yes No

**19.2.** How much cost does it take to make spectacles as prescribed? _____

**19.3**. Are you using spectacles? Yes No

**19.3.1** If no, reason for not making spectacles

i. financial reason
ii. Not felt necessary
iii. Isn't Accessible
iv. Social Stigma
v. Others……..

**19.3.2** If no, reason for not using spectacles

i. Financial reason
ii. Not accessible
iii. Not comfortable
iv. Cosmetic blemish
v. Broken (Repair cost, provider cost, far to reach, Travel cost, busy, not required, eye examination cost, spectacle cost, any others)
vi. Forget at home
vii. Social stigma
viii. Others specify ……

**Provider side(Feasibility)**
**Nepal Eye Program**
**Tilganga Institute of Ophthalmology**
Gaushala, Kathmandu

**Research Department**

Thank you for agreeing to answer this questionnaire. It should take about 5-10 minutes to complete. In this survey you will be asked to rate your experience of using the PlenOptika QuickSee autorefractor to screen and diagnose refractive errors in patients.

***Demographic Information:***

1.S.N: _____ 2.Date: _____

3.Name of health Centre: _____

4.Address of health Centre: _____

5.Name: _____ 6.Age: _____

7.Gender: M F

8.Address: _____

9.Education: _____

10.Religion: _____

11.Occupation: _____

12.Contact No: _____

13. Designation: _____

14.Before you had access to the PlenOptika Autorefractor, did you provide screening and diagnosis of refractive errors? [YES/NO]

14.1 If YES, what equipment did you previously use to screen and diagnose refractive errors? _____

14.2 If NO, why did you not?

1. Not trained to provide screening.
2. No equipment to provide screening.
3. No demand from customers for screening.
4. Other, specify_____

15.Were you provided training on how to use PlenOptika QuickSee to screen for refractive errors? [YES/NO]

16.How do you rate the quality of the training you received?

1. Excellent
2. Very Good
3. Good
4. Fair
5. Poor

17.How long did it take to get confident with using the equipment?

1. 1-5 hours
2. 5-10 hours
3. 1-3 days
4. 3-5 days
5. More than a week

18.For the following, please indicate how strongly you agree with the statement: [for each a checkbox for, strongly agree, agree, neutral, disagree, strongly disagree]

| S.no | Question | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|---|
| 1 | I find the PlenOptika QuickSee easy to use | | | | | |
| 2 | Using the PlenOptika QuickSee, I find I can screen and diagnose refractive errors quickly. | | | | | |
| 3 | Using the PlenOptika QuickSee, I find I can screen and diagnose refractive errors accurately | | | | | |
| 4 | Using the PlenOptika QuickSee, makes me efficient at screening and diagnosing refractive errors | | | | | |
| 5 | I find the PlenOptika QuickSee is useful in my job | | | | | |
| 6 | It was easy for me to become skillful at using the PlenOptika Quicksee. | | | | | |

19. Do you have any additional comments about using the PlenOptika QuickSee to screen and diagnose refractive errors? _____

**Patient acceptability**

**Nepal Eye Program**
**Tilganga Institute of Ophthalmology**
Gaushala, Kathmandu

**Research Department**

***Demographic Information:***

1.S.N:_____ 2.Date:_____

3.Name:_____ 4.Age: _____

5.Gender: M F

6.Address:_____

7.Education:_____

8.Occupation: _____

9.Religion: _____

10.For the following, please indicate how strongly you agree with the statement: [for each a checkbox for, strongly agree, agree, neutral, disagree, strongly disagree]

| S.N. | Question | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|---|
| 1 | I came in because I heard that eye testing is available | | | | | |
| 2 | I came in to get something from the pharmacy and saw the availability to have an eye test | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3 | I was provided good information about what would happen during the test | | | | | |
| 4 | I was provided good information about the equipment used during the test | | | | | |
| 5 | The equipment used was comfortable | | | | | |
| 6 | The time I waited before speaking to the provider was acceptable | | | | | |
| 7 | The time taken to carry out the test was acceptable | | | | | |
| 8 | I am confident about the test result | | | | | |
| 9 | Overall I am satisfied with the service | | | | | |
| 10 | I will tell others about the service available | | | | | |

11.The following questions are about your journey today.

11.1Did anyone else come with you to have your eyes tested? YES/NO

11.2If YES, what is their relationship to you? _____

11.3 Did you have to pay to have your eyes tested? YES/NO

11.4 If YES, how much did you pay? _____

11.5 How much time did it take to travel from your home to the clinic to have your eyes tested? _____

11.6 How much did it cost you to travel from your home to the clinic (one way)?

_____

11.7 If you could not get your eyes tested here, where would you have to travel to get your eyes tested?

Location _____

Distance one way _____

Cost to travel (one way) _____

Government of Nepal

# Nepal Health Research Council (NHRC)

Estd. 1991

Ref. No.: 804

**11 December 2023**

**Dr. Raba Thapa**

Principal Investigator

Tilganga Institute of Ophthalmology, Kathmandu, Nepal

**Ref: Approval of research protocol**

**Dear Dr. Thapa,**

This is to certify that the following protocol and related documents have been reviewed and granted approval through the expedited review process for its implementation.

| | | | |
|---|---|---|---|
| **Protocol Registration No/ Submitted Date** | 491/2023<br>29 July 2023 | **Sponsor Protocol No** | NA |
| **Principal Investigator/s** | Dr. Raba Thapa | **Sponsor Institution** | The Fred Hollows Foundation, Australia |
| **Title** | Assessment of Accuracy, Feasibility, Acceptability and Cost Implications for Enhancing Access to Refractive Error Services through Technology and task reallocation in Lalitpur and Dhading district in Nepal | | |
| **Protocol Version No** | NA | **Version Date** | NA |
| **Other Documents** | 1. Data collection tools<br>2. Informed Consent Form<br>3. Support letter<br>4. Sponsor agreement letter<br>5. Declaration letter<br>6. Role and responsibilities<br>7. Ethics training certificate<br>8. Work plan | **Risk Category** | Minimal risk |
| **Co-Investigator/s** | 1. Purushottam Dhungana<br>2. Manish Poudel<br>3. Pratibha Neupane<br>4. Pradeep Banjara<br>5. Ravi Gautam<br>6. Nabin Kumar Rai<br>7. Mohan Krishna Shrestha<br>8. Amanda Davis<br>9. Suit May Ho<br>10. Reshma Dabideen | | |
| **Study Site** | Lalitpur and Dhading district in Nepal | | |

Tel: +977 1 4254220, Ramshah Path, PO Box: 7626, Kathmandu, Nepal
Website: http://www.nhrc.gov.np, E-mail: nhrc@nhrc.gov.np

Government of Nepal

# Nepal Health Research Council (NHRC)

Estd. 1991

Ref. No.: 804

| | | | | |
|---|---|---|---|---|
| **Type of Review** | √ | **Expedited** | **Timeline of study**<br>11 December 2023 to June 2024<br>**Duration of Approval**<br>11 December 2023 to 10 December 2024<br>**This approval will be valid for one year** | **Frequency of continuing review**<br>NA |
| | | Full Board | | |
| | **Review Date:** 11 December 2023 | | | |
| **Total budget of research** | **NRs 1,06,01,000.00** | | | |
| **Ethical review processing fee** | **NRs 3,18,030.00** | | | |

**Investigator Responsibilities**

- If you do not start the project within 3 months of this letter, please contact the Ethical Review M & E Section at NHRC
- Any amendments shall be approved from the ERB before implementing them
- Submit progress report every 6 months
- Submit final report after completion of protocol procedures at the study site
- Comply with all relevant international and NHRC guidelines
- Abide by the principles of Good Clinical Practice and ethical conduct of the research

If you have any questions, please contact the Ethical Review M & E Section at NHRC.

**Thanking you,**

**Dr. Pradip Gyanwali**
**Member Secretary**

Tel: +977 1 4254220, Ramshah Path, PO Box: 7626, Kathmandu, Nepal
Website: http://www.nhrc.gov.np, E-mail: nhrc@nhrc.gov.np