

Near Vision Spectacle Coverage and Associated Factors Among Adults Living in Finote Selam Town, Northwest Ethiopia: Community-Based Cross-Sectional Study

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Background: Near visual impairment leads to difficulty with near tasks at a working distance (40 centimeters) when near visual acuity is 6/12 (N8) or worse. High cost is the main barrier reported for low near vision spectacle coverage.

Objective: This study aimed to determine near vision spectacle coverage and associated factors among adults living in Finote Selam town, Northwest Ethiopia.

Methods: A community-based, cross-sectional study was applied from June 3 to 25, 2019. A total of 565 study participants aged ≥ 35 years were recruited using a systematic random sampling technique. A pre-tested questionnaire with adequate physical examination was used for data collection. The data were entered into EPI INFO software and exported to a statistical package for science for analysis. Mean (standard), frequencies, tables, and figures were used to present descriptive statistics. A bi-variable and multivariable logistic regression was used to determine the association between independent variables and outcome variable with a *P*-value of less than 0.20 and a *P*-value of less than 0.05, respectively. Odds ratios and a 95% confidence interval were used to show strength of association.

Results: A total of 549 adults participated, with a response rate of 97.20% and a mean age of 46.4 ± 8.7 years. The near vision spectacle coverage was 156 (28.42%; 95% CI=24.65–32.31). Higher education level (AOR=2.8; 95% CI=1.21–5.21), history of eye examination (AOR=2.40; 95% CI=1.51–3.81), awareness about near vision problems (AOR=2.12; 95% CI=1.41–3.24), and need of a high plus lens (AOR=4.21; 95% CI=2.41–7.39) were associated with near vision spectacle coverage.

Conclusion: Near vision spectacle coverage was low among adults living in Finote Selam town. Higher educational level, history of eye examination, awareness about near vision problems, and need of a high plus lens were associated with near vision spectacle coverage.

Keywords: near vision spectacle coverage, near visual impairment, Finote Selam, Ethiopia

Introduction

Near visual impairment (NVI) is defined as difficulty with near tasks at a working distance (40 centimeters) when near visual acuity (NVA) is 6/12 (N8) or worse.¹ Presbyopia, which is an age-related reduction in accommodation due to inelasticity of the lens, accounts for most of the causes of near visual impairment in adults.^{2,3} NVI is said to be correctable when it is possible to have the best-corrected binocular near visual acuity (NVA) greater than 6/12 (N8), and uncorrectable when best-corrected

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binocular NVA is $\leq 6/12$.⁴ Old age, female sex, educational status, low income, unaware of near vision problem, and absence of eye checkup practice are identified associated factors with near visual impairment.^{5,6} According to the reports of the World Health Organization (WHO), a total of 2.2 billion people are visually impaired or blind, among which more than 80% were preventable and more than 90% are found in developing countries.⁷ More than 1.8 billion people are living with presbyopia worldwide and the global unmet need/without spectacle correction is 45%, which indicates that most of the near visual impairment burden is from presbyopia.⁸ This causes more than 25.4 billion-dollars of economic loss globally.⁹ More than 50% of those aged greater than 50 years are from developing countries, where lack of awareness and controlling the problem are challenges due to economical constraints and the scarcity of eye care professionals.^{4,9–11} A report of the world economic forum indicated that 23% of employees compromised their work due to the effect of NVI and the unavailability of near vision correction.¹² The proportion of near visual impairment reaches from 61.7% to 85.4% in East Africa, including Ethiopia.¹³

A multi-country prospective study done in China, Nepal, India, Niger, South Africa, and the US showed low prevalence of near vision spectacle coverage.¹⁴ Near vision spectacle coverage varies from 0.7% in a study done in rural China¹⁵ to 99.5% in a study done in the US.² Most of the governmental and non-governmental work activities are based on near and intermediate working distances which rely on the usage of near corrections. Furthermore, fishing, swing, and preying are potential areas that are expected to benefit from the use of near corrections.¹⁶

Uncorrected near visual impairment affects day-to-day activities performed at near/intermediate distances and vision-related quality of lives.^{2,4,17} Correction of near vision problems is an important positive factor to motivate adult workers, especially in low- and middle-income countries.¹² Awareness to burden of near vision problems and economical status of the study areas mainly affects the coverage of near vision correction. High cost is the main barrier reported for low correction coverage (unmet need) for near vision. The average cost for near spectacles (single vision, bifocal, or progressive) in Ghana is \$5.8, and in Ethiopia the willingness-to-pay for spectacles is about \$17.9.¹⁶

A global action plan in 2014–2019 adopted by WHO plans to reduce the burden of visual impairment by 25%

by the year 2019 using different approaches and correction mechanisms.¹⁸ Most of the near visual impairment is corrected by wearing reading eyeglasses as prescribed by Optometrists/Ophthalmologists.^{2,10} Besides, monovision contact lenses (one eye for distance and one for near), bifocal and multifocal contact lenses, accommodative intraocular lenses, and refractive surgery were other options of correction mechanisms.^{11,19}

Most studies done in different areas including Ethiopia focused on distance visual impairment, and near visual impairment was reported as presbyopia, though they are not interchangeable, rather presbyopia is a major cause of NVI. There is a paucity of information on near vision spectacle coverage in Ethiopia as a whole and the absence of published studies even showing the proportion of NVI in the study area. Therefore, this study aims to determine near vision spectacle coverage (NVSC) and its associated factors among adults aged 35 years and above living in Finote Selam town Northwest Ethiopia.

Materials and Methods

Study Design, Method, and Setting

A community-based, cross-sectional study was conducted from June 3 to 25, 2019 in Finote Selam town Northwest Ethiopia. The town has 6123 households and six kebeles (smallest administrative unit). It has two hospitals and five private clinics with only a one room ophthalmic clinic in the general hospital.

Study Population, Inclusion and Exclusion Criteria

All adult population aged 35 years and above living in Finote Selam town during the data collection period were the study population and those adults living in the town for at least the last 6 months were included in the study. Adults who were severely ill and unable to communicate were excluded from the study.

Sample Size Determination and Techniques

A single population proportion formula was used to calculate the minimum sample size required to carry out this study by taking the proportion from a similar study done in Ethiopia as 30.8%²⁰ and using the assumptions of 95% confidence interval and 4% margin of error.

$$n = \frac{(Z_{\alpha/2})^2 P(1 - P)}{d^2}$$

where; n = sample size,

Z = z statistic at 95% confidence interval = 1.96,

P = Proportion of near vision spectacle coverage among adults = 30.8%, and

d = Maximum allowable error (marginal error) 4% = 0.04.

$$\text{Sample size}(n) = \frac{(1.96)^2 0.308(1 - 0.308)}{0.04^2} = 512$$

After considering a 10% non-response rate the final sample size was calculated as 565.

The study participants were selected by using a systematic random sampling procedure after calculating the interval K by dividing the total households in the town to the sample size. Lottery method was used to select the first household that was used as a starting point of the study and every K^{th} household were included to the study. Study participants were selected with the assumption that each household contains one adult and, in houses which had more than one adult, a lottery method was applied to select one participant per household. Next households were taken when there were no adults aged ≥ 35 years in the selected households.

Operational Definitions

Near vision spectacle coverage (%) was determined as: $100(\text{the total number of participants with current near vision spectacle})/(\text{total number of participants with current near vision correction} + \text{total number of participants without near vision corrections})$.

Presbyopia correction coverage (PCC %) was determined as: $100(n \text{ with presbyopia need met})/(n \text{ with presbyopia need unmet})$.

Met need includes persons with functional presbyopia and had spectacles that allowed near vision to improve to 20/50 (N8) or better.²⁰

Unmet need includes those with near vision 20/50 (N8) or worse due to functional presbyopia who did not have near-vision corrective spectacles but which can be corrected to N8 or better.

Awareness of near vision problems was defined as having ever heard of age-related near vision problems (presbyopia).⁵

Alcohol consumption was measured as yes or no. Participants who drinks more than three units of alcohol

(a single unit is 300 mL) in day or most days of a week were considered as an alcohol drinker.²¹

Near visual impairment was defined as difficulty of reading ability at a working distance (40 cm) or uncorrected near visual acuity/habitual near VA of $\leq N8$ at 40 cm (6/12).^{1,3,14}

Presenting near visual impairment (PNVI) was defined based on the updated International Classification of Diseases ICD 11 as presenting near visual acuity worse than 6/12.^{3,22}

NVI was graded as “mild” when PNVA was less than 6/12 to 6/18 (worse than N8 to N10), “moderate” when PNVA was less than 6/18 to 6/60 (worse than N10 to N18), and “severe” when PNVA was less than 6/60 (worse than N18).^{5,15}

Functional presbyopia was defined as binocular near vision less than N8 (20/50) at 40 cm with presenting distance refractive correction, to achieve a near visual acuity (VA) criterion (≥ 1 line of acuity improvement N8 print or (20/50)).^{6,23}

Data Collection Instruments and Procedures

The data collection tool was developed after reviewing different works of literature^{3,4,6,20,23} across the world and adapted accordingly in a way that can measure the study area. The data were collected by eight BSc holder qualified optometrists under two supervisors. Both interobserver and intraobserver agreement were determined between optometrists with respect to visual acuity measurement and refraction. Advanced training was given to data collectors and a pilot study was carried out in a nearby town using similar ophthalmic instruments. First, a face-to-face semi-structured interview was applied using socio-demographic, socio-economic, behavioral, and awareness parts of the questionnaire to know the presence of spectacle coverage and different factors associated with NVI. After completing the interview, physical examination was carried out using distance and near vision charts, torches, trial sets, and streak retinoscopy. The reliability of the questionnaire was assessed by using Cronbach alpha which was 0.78. Initially, the distance unaided presenting visual acuity UPVA (for those who presented with no previous correction) and habitual presenting visual acuity HPVA (for those who presented with previous spectacle correction) were taken to estimate the status of distance vision using a reduced 3 meters illiterate-E chart (tumbling E). Binocular near visual acuity (NVA), both with

and without refraction, was measured at 40 cm using a Tumbling E chart under normal room illumination to diagnose the level of NVI. Visual acuity (VA) was recorded as the smallest/last line read with one or no letter miss. Participants with distance presenting/habitual VA of less than 6/12 were refracted using a Retinoscope and near refraction was done on the top of distance correction.^{15,24} Near refraction was done for all adults whose near visual acuity was $\leq$ N8 using plus lens. Near add was determined by adding plus lenses on the trial frame in a step of +0.25 (+0.25, +0.50, +0.75, and so on) diopters until the participants report “no change” to their near visual acuity at 40 centimeters. Participants whose near vision was corrected to the level of N8 or better were given a formal spectacle prescription and participants with other ocular disorders were referred accordingly.

Data Quality Assurance

The questionnaire was first formatted in English and then translated to local Amharic language and back to English by professional language experts to keep consistency. A pretest was done using 56 (10%) adults in Burie town to measure the coherency, understandability, and cultural acceptance of the questions, and modifications were made accordingly. The data collectors and supervisors were given training for 1 day before data collection. A daily based checkup and correction were done by the supervisors and the principal investigator.

Data Processing and Analysis

After appropriate checking, editing, and coding, the collected data were entered into EPI info version 7 software and exported to statistical package for social sciences (SPSS) for formal analysis. The descriptive statistics were presented using mean (standard deviation), frequencies, percentages, tables, and figures. All variables in a bi-variable logistic regression with a *P*-value of <0.20 were entered into a multivariable logistic regression to control confounding effect. A *P*-value of <0.05 in multivariable logistic regression was used to decide statistical significance between independent variables and NVSC. Adjusted odds ratio and 95% confidence level were used to show the strength of association between independent variables and NVSC.

Ethical Issues

Ethical clearance was obtained from the University of Gondar, College of Medicine and Health Sciences ethical review committee in accordance with the Declaration of

Helsinki. After stating the objective of the study, formal written informed consent was obtained from each study participant. To maintain the confidentiality, names and other identifiers were not collected. Appropriate advice was given to the participants about the nature of eye problems diagnosed.

Results

Socio-Demographic Characteristics

There were 549 study participants with a response rate of 97.20% and a mean age of 46.4 ± 8.7 years. The majority 296 (53.92%) of the study participants were males and only 145 (26.42%) of the participants were getting a monthly income of ≥ 142 USD. Most of the participants (451, 82.15%) were married and slightly more than one-third (207, 37.70%) of the participants were in the age group 35–46 years (Table 1).

Behavioral and Vision-Related Factors

More than half (351, 63.94%) of the participants had no awareness of near vision-related problems/presbyopia and more than two-thirds (382, 69.58%) of the participants had no history of eye examination in the past year. Nearly half (177, 43.17%) of the participants needed from +2.25 Diopters to +2.75 Diopters lenses to correct their near vision and only 81 (14.75%) of them had their distance spectacle correction. The main challenge to wearing near correction was the high cost of spectacles in 232 (42.26%) (Table 2).

Near Visual Impairment and Its Spectacle Correction Coverage

The present study confirmed that the overall near vision spectacle coverage among adults living in Finote Selam town was 156 (28.42%; 95% CI=24.65–32.31). A total of 432 (78.69%) study participants had NVI. Almost all (410, 94.91%) of the NVI cases were correctable (presbyopia) and 22 (4.76%) of them were non-correctable conditions. Nearly half (220, 50.93%) of the participants had mild NVI, followed by moderate NVI (143, 33.10%) (Figure 1). Furthermore, the “met need” for presbyopia was 156 (38.05%; 95% CI=33.48–42.84).

Factors Associated with Near Vision Spectacle Coverage

After checking all independent variables in bi-variable logistic regression, those having a *P*-value of less than

Table 1 Sociodemographic Characteristics of Study Participants Living in Finote Selam Town Northwest, Ethiopia, 2019

Variables	Frequency	Percentage (%)
Age (in years)		
35–46	207	37.70
47–57	189	34.43
58–65	89	16.21
≥66	64	11.66
Sex		
Male	296	53.92
Female	253	46.08
Residence		
Urban	451	82.15
Rural	98	17.85
Educational level		
Unable to read and write	85	15.49
Primary school	109	19.85
Secondary school	206	37.52
College/university	149	27.14
Marital status		
Married	451	82.15
Unmarried	98	17.85
Monthly income (USD)		
23–57	77	14.03
58–104	139	25.31
105–141	188	34.24
≥142	145	26.42
Occupation		
Retired	91	16.58
Employed	182	33.16
Merchant	138	25.12
Farmer	89	16.21
Others*	49	8.93

Note: *Others = weaver, laborer, wood/metal worker.

0.20 including sex, age group, monthly income, alcohol drink, educational level, history of an eye examination, awareness of near vision problems, residence, degree of NVI, amount of near addition needed, and presence of distance correction were entered to multivariable logistic regression.

After controlling the effect for confounders in multivariable logistic regression, having a college/university education (AOR=2.8; 95% CI=1.21, 5.21), history of eye checkup/examination (AOR=2.40; 95% CI=1.51–3.81), having awareness about near vision problems (AOR=2.12; 95% CI=1.41–3.24), and need of high plus lens for near correction (AOR=4.21; 95% CI=2.41–7.39)

Table 2 Behavioral and Vision-Related Characteristics of the Study Participants Living in Finote Selam Town, Northwest, Ethiopia, 2019

Variables	Frequency	Percentage (%)
Awareness of near vision problems/presbyopia		
Yes	198	36.06
No	351	63.94
Presence of difficulties in near activities		
Yes	432	78.69
No	117	21.31
Presence of spectacle to alleviate near vision problems (n=432)		
Yes	156	36.11
No	276	63.89
Reason for unavailability of near vision spectacle (n=276)		
High cost	116	42.03
Unavailability	87	31.52
Fear of stigma from others	31	11.23
Discomfort from weight	42	15.22
The place where glasses were collected (n=156)		
Wayside/street	86	55.13
Formal workshops	57	36.54
Eye clinics/hospital	13	8.33
Family ocular history spectacle		
Yes	104	18.94
No	445	81.06
History of an eye examination/check-up		
Yes	167	30.42
No	382	69.58
Cigarette smoking		
Yes	42	7.65
No	507	92.35
Alcohol drinking		
Yes	142	28.87
No	407	74.13
Use of health insurance		
Yes	102	18.58
No	447	81.42
Presence of distance spectacle correction		
Yes	81	14.75
No	468	85.25

(Continued)

Table 2 (Continued).

Variables	Frequency	Percentage (%)
Degree of NVI (n=432)		
Mild	228	52.78
Moderate	131	30.32
Severe	73	16.90
Amount of plus adds needed to correct near vision (n=410)		
+1.00 to +2.00	132	32.20
+2.25 to +2.50	177	43.17
≥+2.75	101	24.63

Abbreviations: NVI, near visual impairment; USD, United States Dollars.

were significantly associated with near vision spectacle coverage with 95% CI and a *P*-value of less than 0.05 (Table 3).

Discussion

This community-based, cross-sectional study was conducted to determine the near vision spectacle coverage and possible risk factors associated with it among adults living in Finote Selam town, Northwest Ethiopia. The near vision spectacle coverage was found to be 156 (28.42%; 95% CI=24.65–32.31) among adults aged 35 years and

above. This result is similar to a study done in India where the near spectacle coverage was reported as 30%.²⁵ This might be due to similarities in the mean age of study participants and the criteria used in the studies. The result of the present study is higher than a similar study conducted in rural China (0.70%).¹⁵ The present near vision spectacle coverage is lower as compared with other similar studies reported in Ghana (70.40%),²⁶ North China (51.50%),²³ and the US (99.5%).³ This might be due to variations in study setting, study population, and socio-economic conditions between study areas.

The met need for presbyopia was also determined as 156 (38.05%; 95% CI=33.48–42.84) in adults aged 35 years and older in Finote Selam town, which is in line with a study reported in Ghana.⁶ The met need in this study is higher than studies done in Bahir Dar, Ethiopia (30.8%),²⁰ Ghana (30.4%),²⁶ and India (30.00%).²⁵ On the contrary, this result is lower than studies conducted in Hawassa, Ethiopia,⁵ and Nigeria,²⁷ which were 48.74% and 63.6%, respectively. This might be due to the differences in the study population because studies done in Hawassa and Nigeria include only school teachers.

Low near vision spectacle coverage in this study is due to high cost of a spectacle lens (232, 42.26%) followed by the unavailability of optical workshops (141, 25.68%). This is

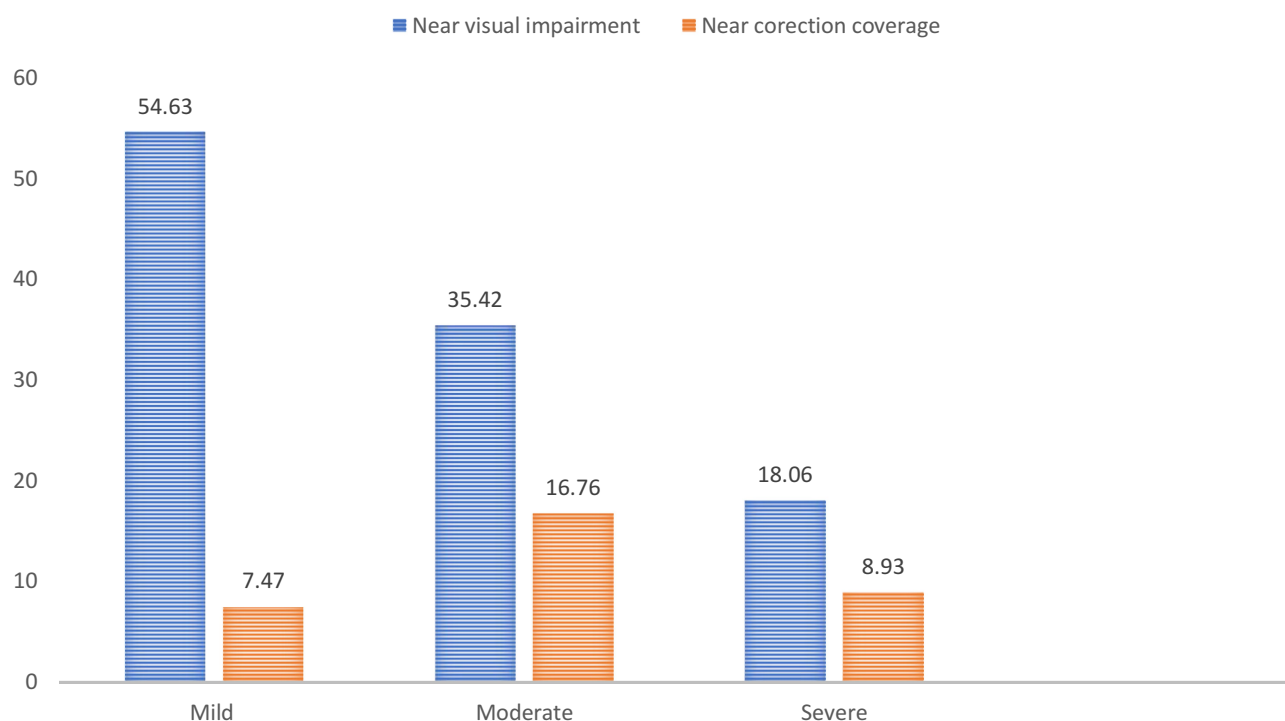


Figure 1 Degree of visual impairment and its near vision spectacle coverage among study participants living in Finote Selam town, Northwest Ethiopia, 2019.

Table 3 Factors Associated with Near Vision Spectacle Coverage Among Adults Living in Finote Selam Town, Northwest Ethiopia, 2019

Variables	Near Vision Spectacle Coverage			
	Yes	No	COR (95% CI)	AOR (95% CI)
Sex				
Male	92	204	1.00	
Female	64	189	1.32 (0.92–1.94)	
Age group				
35–46	50	157	1.00	
47–57	65	124	0.61 (0.39–0.94)	
58–65	27	62	0.73 (0.43–1.51)	
≥66	14	50	1.14 (0.58–2.23)	
Monthly income				
850–2100	20	57	1.00	
2101–3850	54	85	0.55 (0.30–1.02)	
3851–5230	52	136	0.92 (0.50–1.67)	
≥5231	32	113	1.24 (0.65–2.36)	
Educational level				
Unable to read and write	20	65	1.00	
Primary school	40	69	0.53 (0.28–1.01)	
Secondary school	78	128	0.51 (0.34–1.22)	
College/university	18	131	2.24 (1.12–4.52)	2.80 (1.21–5.21)**
Alcohol drink				
Yes	37	105	1.00	
No	119	288	0.85 (0.55–1.31)	
History of an eye examination				
Yes	27	140	2.64 (1.87–4.12)	2.40 (1.51–3.81)***
No	129	253	1.00	
Residence				
Urban	135	315	0.63 (0.37–1.01)	
Rural	21	78	1.00	
Awareness of near vision problems				
Yes	38	160	2.23 (1.38–3.31)	2.12 (1.41–3.24)*
No	118	233	1.00	
Degree of NVI				
Mild	81	147	1.00	
Moderate	43	88	1.13 (0.72–1.77)	
Severe	32	41	0.71 (0.41–1.21)	
Amount of plus add needed (n=410)				
+1.00 to +2.00	64	68	1.00	
+2.25 to +2.50	75	102	1.28 (0.81–2.01)	
≥+2.75	17	84	4.65 (2.51–8.67)	4.21 (2.41–7.39)***
Occupation				
Unemployed	58	128	1.00	
Employed	98	265	1.01 (0.68–1.50)	

Notes: *P-value<0.05, **P-value<0.01, ***P-value<0.001.

supported by a study done in Ethiopia¹⁶ and China.¹⁵ The possible explanation could be due to optical workshops and eye care centers only being available in big cities, which might contribute to the inaccessibility and low spectacle coverage for those with near vision problems.

This research also identified different factors that were significantly associated with near vision spectacle coverage. Participants who needed a $\geq +2.75$ Diopter lens for near add were 4.21-times more likely to have near vision spectacle correction as compared to those who needed a +1.00 to +2.00 Diopter lens. This is in agreement with a study done in China.²³ The possible explanation could be due to participants who need a high amount of plus lens (near add) having moderate–severe near visual problems that may challenge them to perform their near activities. This might obligate adults to collect glasses to resolve their near vision problems.⁴

In agreement with studies done in Ethiopia,²⁰ adult participants who had a history of eye checkup were 2.40-times more likely to afford near vision spectacle correction than those who had no eye checkup history. This could be due to those participants who had a history of eye check-up previously might get supporting information and health education for the eye problems including near vision spectacle correction options that could motivate them to collect their spectacle corrections.¹²

The odds of having near vision spectacle correction were 2.16-times more likely among adults who were aware about near vision problems as compared to others who had no awareness.

Having awareness about near vision problems might lead the participants to search for and read more materials which could in turn encourage them to decide to wear near corrections. Lack of awareness of near vision impairment and place of refraction service was a major factor for uncovered near vision problems.²³ Health promotion activities including education might also increase the awareness about spectacle need of adults with near visual impairment.⁶

Furthermore, in agreement with a study in China,²⁸ participants having college/university education were 2.80-times more likely to have near vision spectacle correction as compared to those having no education. Participants who have a higher level of education could access many sources of information and knowledge about near vision problems²⁹ which might contribute to eye checkup practices including near vision refraction. In addition, educated persons spend most of their time in near work activities, which might obligate them to use near vision spectacles to perform their tasks efficiently, as compared to illiterates.

Limitation

Vital documents, including birth certificates, are not practiced well in Ethiopia. Due to this, the study participants were telling their age by guess. This adds a challenge in the inclusion criteria of study participants. Measuring distance refractive error was also a challenge in ambient light conditions, since it affects the visibility of streak movement of the retinoscope. In addition, some of the questions depend on the participants ability to remember in the previous 12 months, which might create a recall bias to the study.

Conclusion

The near vision spectacle coverage was low among adults living in Finote Selam town. The need of high plus lens (add) for near vision correction, having college/university education, history of eye checkup, and awareness about near visual impairment were identified as significant factors for near vision spectacle coverage.

Abbreviations

AOR, adjusted odds ratios; HPVA, habitual presenting visual acuity; NVA, near visual acuity; NVI, near visual impairment; NVSC, near vision spectacle coverage; PNVA, presenting near visual acuity; UPVA, unaided presenting visual acuity; USD, United States Dollars; VA, visual acuity; WHO, World Health Organization.

Data Sharing Statement

The data will be available upon request from the corresponding author.

Consent for Publication

Not applicable.

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Author Contributions

All authors made substantial contributions to the conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed on the journal to which the article will be submitted; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

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Disclosure

We, the authors, declare that we have no competing interests for this study.

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