ISSN: 2457-0400

Impact Factor: 7.675

WORLD JOURNAL OF ADVANCE HEALTHCARE RESEARCH

www.wjahr.com

Volume: 10, Issue: 8

Page N. 163-174

Year: 2026

Original Article

Coden USA: WJAMA3

ASSESSMENT OF VISUAL IMPAIRMENT IN PRIMARY SCHOOL CHILDREN AND EFFECTIVENESS OF SCHOOL VISION SCREENING PROGRAMS IN KARBALA, IRAQ

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Article Received: 30 June 2026 **Article Revised:** 21 July 2026 **Article Published:** 01 Aug. 2026

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DOI: https://doi.org/10.5281/zenodo.21702871

How to cite this Article: Safa Hassan Abd AL-Hussain[1]*, Anwer Hameed Rashid[2], Sakina Abd AL-Hai[2]. (2026). Assessment of Visual Impairment In Primary School Children and Effectiveness of School Vision Screening Programs In Karbala, Iraq. World Journal of Advance Healthcare Research, 10(8), 151–162.

ABSTRACT

Introduction: Visual impairment in children is a significant public health challenge, particularly in low- and middle-income countries where early detection programs are often underdeveloped**. Method:** This study aimed to assess the prevalence and causes of visual impairment among primary school children in Karbala, evaluate the effectiveness of existing school vision screening program, and identify barriers to spectacle use and referral adherence. **Results:** A cross-sectional analytic study was conducted in Karbala Governorate between the 23rd of March and end of April 2025. Prevalence of visual impairment was obtained from Primary Health Care sectors records. For the assessment of parental awareness and obstacles to vision correction, questionnaires were administered to parents of children with reduced vision. A total of 477 children aged 6–12 years were included. **Results:** The prevalence of visual impairment higher in urban (3.7%) than rural (1.23%) children. Refractive errors were the main causes, mainly myopia (33.5%) and astigmatism (28.1%). Spectacle use was significantly higher in urban areas (59.9% vs. 38.9%; p<0.001). Higher Parental education, income, and urban residence were strongly associated with wearing glasses. Wearing glasses were also associated with improvement in academic and psychosocial wellbeing (p<0.001). Urban and male gender was associated with higher screen time (P< 0.019 and 0.038 respectively). Despite 99.5% coverage of school-based screening, referral adherence was limited with only 44.7% completing the referral pathway. Awareness remained low 36.1% of parents recognized the school vision test as structured program, and less than half received reports or educational materials. Still Major barriers to spectacle uptake included child refusal (45.7%) and high cost (33.5%). **Conclusion:** Visual impairment among primary school children in Karbala is relatively low (3.7% in urban and 1.23% in rural), but refractive errors remain the leading cause. School-based screening programs are effective with coverage of 99.5%, yet their impact is weakened by poor referral adherence (44.7%), financial barriers, and limited parental awareness. Strengthening referral systems, subsidizing spectacles, and enhancing communication with families are essential for improving program outcomes. Importantly, consistent use of corrective spectacles also contributes to better academic achievement and psychosocial wellbeing.

KEYWORDS: Visual impairment, primary school children, school vision screening program, Iraq, Karbala City.

INTRODUCTION

Visual impairment (VI) is a condition of reduced visual performance that can or cannot be treated by refractive correction (spectacles or contact lenses) and surgery. Consequently, it results in functional limitations of the visual system that may be characterized by irreversible vision loss, restricted visual field and decreased contrast sensitivity, increased sensitivity to glare as well as decreased ability to perform activities of daily living, such as reading or writing.[1]

Globally, there are around 18.94 million visually impaired children, with 1.42 million of them being blind. The major cause of VI in children is untreated or inappropriately corrected refractive error (RE), accounting for around 12.8 million cases with 90% of children with VI live in low- to middle-income countries (LMICs).[2]

The causes of VI vary depending on the residence location of the examined population (urban versus rural) or the developed, underdeveloped, or developing countries, as well as the prevention strategies within each health system.[3] Uncorrected RE is the most prevalent cause of VI in school-aged children in the Eastern Mediterranean Region. Amblyopia (often known as "lazy eye"), cataracts, and retinal diseases are the next most common causes of VI in this age group.[1]

Refractive error (also called ametropia) is an optical defect in which the eye's refractive system (cornea, lens, eyeball length) fails to focus light correctly on the retina when accommodation is relaxed. As a result, images appear blurred. Myopia, hyperopia, and astigmatism are all types of refractive defects that make images on the retina blurry or out of focus.[4]

In Iraq a 2024 meta-analysis systematically reviewed the prevalence of RE among schoolchildren and confirmed that RE is the leading cause of VI in this population with a prevalence of 27.6% and myopia and astigmatism being the most common subtypes.[5]

Visual impairment has been associated with poor academic performance and mental illness such as depression and anxiety among children, with the strongest associations observed when refractive error remains uncorrected. [6] Identifying affected children in the community is critical. Early diagnosis of affected children reduces the worldwide burden of pediatric VI and improves public health outcomes. Regular check-ups, as well as access to primary, secondary, and tertiary eye care, are critical for preventing avoidable childhood blindness and VI among school-aged children.[7]

Despite the global and regional evidence on childhood visual impairment, there is a lack of studies reporting the prevalence and the effectiveness of vision screening programs in Karbala. This study aims to Assess the prevalence and underlying causes of visual impairment among primary school children in Karbala, evaluate the effectiveness and coverage of school vision screening program implemented in school settings and to Investigate the barriers that hinder the success of pediatric vision care in the region.

PATIENTS AND METHODS

Study Design

A cross-sectional and analytic study

Setting and sample

The study was conducted in Karbala Governorate between the 23rd of March and end of April 2025 to assess the prevalence of visual impairment and evaluate the effectiveness of school vision screening program among primary school children of Karbala.

Sampling Framework

A multistage sampling technique was employed: Karbala is administratively divided into four Primary Health Care (PHC) sectors two central (urban) and two peripheral (rural). One central sector (Al-Markaz sector) and one peripheral sector (Al-husseiniya sector) were randomly selected by simple random sampling to ensure geographical representation.

1-Urban Areas: From the selected central PHC sector (Qata' Al-Markaz), 6 PHC centers were chosen by simple random sampling. From each center two primary schools where chosen by stratified random sampling (one for boys and one for girls) resulting in a total of 12 schools in the urban area.

2-Rural Areas: From the chosen peripheral PHC sector (AL-Husseiniya sector), 3 PHC centers were selected. Similarly, two schools (one for boys and one for girls) were selected per center resulting in totaling 6 rural schools.

From each selected school all visually impaired children were included in the study. The students with VI were identified through school screening records maintained by the PHC centers.

The sample size was calculated using the formula

$$n_{adj} = n/1+(n-1/N)$$

Where n_{adj} = the adjusted sample size

n → Initial sample size (calculated from the basic formula $n = z^2p(1-p)/d^2$).

N → Population size (total number of primary school children in Al-Markez and Al-Hussainiya sectors is≃ 131000)

Therefore, a minimum of 384 children was considered sufficient for the study.

In practice a total of 600 students was included in the research. Those who didn't complete the survey or had special issues regarding the survey were excluded, so the final sample was 477 students with visual impairment were included in the study with a response rate of 79.5%.

Inclusion Criteria

- Primary school children aged 6 to 12 years enrolled in the selected urban and rural schools within the study sectors of Karbala.
- Children who have documented visual impairment as identified by school-based vision screening programs conducted by trained optometrists and PHC staff.

- Children with complete and accessible screening records from the Primary Health Care (PHC) centers.

Exclusion Criteria

- Children with incomplete screening data or those whose records could not be retrieved or verified.

Vision Screening and Data Collection

Vision screening was conducted as part of the routine school health program by trained optometrists and nurses affiliated with the PHC centers. Screening procedures included assessment of visual acuity and identification of any ocular abnormalities. The collected data were used to identify children with visual impairment (defined as presenting visual acuity equal or worse than 6/12 in either eye).

Once identified, these students were provided with a structured questionnaire, this questionnaire was self-made developed based on the International Agency for the Prevention of Blindness (IAPB) School Eye Health Program Guidelines.[8] The tool included items on sociodemographic characteristics, symptoms related to visual impairment, previous diagnosis and use of corrective measures, parental awareness of school-based eye screening, and perceived barriers to spectacle use[9], to be completed by their parents or guardians.

The questionnaire was pretested in a **pilot study** to ensure clarity and feasibility. As no major issues were identified, no modifications were made, the participants in pilot study were included in the main study and the same version was used for data collection in the main study.

Statistical Analysis

Data were entered and analyzed throughout the use of the Statistical Package for the Social sciences (SPSS 23.0 for Windows).

1. Descriptive Statistics

Frequencies and percentages were used to describe categorical variables such as gender and causes of visual impairment.

Means and standard deviations were calculated for continuous variables where applicable, such as age.

2. Comparative Analysis

The Chi-square test (χ^2) was used to examine associations between categorical variables.

3. Statistical Significance

A p-value of ≤ 0.05 was considered statistically significant.

4. Data Presentation

Results were presented in the form of tables and graphs.

5. Data Quality

Double data entry and consistency checks were conducted to minimize data entry errors. Missing data were reported and excluded from analysis on a case-by-case basis unless otherwise stated.

Ethical Considerations

This study received ethical approval from the Arab board of family medicine, Karbala Health Directorate and Karbala Directorate of Education ensuring compliance with ethical standards for research involving human participants. Approval covered both the use of medical screening records and the distribution of questionnaires to parents.

Participation in the study was voluntary. For each student included verbal consent was obtained from their parent or legal guardian, and verbal assent was obtained from the children themselves prior to data collection. Data were used solely for the purposes of this research. Participants were assured of the confidentiality and anonymity of their responses, and no names or identifying information was disclosed in any reports or publications.

RESULTS

The prevalence of VI among primary school children in Karbala was higher in urban areas compared to rural areas. As shown in **Figure 1**, 3.7% of urban children were found to have visual impairment, whereas the prevalence in rural children was only 1.23%.

Coverage of school-based vision screening program was 99.5% in both urban and rural area.

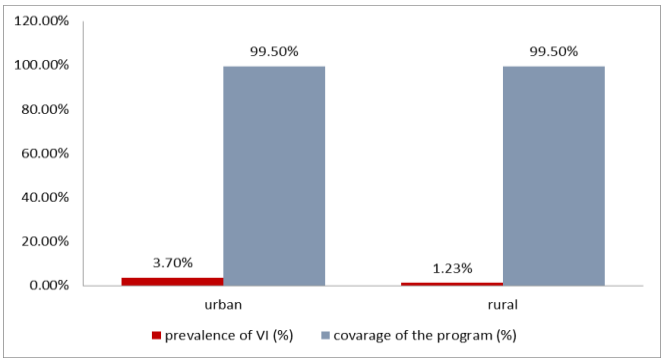

Figure 1: Prevalence of Visual Impairment and Coverage of School Vision Screening Programs by Residency.

The current study included a total of 477 primary school children who are visually impaired in Karbala Province. The mean age of the participants was 9.54±1.84 years. More than one half of the participants were female and three quarters had urban residence. One third of the study participants reported good family income whereas12.4% reported low income (table 1).

Table 1: Socio-demographic Characteristics among Study Participants.

Characteristics	Categories	Number (%) N=477
Sex	Male	219 (45.9)
	Female	258 (54.1)
Age (years)	Mean ± SD	9.54±1.84
Residence	Urban	364 (76.3)
	Rural	113 (23.7)
Father educational level	No formal education	26 (5.5)
	Primary education	137 (28.7)
	Secondary education	138 (28.9)
	University and higher	176 (36.9)
Mother educational level	No formal education	37 (7.8)
	Primary education	140 (29.4)
	Secondary education	159 (33.3)
	University and higher	141 (29.6)
Income	Good	159 (33.3)
	Moderate	259 (54.3)
	Low	59 (12.4)

The distribution of study children by classes according to their residence showed that the majority of participants in all grade levels were from urban areas The highest number of urban students was recorded in the 2nd and 5th grades (both with 77 students), followed by the 3rd (67), 4th (64), and 6th grades (49). In contrast, rural participation was most notable in the 1st grade, with 60 students, while the remaining grades showed considerably lower rural representation. (Figure 2).

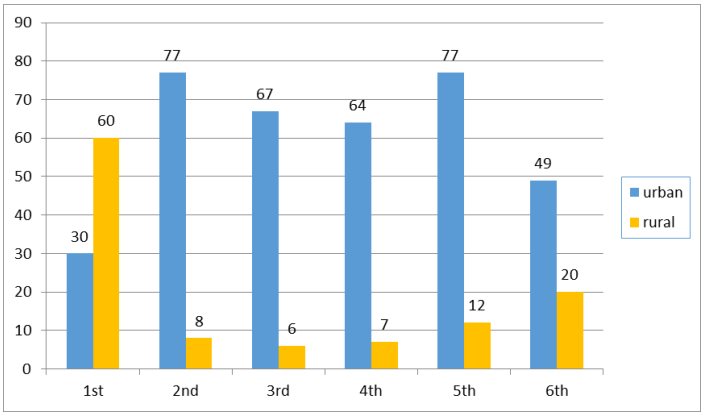

Figure 2: Distribution of Study Group by Classes According to Their Residence.

About one half of the study children reported family history of eye disease (figure 3).

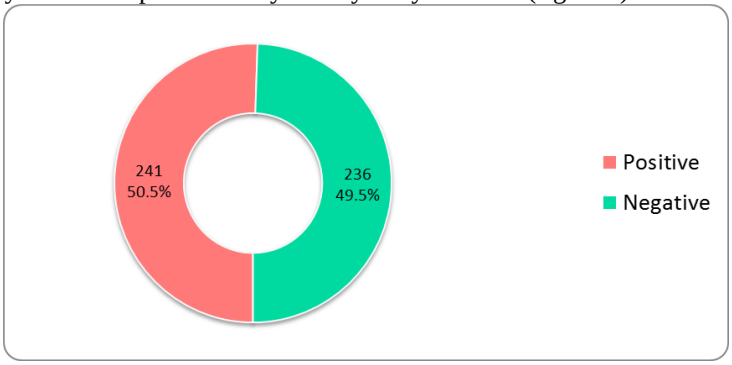

Figure 3: Distribution of Study Group by Family History of Eye Disease.

In regard to symptoms of visual impairment among study participants, 375 (78.6%) reported positive symptoms of visual impairment. *Difficulty seeing the board*, *Blurred vision* and *Eye rubbing* were the higher proportion among reported symptoms (table 2).

Table 2: Frequencies and Proportion of Symptoms among Symptomatic Students.

Symptoms	Number (%) N=375
Difficulty seeing the board	229 (61.1)
Blurred vision	184 (38.6)
Eye rubbing	142 (29.8)
Headache	91 (19.1)
Brings objects closer to eyes	84 (17.6)

Note: Participants could select more than one symptom.

In regard to causes of visual impairment, the study revealed that Myopia accounted for one third of the causes of visual impairment among study children, followed by Astigmatism (28.1%) as showed in the (figure 4) below.

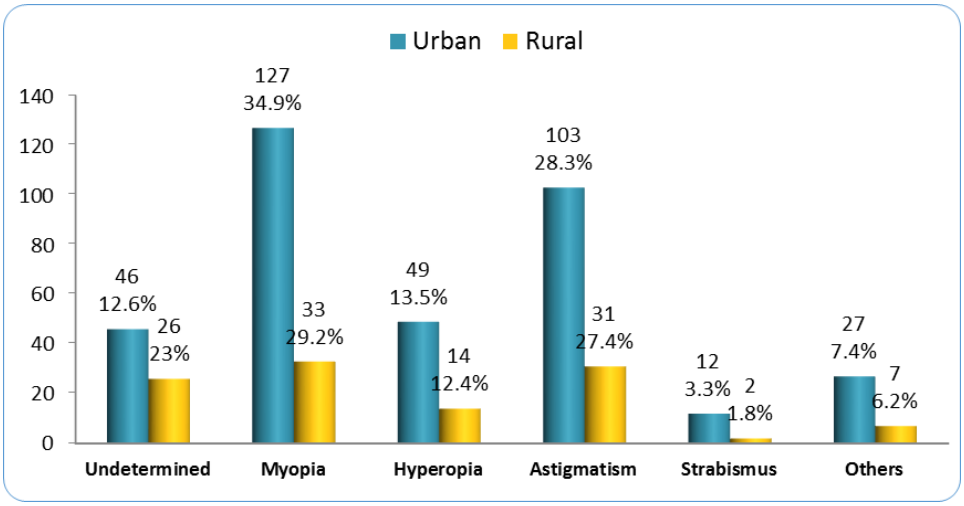

Figure 4: Proportions of Causes of Visual Impairment According to Residence of Study Participants.

Regarding the time of diagnosis of visual impairment, more than one half (53%, N=253) of the study children with visual impairment were diagnosed during this academic year (figure5).

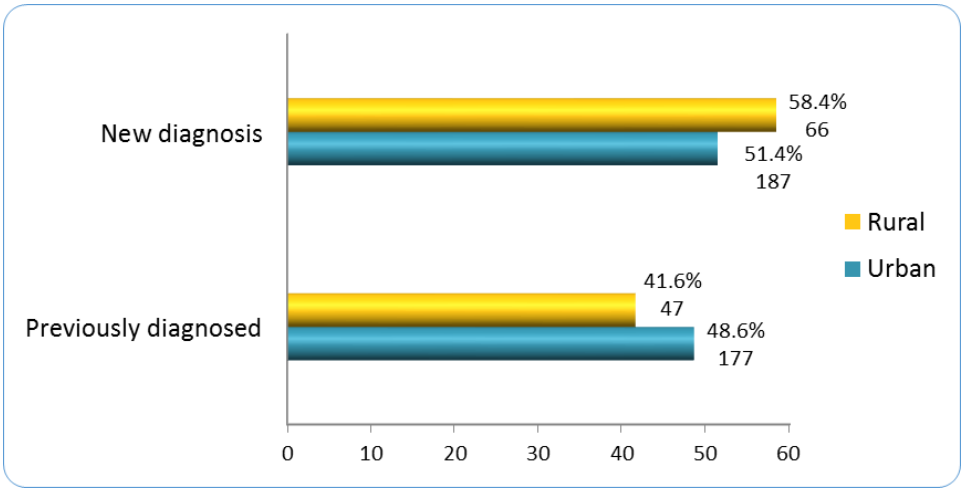

Figure 5: Frequencies and Proportion of Time of Diagnosis According to Residence of Study Participants.

The study revealed that more than one-third of children (35.4%, N=169) reported less than one hour of daily screen use (any digital screen-based device) 308 children (64.5%) had screen exposure greater than one hour daily (figure 6).

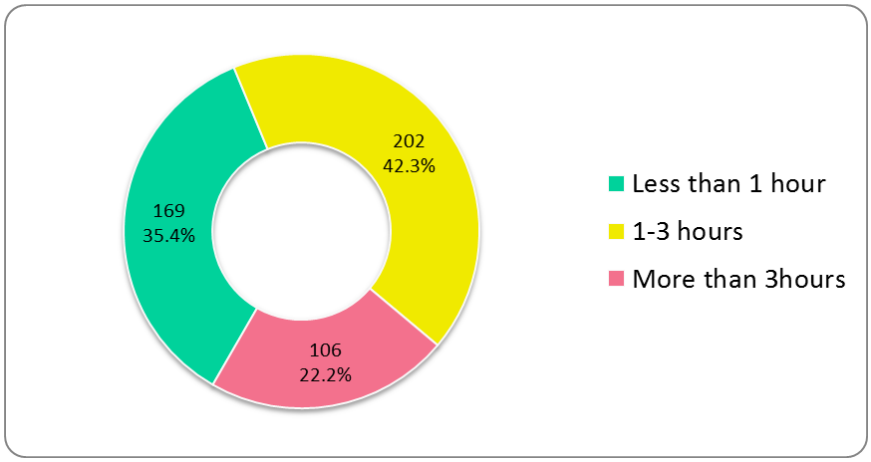

Figure 6: Frequencies and Proportion of Screen Time among Study Participants.

Overall, 54.9% of the children reported wearing glasses. However, when stratified by residence, wearing glasses was higher among urban children compared to rural (figure 7).

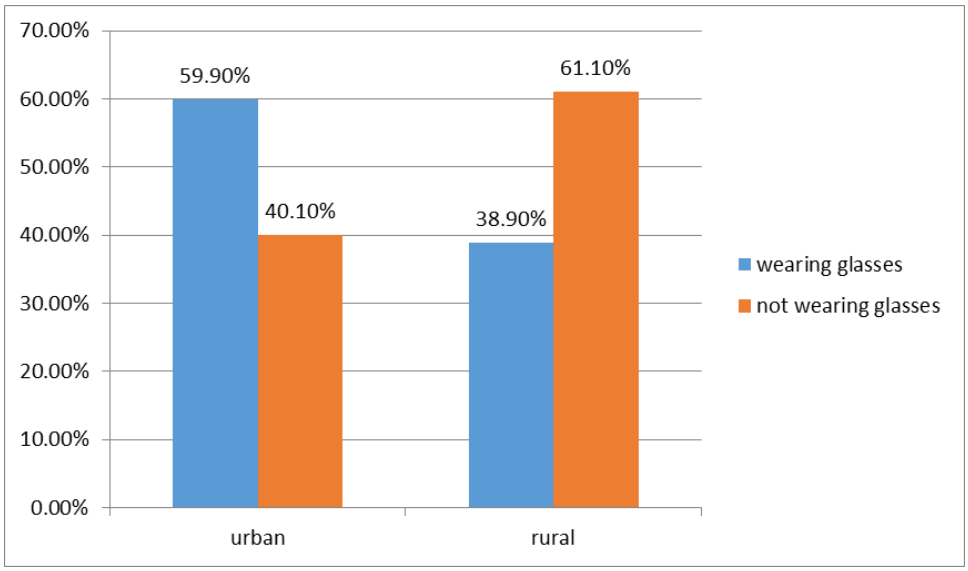

Figure 7: Percentage of Glasses Wearing Among Urban and Rural Area.

Less than one third of the study children reported the school as the only the Site of Examination which mean they didn't have any follow up after school vision screening, whereas 38% choose private clinic (figure 8).

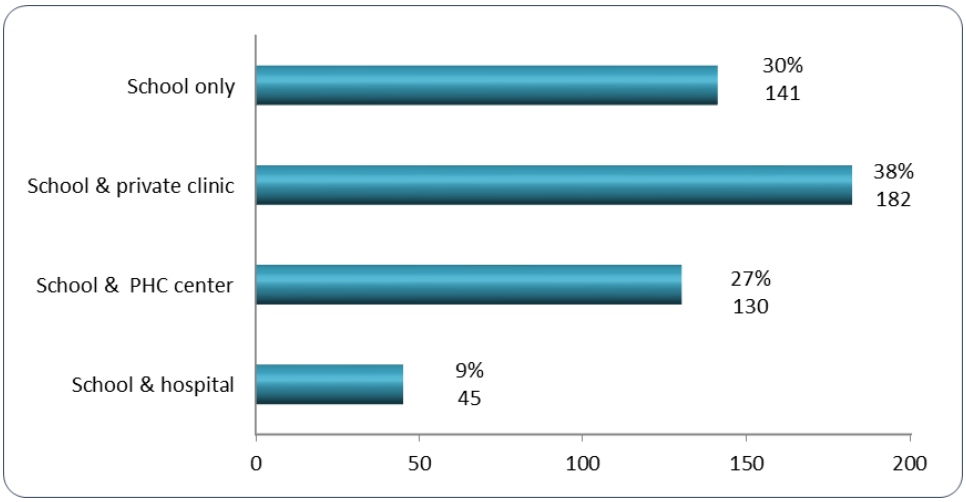

Figure 8: Frequencies of Site of Examination among Study Participants.

Among newly diagnosed children with visual impairment (N=205), the site of eye examination after screening at school varied across different settings. About one-third (35.2%) were examined through PHC centers, one quarter (24.1%) underwent examinations in private clinics, and the least frequent site was at hospital (9.5%) while (31.2%) were assessed at school only and didn't follow any further eye examination (figure 9).

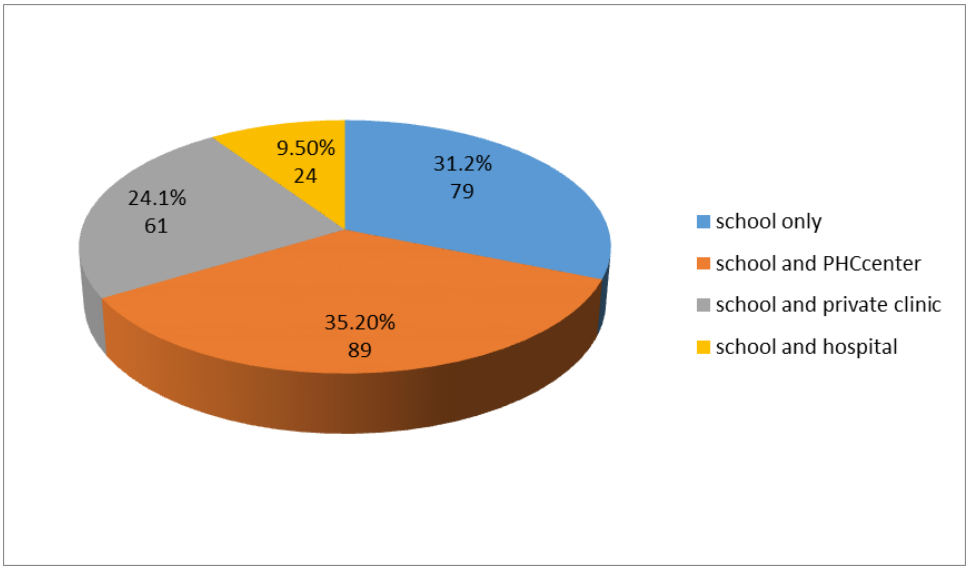

Figure 9: Site of Eye Exam among Newly Diagnosed Children with Visual Impairment.

In regard to the Awareness Questions, slightly more than one third of the parents of the study children recognized that vision test was a part of structured program. Family provided with report was mentioned by 48% of the study children. Improvement in academic performance, social and psychological well-being reported by 31% and 28.9% respectively. Received vision awareness was reported by 44.4% of the study children and the main source of information were posts and posters as illustrated by (table 3) below.

Table 3: Frequencies and Proportion of Awareness Questions among Study Participants.

Awareness Questions	Categories	Number (%) N=477
Know vision test was part of structured program	Yes	172 (36.1)
	No	305 (63.9)
Aware program Includes referral to specialists	Yes	200 (41.9)
	No	65 (13.6)
	Don't know	212 (44.4)
Received written report about child's vision	Yes	229 (48)
	No	248 (52)
Improved academic performance	Yes	148 (31)
	No	193 (40.5)
	Don't know	136 (28.5)
improved social and psychological well-being	Yes	138 (28.9)
	No	218 (45.7)
	Don't know	121 (25.4)
Support mandatory vision test	Yes	462 (96.9)
	No	15 (3.1)
Received vision awareness	Yes	212 (44.4)
	No	265 (55.6)
Source of information	Posts	104 (21.8)
	Posters	72 (15.1)
	Lectures	34 (7.1)
	No	267 (56)

The program evaluation was excellent, very good and good by nearly three quarters of the study children (figure 10).

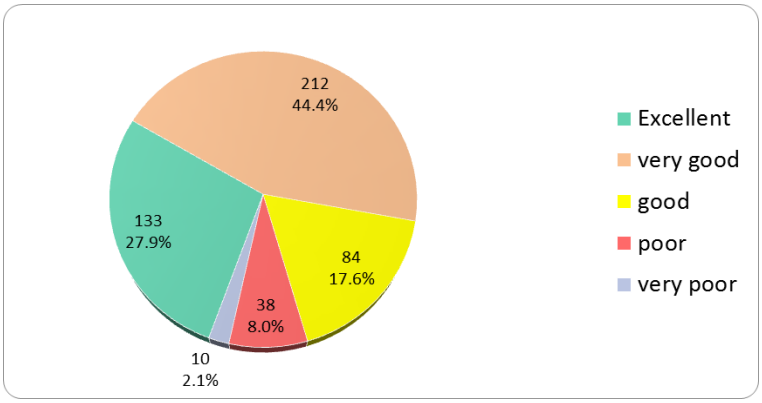

Figure 10: Frequencies and Proportion of Program Evaluation among Study Participants.

In regard to Obstacles, 84.7% of the parents of the study children reported the Presence of Obstacles. Child refusal and high prices were the main obstacles reported (table 4).

Table 4: Frequencies and Proportion of Obstacles among Study Participants.

Obstacles	Categories	Number (%) N=404
Child refusal	Yes	218 (54.0)
High prices	Yes	160 (39.6)
Difficulty arriving PHC	Yes	34 (8.4)
Others	Yes	81 (20)

Note: Participants could select more than one obstacle.

Regarding association of the socio-demographic characteristics and Wearing Glasses among study participants wearing glasses was significantly higher among urban residence, Higher education of parents and Good income. Wearing glasses also associated with Improved academic performance and Improved social/psychological well-being ($p<0.001$).

Table 5: Association of the Socio-demographic Characteristics and Improvement in Academic and Psychosocial wellbeing to Wearing Glasses among Study Participants.

Characteristics	Categories	Wearing Glasses No. (%)		P value
		Yes	No	
Sex	Male	126(57.5)	93(42.5)	0.292
	Female	136(52.7)	122(47.3)	
Age in years	Mean ±SD	9.62±1.66	9.45±2.04	0.323
Residence	Urban	218(59.9)	146(40.1)	<0.001*
	Rural	44(38.9)	69(61.1)	
Father educational level	No formal education	11(42.3)	15(57.7)	<0.001*
	Primary education	56(40.9)	81(59.1)	
	Secondary education	61(44.2)	77(55.8)	
	University and higher	134(76.1)	42(23.9)	
Mother educational level	No formal education	10(27)	27(73)	<0.001*
	Primary education	53(37.9)	87(62.1)	
	Secondary education	85(53.5)	74(46.5)	
	University and higher	114(80.9)	27(19.1)	
Income	Good	114(71.7)	45(28.3)	<0.001*
	Moderate	132(51)	127(49)	
	Low	16(27.1)	43(72.9)	
Improved academic performance	Yes	113(76.4)	35(23.6)	<0.001*
	No	55(28.5)	138(71.5)	
	Don't know	94(69.1)	42(30.9)	
improved social and psychological well-being	Yes	108(78.3)	30(21.7)	<0.001*
	No	64(29.4)	154(70.6)	
	Don't know	90(74.4)	31(25.6)	
* Significant P value of less than 0.05. Chi-Square test or Independent Samples T- test was used.				

(Table 6) shows the association between residence, gender, age, and screen time among the studied children. Urban children were significantly more likely to spend longer hours on screens compared to their rural counterparts (p = 0.019). Similarly, males reported higher screen time than females, with a statistically significant difference (p = 0.038). In contrast, the mean age did not significantly differ across screen time categories (p = 0.059), although children who spent more than three hours on screens had a slightly higher mean age (9.89 ± 1.85 years) compared to those with less screen exposure.

Table 6: Association between Residence, Gender, Age And Screen Time.

Variable	Categories	<1h	1-3h	>3h	p-value
Residence	urban	117	159	88	0.019*
	rural	52	43	18	
Gender	male	75	84	60	0.038*
	female	94	118	46	
Age	Mean(SD) per group	9.50(±2.11)	9.53(±1.63)	9.89(±1.85)	0.059
* Significant P value of less than 0.05. Chi-Square test or ANOVA test was used.					

DISCUSSION

This study provides new insights into childhood visual impairment in Karbala, addressing key factors such as sociodemographic influences, prevalence patterns, causes, service utilization, parental awareness, and program effectiveness.

The prevalence of VI obtained from the health sectors (Al-Markaz and Al-Husseiniya) using presenting visual acuity (PVA) ≤6/18 in the better eye was 3.7% in urban areas and 1.23% in rural areas. The lower rural prevalence may reflect both lifestyle and detection efficiency: rural children spend more time outdoors and engage in less near-work, while urban children face higher educational pressures and screen exposure, increasing refractive error risk. Similar urban–rural contrasts have been reported in India and Nigeria.[9][10][11]

Beyond these rural–urban differences, the overall prevalence observed remains consistent with previous reports from Iraq such as findings from Baghdad, which reported a 3.5% prevalence of VI among Children at Primary School Entry's Medical Exam using the PVA<18/6 in either eye.[12] Lower than that in Kufa City which found a 5.4% prevalence when impairment was defined as ≤6/18 in either eye.[13] These comparisons suggest that when using a better-eye ≤6/18 cut-off within general school-age populations, VI prevalence tends to be lower. Higher estimates are associated with broader definitions (any eye) and lower cut-off point.

In the regional context, Karbala findings are comparable to Gondar, Ethiopia (1.8%, better eye ≤6/18).[14] And in Sudan where PVI was 4.4%.[1]

By contrast, Bahir Dar, Ethiopia, reported 8.7% which is higher rates.[15] Globally studies found a pooled PVA-based prevalence of 3.82%.[16] Moreover, in Eastern Mediterranean Region data indicates regional childhood VI prevalence ranging from 2% in South Africa, 4–5% in Sudan, to 8.7% in Ethiopia—highlighting both low and high ends of the spectrum.[1][15][17]

Vision screening coverage among primary school children in Karbala reached 99.5%, which is higher than many recent programs worldwide. For example, participation in Greenland's school screening rose from 43% in 2017 to 61% in 2022.[18] While studies from United state commonly report coverage between 77–85%.[19] These findings suggest that the Karbala program achieved exceptionally high reach compared with global vision screening programs.

Sociodemographic analysis revealed that urban residents made up more than three-quarters of the study sample. This imbalance is explained by the underlying demographic distribution in Karbala, where the central sector has higher population density than Al-Husseiniya (peripheral) sector.

A higher proportion of 1st class students were examined in rural schools, reflecting the emphasis on school-entry screening and the relative lack of records for higher grades. While this focus ensures early detection, it highlights the need to strengthen documentation and extend it to all primary school levels.

Residence, parental education, and family income were significantly associated with spectacle wear. Urban children, children of university-educated parents and higher income were more likely to wear glasses (p<0.001) suggest that socioeconomic advantage may facilitates better access. These results agree with evidence linking socioeconomic status, education, and urban living to compliance.[20][21]

Family history of eye disease was present in 50.4% of visually impaired children, falls between the rates reported in Egypt 65% and Saudi Arabia 40% suggesting an intermediate position within the regional spectrum.[22][23]

Since this sample included only affected children, we could not test association, but the high proportion suggests a strong familial contribution.

In contrast, Other studies are inconsistent: some meta-analyses found no significant link.[24] Furthermore, a study in China emphasize environmental factors such as screen time and reduced outdoor activity.[25]

In term of symptoms 78.6% of children had symptoms, yet near than half were not wearing glasses. Similar to global adherence rates of ~40% and India where around 20% of students didn't wear glasses despite free provision.[26][27][28]

The main barriers were child refusal and high cost, consistent with reports from India, Ethiopia, and other LMICs where stigma, discomfort, and affordability are common obstacles.[29][30]

Accessibility also played a role, with 8.4% reporting difficulty reaching PHC centers, echoing Iraqi evidence of distance as a barrier.[31]

Persistent symptoms despite diagnosis reflect low spectacle uptake and poor adherence, driven by cultural, economic, and logistical challenges.

In this study, the leading causes were myopia and astigmatism, while hyperopia was less common. Other causes accounted for 7%, with undetermined causes more frequent in rural areas. These results align with Saudi Arabian study showing myopia as the most common refractive error, followed by astigmatism and hyperopia.[32]

However, a 2024 Middle East meta-analysis reported pooled prevalence of astigmatism exceeding myopia.[33] The higher undetermined rate in rural areas may also reflect diagnostic limitations in primary care settings.

After school-based screening, all newly diagnosed children were referred to PHC centers. However, only 35.2% completed PHC follow-up and 9.5% continued to government hospitals, giving an overall 44.7% adherence. More than half did not follow the pathway: 24.1% sought private care and 31.2% had no follow-up.

Similar challenges have been observed in the region: in Saudi Arabia, only 57.6% of families adhered to diagnostic follow-up after school-health screening referrals.[34] More broadly, reviews across United States confirm that only 20–50% of parents complete referral care after school screening.[35]

While in Qatar, nurse adherence to referral standards improved to nearly 99.6%, showing that system-level strengthening of school–PHC links can reduce loss to follow-up.[36]

These findings position the Karbala results within a wider regional and global challenge, highlighting weak links between schools, PHC, and families.

Regarding parental awareness of school eye health programs In this study, fewer than half received reports or educational messages, and only 41.9% aware that the program includes specialist referral. A comparable study in Nigeria, found that the main reason parents did not take their child for an eye exam was that they had never received the referral letter.[37]

Globally, Low levels of awareness among parents were identified as cultural barriers that limited the uptake of services and the wearing of spectacles and this lack of awareness is strongly associated with poor referral adherence.[38][39]

Despite this, 72.3% of parents evaluated the program positively, consistent with general satisfaction with PHC services in Karbala.[40]

In regards to parental perception of spectacles, wearing glasses was significantly associated with better academic performance and improved psychosocial well-being. These findings agree with international evidence showing that vision correction enhances literacy, math scores, and classroom participation while also reducing anxiety and improving quality of life.[41]

While spectacles generally improve outcomes, some studies found no academic benefit in better-resourced schools, though psychosocial effects remain positive.[42]

Male children and those residing in urban areas have higher screen time compared to their rural counterparts which may help to explain the higher prevalence of VI reported from Al-Markez health sector. This urban–rural disparity is consistent with findings from similar study in Thi-Qar Governorate study in Iraq.[43]

Limitations of the study

This study has some limitations as only visually impaired children were included which limited the ability to test associations (e.g., family history vs. risk of impairment). Also visual acuity was assessed with the E-test at school level; more precise tools such as cycloplegic refraction were not used, which may have led to underestimation of refractive errors, particularly hyperopia. Data recording in Al-Husseiniya sector was incomplete and less systematic compared to urban sectors, which may have weakened comparisons.

CONCLUSIONS

This study found a relatively low prevalence of visual impairment among primary school children in Karbala, higher in urban areas (3.7%) than rural areas (1.23%) reflecting urban–rural differences in risk and detection.

Refractive errors, particularly myopia (35% urban; 29% rural) and astigmatism (28% vs. 27%), were the main causes, with family history present in 50.4% of affected children.

Urban children and males were more likely to spend longer hours on screens, while no significant difference was found by age.

Spectacle wear was significantly associated with residence, parental education, and income. Although wearing glasses was linked to significant improvements in academic performance and psychosocial wellbeing.

The overall compliance and referral adherence remained low, with only 44.7% completing follow-up. While the school screening program was effective in early detection, its overall impact was constrained by poor compliance, low parental awareness, and weak referral systems.

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