

Predictors of vision screening among Saudis at primary healthcare settings in Riyadh, Saudi Arabia: findings from a cross-sectional survey

Ashraf Elmetwally^{1,2}, Mamdouh Shubair³, Ibtehaj Alshdoukhi^{1,4}, Rasha Alhazzaa^{1,4}, Faris Fatani⁵, Aljohrah Aldubikhi⁶, Dr Badr Alkhateeb^{1,2,7}, Naif Alhawiti^{1,8}, Raed Aldahash^{1,9,10}, Jumanaa Masoudi¹¹ and Hanan Al Kadri^{1,2,12}

¹ King Abdullah International Medical Research Centre, Riyadh, Saudi Arabia

² Department of Epidemiology and Biostatistics, College of Public Health & Health Informatics, King Saud bin Abdulaziz University for Health Science, Riyadh, Saudi Arabia

³ School of Health Sciences, University of Northern British Columbia, Prince George, Canada

⁴ Department of Basic Sciences, College of Science and Health Professions, King Saud bin Abdulaziz University for Health Science, Riyadh, Saudi Arabia

⁵ Department of Population Health, Riyadh Second Health Cluster, Riyadh, Saudi Arabia

⁶ College of Health Sciences, Saudi Electronic University, Riyadh, Saudi Arabia

⁷ Department of Family Medicine, King Abdulaziz Medical City, Ministry of the National Guard-Health Affairs, Riyadh, Saudi Arabia

⁸ Department of Clinical Laboratory Sciences, College of Applied Medical Sciences, King Saud bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia

⁹ King Saud bin Abdulaziz for Health Science, Riyadh, Saudi Arabia

¹⁰ Department of Medicine, Ministry of National Guard-Health Affairs, Riyadh, Saudi Arabia

¹¹ Department of Clinical Evaluation, Saudi Food and Drug Authority (SFDA), Riyadh, Saudi Arabia

¹² Department of Obstetrics and Gynecology, King Abdulaziz Medical City, Ministry of the National Guard-Health Affairs, Riyadh, Saudi Arabia

Submitted 18 November 2024

Accepted 24 September 2025

Published 23 October 2025

Corresponding author

Mamdouh Shubair,
mamdouh.shubair@unbc.ca

Academic editor

Sonia Oliveira

Additional Information and
Declarations can be found on
page 15

DOI 10.7717/peerj.20239

© Copyright

2025 Elmetwally et al.

Distributed under

Creative Commons CC-BY 4.0

OPEN ACCESS

ABSTRACT

Background: Visual impairment, including low vision and blindness, is an important global health concern. In Saudi Arabia, research on vision screening prevalence and its predictors is limited. This study aimed to determine the prevalence of vision screening and identify associated factors among Saudi residents attending primary healthcare settings.

Methods: A cross-sectional survey was conducted from March to July 2023, involving 14,239 participants from 48 randomly selected primary healthcare centers in Riyadh. Data were collected electronically from participants aged 18 years and older, using a validated questionnaire covering sociodemographic characteristics, health-related behaviors, and comorbidities. Vision screening (yes/no) was the outcome of interest, and predictors were identified using multiple logistic regression. All statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) software.

Results: The mean age of the population sample was 59.7 years $\pm$ SD 16.6 years, 56.6% were female, and 65.3% were married. The overall prevalence of vision screening was 9.1%. Multivariable analysis revealed that higher education (AOR 0.65–0.67, 95% CI [0.50–0.84] for up to high school; [0.52–0.87] for college/university; [0.44–0.76] for others) and marriage (AOR 0.81, 95% CI [0.70–0.94])

were associated with lower odds of vision screening. Conversely, unemployment (AOR 1.28, 95% CI [1.12–1.46]), exercise (AOR 1.29, 95% CI [1.14–1.47]), diabetes (AOR 1.49, 95% CI [1.24–1.80]), and obesity (AOR 1.39, 95% CI [1.11–1.75]) were associated with higher odds (all $p < 0.05$). Age, sex, insurance coverage, smoking, and hypertension did not reach statistical significance.

Conclusion: Overall, the prevalence of vision screening among the Saudi residents was low. This study identified key sociodemographic and health-related predictors of vision screening among Saudi residents. Targeted interventions are needed to improve screening rates, particularly among underutilizing groups such as those with higher education, married individuals, and employed individuals. Future research should qualitatively explore underlying reasons for these disparities to inform effective and culturally sensitive strategies.

Subjects Epidemiology, Internal Medicine

Keywords Vision screening, Predictors, Logistic regression, Survey, Saudi Arabia

INTRODUCTION

Visual impairment, encompassing low vision and legal blindness, represents a major global health concern, with an estimated 2.2 billion individuals experiencing vision problems (Alhazmi et al., 2020; Pelletier, Rojas-Roldan & Coffin, 2016). Early detection and intervention are paramount to preventing irreversible vision loss and managing ocular conditions effectively. Within this context, vision screening serves as a vital public health intervention (Abdulhussein & Abdul Hussein, 2023). Vision screening is defined as the presumptive identification of unrecognized vision problems or conditions by the application of rapid, validated tests to sort out apparently well persons who probably have a vision deficit from those who probably do not, thereby facilitating timely referral for a comprehensive eye examination and necessary treatment (Abdulhussein & Abdul Hussein, 2023; Williamson, 2022). Alarming, a substantial portion of these cases are preventable or treatable, highlighting critical gaps in eye healthcare access and the urgent need for effective preventive strategies (Saydah et al., 2020). In regions like the Eastern Mediterranean and Saudi Arabia, the prevalence of blindness and visual impairment is notably high, with a considerable proportion of these cases amenable to corrective measures (Alsaqr, 2021; Pascolini & Mariotti, 2011). The risk factors contributing to vision loss are multifaceted. While aging is a well-established determinant, other conditions such as diabetes and lifestyle choices also play a substantial role in influence visual acuity (Mangione et al., 2022). Diabetic retinopathy (DR), a complication of diabetes, poses a substantial threat to vision, with prevalence rates varying across different populations (Al-Ghamdi, 2019; Aljehani et al., 2023; Grauslund et al., 2023; Scanlon et al., 2022; Wasnik et al., 2023). The impact of progressive vision loss extends beyond physical health, profoundly affecting quality of life, including economic stability, educational attainment, and daily functioning (Wasnik et al., 2023).

Given the high prevalence of undiagnosed visual impairment, population-based screening is considered a crucial tool for early detection and intervention ([Colombatti et al., 2023](#); [Mangione et al., 2022](#)). Despite this, evidence supporting the effectiveness and implementation of programmatic vision screening in adult populations remains limited globally. In Saudi Arabia, existing studies on vision screening are few and primarily focus on narrow subpopulations or small sample sizes, lacking comprehensive assessment of screening prevalence and its predictors across diverse primary healthcare settings. Moreover, many regional investigations have concentrated on preschool children or children with special needs and have not examined sociodemographic and health-related factors influencing screening uptake among adults, limiting the understanding necessary to inform targeted interventions in this age group ([Algethami et al., 2019](#); [Alkhteeb et al., 2024](#); [Bardisi & Bin Sadiq, 2008](#); [Gosadi, 2019](#)). Consequently, research specifically addressing vision screening prevalence and its determinants in a large, representative adult Saudi cohort is notably scarce. This study therefore aims to fill this gap by estimating the prevalence of vision screening and identifying key factors associated with its utilization among Saudi residents attending primary healthcare centers. This study focused on several sociodemographic and health-related predictors. Sociodemographic factors such as age, sex, education level, marital status, employment status, and insurance coverage were examined due to their established influence on healthcare access and utilization ([Bikbov et al., 2021](#); [Bourne et al., 2021](#); [Yagi et al., 2022](#)). For instance, marital status might reflect variations in lifestyle and social support, potentially impacting healthcare-seeking behavior. Employment status can influence time availability and access to healthcare services, with unemployed individuals potentially having more flexibility for preventive screenings. Education level is an indicator of health literacy and awareness of preventive care ([Egunsola et al., 2021](#); [Van Der Heide et al., 2013](#)). Health-related behaviors, including smoking and exercise, were also considered as potential predictors. These behaviors often correlate with overall health consciousness and engagement in preventive care ([Li & Sun, 2022](#)). Comorbidities such as diabetes, hypertension, and obesity were included due to their clinical relevance to vision health. These conditions are associated with an increased risk of ocular complications ([Ng Yin Ling et al., 2021](#); [Shih, Lam & Tong, 2017](#)), potentially influencing the likelihood of seeking vision screening.

MATERIALS AND METHODS

Study design, study setting

A cross-sectional survey was conducted from March to July 2023 to examine vision screening practices. This study was embedded within a larger health system reform in Saudi Arabia, initiated between 2021 and 2022, which aimed to reorganize healthcare delivery into a health cluster model. The research took place in the Riyadh region, which is structured into three health clusters overseen by Central Health Services, encompassing both primary healthcare centers (PHCs) and hospitals. The design, performance, analysis, and reporting phases of our investigation were conducted in accordance with the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) checklist ([Supplemental File](#)).

Sampling strategy

To obtain a representative sample of primary healthcare users in Riyadh, a multi-stage cluster sampling approach was employed. Initially, Riyadh was segmented into three health clusters, and Health Cluster 2, known for its diverse population and robust healthcare infrastructure, was selected. This cluster serves approximately 3.7 million residents and includes 105 primary healthcare centers (PHCs). From this cluster, 48 PHCs were randomly chosen using stratified random sampling to ensure proportional representation of both urban and suburban areas. Within these selected PHCs, participants were identified using systematic random sampling. This multi-stage process aimed at creating a sample that accurately reflects the general population utilizing primary healthcare services in Riyadh, thereby reducing potential selection bias.

Target population, eligibility criteria, and sample size

The target population for this survey was individuals above the age of 18 years who visited the selected primary healthcare centers during the study period, including Saudi and non-Saudi participants. In addition, individuals were eligible to participate in the survey if they were attending primary healthcare centers regardless of their residential status or nationality. However, the staff of primary healthcare centers and healthcare practitioners were not included in this study, and visitors below the age of 18 years were excluded. The data collector approached visitors in the waiting areas of the primary healthcare centers to fill in the electronic survey form. In total, 14,239 participants completed the survey. Therefore, the sample size for this analysis was 14,239.

Questionnaire development

The study questionnaire, designed to evaluate health perceptions, behaviors, and priorities, was developed through a collaboration between the Central Health Services Reform Management Team and consultants from across Saudi Arabia. This standardized tool, part of a national health system reform, included sections on self-reported health, health priorities, health-related behaviors (smoking and physical activity), perceived health status, sociodemographic data (age, education, employment, sex, marital status), medical history, comorbidities (diabetes, obesity, and hypertension), insurance coverage, and vision screening history. This comprehensive design aimed at capturing diverse factors influencing health outcomes and healthcare utilization.

Questionnaire validation

To ensure the questionnaire's validity and reliability, a thorough evaluation was conducted. Content validity was established through expert review by 15 healthcare and public health specialists, leading to necessary modifications. Face validity was assessed *via* a pilot study with 200 participants, where clarity and comprehensibility were evaluated. To further ensure understanding, trained data collectors read the questions aloud during interviews. Test-retest reliability, conducted with 100 pilot participants *via* phone, yielded a coefficient of 0.83, indicating high consistency. Linguistic accuracy was maintained through English-to-Arabic and back-translation.

Pilot study in Hail City

The pilot study was conducted in Hail City, chosen by the Central Health Services Reform Management Team as a representative testing site due to its demographic and health profile mirroring the broader Saudi population. The pilot involved 100 patients and 20 focus group participants, who assessed the questionnaire's clarity and comprehensibility. Their feedback resulted in necessary revisions, ensuring the tool's effectiveness before its widespread use in Riyadh.

Data collection

Data collection was conducted *via* electronic surveys administered by interviewers. Initially, a questionnaire was developed and loaded onto iPads or Android devices used by data collectors at primary healthcare centers in Riyadh, Saudi Arabia. Data collectors screened individuals for eligibility, including those aged 18 and older, before inviting them to participate in the vision screening research. The purpose of the study was explained, and written informed consent was obtained prior to participation. Participation was voluntary. The interviewers then administered questions related to sociodemographic characteristics (age, sex, household size, marital status, education, employment, and health status), behavioral factors (smoking, fast food consumption, and physical activity), and comorbidities (hypertension, diabetes, and obesity).

Statistical methods

The distribution of continuous variables was assessed using histograms and P-P plots. Normally distributed continuous variables, such as age, were reported using means and standard deviations. Age was subsequently categorized for further analysis. Categorical variables, including education, employment status, marital status, health status, and insurance coverage, were described using frequencies and proportions.

Given the binary outcome of vision screening (Yes/No), logistic regression was employed to analyze predictors. The logistic regression models assumed independence of observations, a linear relationship between continuous predictors and the log odds of the outcome, and absence of multicollinearity among independent variables ([Starbuck, 2023](#)). The distribution of continuous variables was assessed to verify normality assumptions where relevant. Univariate logistic regression analyses were conducted to examine associations between each independent variable and the binary outcome of interest (vision screening: Yes/No). Univariate logistic regression results were reported as odds ratios (OR) with 95% confidence intervals (CIs). To identify candidate variables for multivariable logistic regression, we initially conducted univariate analyses for all potential predictors. Variables demonstrating an association with the outcome at a relaxed significance level of $p < 0.25$ were advanced for inclusion in the multivariable model. This less stringent threshold of $p < 0.25$ was chosen to minimize the risk of prematurely excluding variables that, while not independently significant at a conventional $p < 0.05$ level, may become important predictors or confounders when considered in conjunction with other variables in a multivariable context. This approach is consistent with established recommendations for purposeful variable selection in regression modeling, as outlined in the literature

(*Hosmer, Lemeshow & Sturdivant, 2013*), and aims to build a comprehensive and parsimonious model that accurately reflects the underlying relationships. Sociodemographic variables (age, sex, education, marital status, employment status, insurance coverage), health-related behaviors (smoking, exercise), and comorbidities (diabetes, hypertension, obesity) were included based on their established relevance to healthcare utilization and vision health. While these factors are important predictors, some may act as potential confounders, influencing both the likelihood of vision screening and other associated behaviors. For instance, employment status may be linked to access to healthcare, while education level may shape health awareness and preventive care practices. Recognizing these interrelationships helps interpret the observed associations with caution and underscores the need for adjusted analyses to account for potential confounding effects.

Variables reaching statistical significance ($p < 0.25$) in the univariate analysis were entered simultaneously into the multivariable logistic regression to identify independent predictors of vision screening, using a significance threshold of $p < 0.05$. This simultaneous entry method controlled for potential confounding effects, allowing for the assessment of each predictor's independent association with vision screening. Multivariable logistic regression results were reported as adjusted odds ratios (AOR) with 95% CIs. All statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) software.

Ethics approval and consent to participate

The study was reviewed by the Ethics Committee of King Fahad Medical City (KFMC) and exempted from requiring ethics approval (approval no. 22-397E). An approval letter from the Institutional Review Board (IRB) Chair is provided. A written informed consent was obtained from all the participants before the data collection.

Sample size and *post-hoc* power assessment

A formal sample size calculation was conducted prior to data collection for multiple research questions and variables in the broader study, not solely for vision screening. For each individual variable, approximately 358–385 participants would have been required to estimate prevalence with acceptable precision. In the current study, we included 14,239 participants, substantially exceeding these minimum requirements. Given the observed overall prevalence of vision screening of 9.1%, we conducted a *post-hoc* power assessment for multivariate analyses. This revealed that the study had over 99% power to detect an odds ratio of 1.2 or greater for associations between predictors and vision screening, indicating that the sample size was more than sufficient to provide robust and precise estimates of the observed associations.

RESULTS

Sociodemographic profile of the study population

Table 1 presents the socio-demographic profiles of the study sample. The study, involving 14,239 participants, revealed a diverse population in terms of sociodemographic and health characteristics. Notably, nearly half (48.8%) were aged 50–75 years, with a significant

Table 1 Demographic and health-related characteristics of the study population ($n = 14,239$).

Characteristic	Category	<i>n</i>	%
Age category	<50 years	4,848	34.0
	50 to 75 years	6,945	48.8
	At least 75 years	2,446	17.2
Sex	Females	8,062	56.6
	Males	6,177	43.4
Marital status	Married	9,300	65.3
	Single	4,939	34.7
Employment status	Employed	7,317	51.4
	Unemployed	6,922	48.6
Insurance coverage	No	10,782	75.7
	Yes	3,457	24.3
Education	Primary	572	4
	Up to high school	3,937	27.6
	College/University	7,336	51.5
	Others	2,394	16.8
Health status perception	Bad	9,668	67.9
	Good	4,571	32.1
Smoking status	No	10,297	72.3
	Yes	3,942	27.7
Physical activity	No	5,598	39.3
	Yes	8,641	60.7
Obesity	No	13,502	94.8
	Yes	737	5.2
Diabetes mellitus	No	12,474	87.6
	Yes	1,765	12.4
High blood pressure	No	12,659	88.9
	Yes	1,580	11.1
Vision screening	No	12,941	90.9
	Yes	1,298	9.1

majority married (65.3%), non-smokers (72.3%), and physically active (60.7%). While employment was relatively balanced, one third of the sample (32.1%) perceived their health status to be good; however, most participants lacked insurance (75.7%). Educational attainment varied, with over half holding college or university degrees. Common health conditions included diabetes (12.4%) and hypertension (11.1%). The prevalence of vision screening was only 9.1% in the study sample, as illustrated in [Table 1](#).

Predictors of vision screening: findings of univariate analysis

[Table 2](#) presents the univariate analysis of predictors for vision screening among Saudis, examining sociodemographic and health-related factors. Using a significance threshold of $p < 0.25$, several variables demonstrated associations with vision screening. Age was a notable factor influencing screening, with individuals aged 50–75 years exhibiting lower

Table 2 Predictors of vision screening among Saudis: findings of univariate analysis ($n = 14,239$).

Univariate analysis				
Predictors		95% CI		P-value
		OR	LL	
Age				
<50 years	1.00			<0.001
50 to 75 years	0.80	0.71	0.91	
At least 75 years	1.03	0.88	1.21	
Sex				
Female	1.00			0.02
Male	0.87	0.77	0.98	
Education				
Primary	1.00			<0.001
Up to high school	0.58	0.45	0.74	
College/University	0.54	0.43	0.69	
Others	0.49	0.37	0.64	
Marital status				
Single	1.00			<0.001
Married	0.81	0.72	0.91	
Employment status				
Employed	1.00			<0.001
Unemployed	1.37	1.22	1.54	
Insurance coverage				
No	1.00			0.04
Yes	1.14	1.00	1.30	
Smoking				
No	1.00			0.02
Yes	1.15	1.02	1.31	
Exercise				
No	1.00			0.02
Yes	1.29	1.14	1.45	
Health status perception				
Bad	1.00			0.97
Good	0.97	0.86	1.10	
Diabetes				
No	1.00			<0.001
Yes	1.73	1.49	2.01	
Hypertension				
No	1.00			<0.001
Yes	1.64	1.40	1.92	
Obesity				
No	1.00			<0.001
Yes	1.73	1.40	2.15	

Note:

OR, Odds ratio; LL, Lower limit; UL, Upper limit; 95% CIs, 95% confidence interval; p -value cutoff for univariate analysis <0.25.

Table 3 Predictors of vision screening among Saudis: findings of multivariate analysis ($n = 14,239$).

Multivariate analysis				
Predictors	AOR	95% CI		P-value
		LL	UL	
Age				
<50 years	1.00			0.25
50 to 75 years	0.91	0.78	1.06	
At least 75 years	1.02	0.84	1.24	
Sex				
Female	1.00			0.13
Male	0.91	0.80	1.03	
Education				
Primary	1.00			0.001
Up to high school	0.65	0.50	0.84	
College/University	0.67	0.52	0.87	
Others	0.58	0.44	0.76	
Marital status				
Single	1.00			0.01
Married	0.81	0.70	0.94	
Employment status				
Employed	1.00			<0.001
Unemployed	1.28	1.12	1.46	
Insurance coverage				
No	1.00			0.14
Yes	1.11	0.97	1.26	
Smoking				
No	1.00			0.56
Yes	1.04	0.91	1.20	
Exercise				
No	1.00			<0.001
Yes	1.29	1.14	1.47	
Diabetes				
No	1.00			<0.001
Yes	1.49	1.24	1.80	
Hypertension				
No	1.00			0.07
Yes	1.20	0.99	1.46	
Obesity				
No	1.00			0.001
Yes	1.39	1.11	1.75	

Note:

AOR, Adjusted Odds ratio; LL, Lower limit; UL, Upper limit; 95% CI, 95% confidence interval.

odds of undergoing screening (OR 0.80, 95% CI [0.71–0.91], $p < 0.001$) compared to those under 50. Male participants had slightly lower odds of screening than females (OR 0.87, 95% CI [0.77–0.98], $p = 0.02$). Education level was inversely associated with screening, as those with higher education levels (up to high school, college/university, or other) had significantly lower odds of screening compared to those with primary education (all $p < 0.001$). Marital status was also associated with screening behavior, as married individuals had lower odds of undergoing screening compared to single individuals (OR 0.81, 95% CI [0.72–0.91], $p < 0.001$). Conversely, unemployed individuals had higher odds of screening compared to employed individuals (OR 1.37, 95% CI [1.22–1.54], $p < 0.001$). Having insurance coverage was associated with slightly higher odds of screening (OR 1.14, 95% CI [1.00–1.30], $p = 0.04$). Smokers had slightly higher odds of screening compared to non-smokers (OR 1.15, 95% CI [1.02–1.31], $p = 0.02$). Similarly, those who exercised had higher odds of screening than those who did not (OR 1.29, 95% CI [1.14–1.45], $p = 0.02$). Perceived health status showed no meaningful influence on screening ($p = 0.97$). However, having diabetes, hypertension, or obesity was associated with significantly higher odds of screening (OR 1.73, 95% CI [1.49–2.01], $p < 0.001$ for diabetes; OR 1.64, 95% CI [1.40–1.92], $p < 0.001$ for hypertension; OR 1.73, 95% CI [1.40–2.15], $p < 0.001$ for obesity) as shown in [Table 2](#).

Predictors of vision screening: findings of multivariate analysis

[Table 3](#) presents the multivariate analysis of predictors for vision screening among Saudis, focusing on variables that retained significance after adjusting for other factors, using a p -value threshold of <0.05 . Education level emerged as a important predictor, with individuals holding higher education degrees, including up to high school (AOR 0.65, 95% CI [0.50–0.84], $p = 0.001$), college/university degrees (AOR 0.67, 95% CI [0.52–0.87], $p = 0.001$), and other forms of education (AOR 0.58, 95% CI [0.44–0.76], $p = 0.001$), demonstrating significantly lower adjusted odds of vision screening compared to those with primary education. Marital status was also linked to screening. Married individuals had lower adjusted odds of screening than single individuals (AOR 0.81, 95% CI [0.70–0.94], $p = 0.01$). Conversely, unemployment was a strong predictor of vision screening, with unemployed individuals having appreciably higher adjusted odds of screening compared to employed individuals (AOR 1.28, 95% CI [1.12–1.46], $p < 0.001$). Exercise was another key predictor; those who exercised showed markedly higher adjusted odds of screening than those who did not (AOR 1.29, 95% CI [1.14–1.47], $p < 0.001$). Finally, diabetes was positively associated with higher adjusted odds of vision screening (AOR 1.49, 95% CI [1.24–1.80], $p < 0.001$). Similarly, obesity also showed a considerable association, with higher adjusted odds of screening (AOR 1.39, 95% CI [1.11–1.75], $p = 0.00$). Age, sex, insurance coverage, smoking, and hypertension did not reach statistical significance at the $p < 0.05$ level in the multivariate analysis as revealed in [Table 3](#).

DISCUSSION

This cross-sectional study aimed to identify predictors of vision screening among residents of Saudi Arabia attending primary healthcare settings. The multivariate analysis revealed

that education level, marital status, employment status, exercise, diabetes, and obesity significantly predicted vision screening, each demonstrating unique associations. Specifically, individuals with higher education, married individuals, and employed individuals showed lower odds of screening, while those who exercised, were unemployed, and had diabetes or obesity showed higher odds.

Notably, individuals with higher education levels demonstrated significantly lower adjusted odds of undergoing vision screening compared to those with primary education. This counterintuitive finding might be attributed to a perception among more educated individuals that they possess greater awareness of their health, leading to self-management rather than seeking formal screening. For instance, the evidence suggests individuals with higher education levels often overestimate their ability to manage their health independently, which may reduce their reliance on preventive health services such as vision screening ([Mackenbach et al., 2008](#)). Additionally, higher education does not always translate to higher utilization of preventive services, as educated individuals may prioritize other aspects of life over routine health checks ([Cutler & Lleras-Muney, 2010](#)). Furthermore, findings from a systematic review emphasized that social determinants, including education, influence health behaviors in complex ways, sometimes leading to unexpected patterns in healthcare utilization ([Cutler & Lleras-Muney, 2010](#)). However, our findings contradict some studies that suggest higher education is generally associated with greater utilization of preventive health services ([Blackwell et al., 2009](#); [Chou et al., 2016](#); [Hammond, Matthews & Corbie-Smith, 2010](#)). This discrepancy could be due to several factors. First, cultural and contextual differences in health-seeking behaviors may play a essential role. For example, in certain settings, highly educated individuals may prioritize productivity or career advancement over preventive health measures. Second, access to primary healthcare services may vary even among educated populations, with some individuals facing barriers such as time constraints or lack of insurance coverage for routine screenings. Finally, the perception of self-efficacy among educated individuals may lead to overconfidence in their ability to manage health issues without formal screening, as noted in literature ([Chou et al., 2016](#)). These factors collectively highlight the nuanced relationship between education and health behaviors, which may not always align with conventional expectations.

Similarly, married individuals showed lower adjusted odds of screening than their single counterparts. This could potentially be linked to variations in lifestyle, priorities, or perceived health needs between these groups. Single individuals might prioritize and engage in preventive care due to a stronger sense of personal responsibility for their health ([Umberson & Karas Montez, 2010](#)). Alternatively, the demands of family life and household responsibilities might limit the time available for married individuals to attend preventive screenings. Married individuals, particularly those with children, often prioritize caregiving roles over their own health needs, resulting in lower engagement with preventive healthcare ([Umberson & Karas Montez, 2010](#)). Additionally, it has been observed that married individuals, especially women, contend with considerable time limitations from caregiving duties, thereby reducing their capacity for preventive health

behaviors ([McCullough, 2008](#)). This highlights the need to consider the impact of social roles and time constraints on healthcare-seeking behaviors.

Ideally, employed individuals should have greater access to preventive health services due to higher incomes and employer-provided benefits. Findings from prior studies suggest that higher socio-economic status, including employment, is generally associated with higher attendance at health checks ([Dryden et al., 2012](#); [Shin et al., 2018](#)). However, our findings showed that unemployed individuals had higher odds of undergoing vision screening. This counterintuitive result may be explained by time constraints faced by employed individuals, as evidence suggests that non-participants in health check-ups were often employed or self-employed ([Funahashi et al., 2013](#)). Unemployed individuals may have more time flexibility or rely more on publicly funded services, where screenings are readily available. These findings highlight the complex relationship between employment status and healthcare access. While employed individuals have greater resources, work-related time constraints may limit their ability to attend screenings. More research is needed to explore workplace barriers, employer incentives, and the role of paid leave in influencing preventive healthcare utilization. Addressing these gaps can help develop targeted interventions to improve access across all employment groups. Additionally, potential interactions between education and employment status may influence vision screening behaviors. Higher educational attainment often correlates with better employment opportunities, which could jointly affect access to healthcare and health-seeking behaviors. Exploring these interactions in future studies could provide a deeper understanding of how combined sociodemographic factors shape vision screening uptake.

Hence the study's findings suggest several potential barriers to vision screening. Firstly, time constraints due to employment or family responsibilities might deter married and employed individuals from seeking preventive care. Secondly, a perception of lower risk or higher health literacy among individuals with higher education could lead to underutilization of screening services. Thirdly, limited awareness or accessibility of vision screening services within primary healthcare settings might disproportionately affect certain demographic groups.

Conversely, physical activity was a strong predictor, with active individuals showing a greater likelihood of undergoing vision screening. This aligns with the broader trend of health-conscious behaviors, where individuals who prioritize physical fitness are also more likely to engage in preventive healthcare. Physically active individuals often exhibit a proactive approach to health management, including regular check-ups and screenings. Findings of one study revealed that physical activity is strongly associated with higher utilization of preventive health services, as active individuals tend to have greater health awareness and a stronger commitment to maintaining overall well-being ([Kang & Xiang, 2017](#)). Similarly, a systematic review of current reviews highlighted that physical activity is linked to improved health literacy and a greater likelihood of utilizing preventive healthcare services ([Warburton & Bredin, 2017](#)). These findings suggest that exercise serves as a marker for a broader commitment to health and wellness, which includes participation in vision screening.

Finally, individuals with diabetes or obesity had markedly higher adjusted odds of undergoing vision screening. Specifically, vision screening was more common among diabetic and obese individuals compared to their non-diabetic and non-obese counterparts. This aligns with clinical guidelines recommending regular eye examinations for individuals with these chronic conditions due to the heightened risk of ocular complications. These findings underscore the importance of targeted screening strategies for high-risk populations. The literature indicates that individuals with diabetes are more susceptible to developing vision-related problems or blindness, with diabetic retinopathy being a prevalent complication. Consequently, diabetic individuals are likely either well-informed about the long-term benefits of these screening programs or are being counseled and referred by their physicians for early detection of potential visual impairments. Furthermore, research suggests that social and cognitive factors, such as social comparison and concern for familial impact, also motivate diabetic individuals to opt for vision screening ([Lake et al., 2017](#)), consistent with previous studies. For instance, studies have shown that routine annual eye examinations or vision screenings for early detection and management of diabetic retinopathy can prevent 90% of vision loss attributed to diabetes ([Ferris, 1993](#)). In light of this, the American Academy of Ophthalmology recommends annual eye examinations for all diabetic individuals to screen for vision problems ([American Diabetes Association Professional Practice Committee, 2022](#)).

The strong association between comorbidities like diabetes and obesity and vision screening rates underscores the broader implications for public health interventions. These comorbidities not only increase the risk of ocular complications but also contribute to a range of other health problems. Integrating vision screening into comprehensive chronic disease management programs is essential. Moreover, public health campaigns should emphasize the interconnectedness of these conditions and the importance of holistic preventive care. The finding that these individuals are more likely to get screened also presents an opportunity to provide more general preventative care and education. Further, the results also indicate that exercise predicts screening. This may suggest that those who are already engaged in a healthy lifestyle are more likely to seek out preventative care. Public health interventions could leverage this by promoting exercise as a gateway to overall health awareness and screening.

Lastly, while age, sex, insurance coverage, smoking, and hypertension were not significant predictors of vision screening in our study, these findings warrant careful consideration. One possible explanation is that vision screening behaviors may be more strongly influenced by awareness, cultural perceptions, and health system factors rather than by demographic variables alone. For example, while older adults and individuals with chronic conditions such as hypertension might be expected to seek screening more often, competing health priorities and limited awareness of the benefits of preventive eye care could reduce uptake. Similarly, the lack of association with insurance coverage may reflect the fact that eye care in Saudi Arabia is often accessible through public health services, thereby diminishing differences based on insurance status. Non-significant associations may also arise from residual confounding, such as unmeasured variables including health

literacy, perceived need for care, or accessibility of eye clinics. These results highlight the complexity of health-seeking behaviors and suggest that interventions to increase screening uptake should not only target clinical risk factors but also address contextual and behavioral determinants.

Strengths and limitations

Strengths

This study boasts several strengths. Firstly, the large, representative sample, achieved through multistage random sampling, enhances the generalizability of our findings to Saudi Arabia and regions with similar sociodemographic profiles. This sampling method minimized self-selection bias, ensuring all primary healthcare attendees had an equal chance of participation. However, because data were collected from a single region, regional variations within Saudi Arabia may limit the generalizability of the results to the entire country. Future multicenter or nationally representative studies would be valuable to capture potential regional differences. Secondly, the comprehensive questionnaire, validated and shown to have high reliability, allowed for the examination of numerous sociodemographic, behavioral, and health-related factors associated with vision screening. This reduces the likelihood of measurement errors and provides valuable insights for researchers and policymakers in developing targeted interventions.

Limitations

However, our findings should be interpreted with caution due to certain limitations. First, the cross-sectional design precludes establishing temporality or causality between predictors and vision screening; thus, the associations observed should be understood as correlations rather than causal relationships. Future longitudinal or interventional studies would be valuable to clarify causal pathways and confirm these findings. Second, although the questionnaire demonstrated face validity and high test–retest reliability, reliance on self-reported data introduces potential recall and social desirability biases. This limitation is particularly relevant for sensitive behaviors such as smoking and self-reported health status, where participants may have underreported unhealthy behaviors or overreported favorable ones, potentially leading to an overestimation of positive health behaviors and an underestimation of risk factors. To minimize this, anonymity and confidentiality were emphasized during data collection, which likely reduced, but could not eliminate, the risk of biased reporting. Future studies should consider validating self-reported measures against objective data sources, such as medical records, screening attendance logs, or biometric indicators, to improve accuracy and triangulate findings. Third, although our multivariate analyses controlled for key sociodemographic and health-related factors, residual confounding may still exist due to unmeasured variables, such as health literacy, access to healthcare services, cultural beliefs, or provider recommendations, which could influence vision screening behaviors. Additionally, certain non-modifiable variables (*e.g.*, age, sex) were not significant predictors in our study, but their potential interactions with modifiable factors and contextual determinants warrant further exploration. Finally, the study focused solely on quantitative associations, which, while informative, do not capture

the underlying perceptions, motivations, or barriers influencing vision screening behaviors. Integrating qualitative research methods, such as interviews or focus groups, in future studies could provide deeper insights into behavioral determinants, inform targeted interventions, and strengthen the translation of findings into practice.

CONCLUSIONS

In general, Saudi residents have a very low prevalence of vision screenings. Notable sociodemographic and health-related factors predicting vision screening among Saudi residents were uncovered in this study. While some predictors, such as age and sex, are non-modifiable, the identification of modifiable factors, including exercise, health awareness, and conditions like diabetes and obesity, offers actionable entry points for intervention. Specifically, higher education, marriage, and employment correlated with decreased odds, whereas unemployment, exercise, diabetes, and obesity correlated with increased odds. These findings underscore the need for healthcare providers and policymakers to design targeted, culturally sensitive interventions that promote behavioral change and increase awareness about the importance of preventive vision care. Actionable strategies include community-based education, integration of screening into routine primary care, and strengthening access to screening services. Future research should qualitatively explore the underlying reasons for these disparities to inform effective and regionally adaptable strategies. Beyond Saudi Arabia, these findings contribute to the global evidence base on preventive eye health, suggesting that similar approaches may be beneficial in other resource-limited settings.

Implications for health policy

These findings carry important implications for health policy, particularly in resource-limited settings. Evidence-based strategies should focus on increasing accessibility and uptake of vision screening. Tailored awareness campaigns can target specific groups identified as under-screened, such as individuals with higher education or employed adults, using culturally appropriate messaging and communication channels. Integrating vision screening into routine primary care visits, including annual check-ups, can ensure systematic coverage. Community health workers can play a pivotal role by conducting outreach, providing education, and facilitating screening at local health centers or home visits. Prioritizing high-risk populations, including individuals with diabetes, obesity, or other chronic conditions, can maximize the efficiency of limited resources. These approaches together provide actionable steps for policymakers and practitioners to improve preventive eye care and reduce vision-related morbidity.

ADDITIONAL INFORMATION AND DECLARATIONS

Funding

This work was funded by King Salman Center for Disability Research through research group number KSRG-2023-196. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Grant Disclosures

The following grant information was disclosed by the authors:
King Salman Center for Disability Research: KSRG-2023-196.

Competing Interests

The authors declare that they have no competing interests.

Author Contributions

- Ashraf Elmetwally conceived and designed the experiments, authored or reviewed drafts of the article, and approved the final draft.
- Mamdouh Shubair conceived and designed the experiments, analyzed the data, prepared figures and/or tables, authored or reviewed drafts of the article, and approved the final draft.
- Ibtehaj Alshdoukhi performed the experiments, authored or reviewed drafts of the article, and approved the final draft.
- Rasha Alhazzaa performed the experiments, authored or reviewed drafts of the article, and approved the final draft.
- Faris Fatani conceived and designed the experiments, performed the experiments, prepared figures and/or tables, authored or reviewed drafts of the article, and approved the final draft.
- Aljohrah Aldubikhi performed the experiments, authored or reviewed drafts of the article, and approved the final draft.
- Dr Badr Alkhateeb conceived and designed the experiments, authored or reviewed drafts of the article, and approved the final draft.
- Naif Alhawiti performed the experiments, analyzed the data, prepared figures and/or tables, authored or reviewed drafts of the article, and approved the final draft.
- Raed Aldahash performed the experiments, authored or reviewed drafts of the article, and approved the final draft.
- Jumanaa Masoudi performed the experiments, authored or reviewed drafts of the article, and approved the final draft.
- Hanan Al Kadri conceived and designed the experiments, authored or reviewed drafts of the article, and approved the final draft.

Human Ethics

The following information was supplied relating to ethical approvals (*i.e.*, approving body and any reference numbers):

The study was reviewed by the Ethics Committee of King Fahad Medical City (KFMC) and exempted from requiring ethics approval (approval no. 22-397E).

Data Availability

The following information was supplied regarding data availability:

The dataset is available in the [Supplemental File](#).

Supplemental Information

Supplemental information for this article can be found online at <http://dx.doi.org/10.7717/peerj.20239#supplemental-information>.

REFERENCES

- Abdulhussein D, Abdul Hussein M. 2023. WHO Vision 2020: Have we done it? *Ophthalmic Epidemiology* 30:331–339 DOI 10.1080/09286586.2022.2127784.
- Al-Ghamdi A. 2019. Adults visual impairment and blindness-an overview of prevalence and causes in Saudi Arabia. *Saudi Journal of Ophthalmology* 33(4):374–381 DOI 10.1016/j.sjopt.2019.10.001.
- Algethami MR, Student M, Raffa LH, Alhibshi RH, Baabdullah MY, Alobudi AH. 2019. Vision screening services in special needs schools in Western Saudi Arabia. *Saudi Medical Journal* 40:385 DOI 10.15537/smj.2019.4.24076.
- Alhazmi GA, Balubaid RN, Sajiny S, Alsabbah R. 2020. Assessment of insulin injection technique among diabetic patients in Makkah region in Saudi Arabia. *Cureus* 12:e10679 DOI 10.7759/cureus.10679.
- Aljehani EA, Alhawiti AE, Mohamad RM, Aljehani IVEA, Hawiti A. 2023. Prevalence and determinants of diabetic retinopathy among type 2 diabetic patients in Saudi Arabia: a systematic review. *Cureus* 15: DOI 10.7759/cureus.42771.
- Alkhteeb NA, AlGhunaim M, Aldarwish R, AlJughaiman A, Alzahrani F, Al Owaifeer AM. 2024. Adherence of parents to vision screening for school-aged children in Eastern Region, Saudi Arabia. *International Journal of Medicine in Developing Countries* 8:128–128 DOI 10.24911/IJMDC.51-1699243424.
- Alsaqr AM. 2021. Barriers to low vision services among optometrists in Saudi Arabia. *The Open Ophthalmology Journal* 15(1):178–188 DOI 10.2174/1874364102115010178.
- American Diabetes Association Professional Practice Committee. 2022. 12. Retinopathy, neuropathy, and foot care: standards of medical care in diabetes—2022. *Diabetes Care* 45:S185–S194 DOI 10.2337/dc22-s012.
- Bardisi WM, Bin Sadiq BM. 2008. Vision screening of preschool children in Jeddah, Saudi Arabia. *Eye Care Review* 2.
- Bikbov MM, Kazakbaeva GM, Rakhimova EM, Rusakova IA, Fakhretdinova AA, Tuliakova AM, Panda-Jonas S, Gilmanshin TR, Zainullin RM, Bolshakova NI. 2021. Prevalence factors associated with vision impairment and blindness among individuals 85 years and older in Russia. *JAMA Network Open* 4(8):e2121138 DOI 10.1001/jamanetworkopen.2021.21138.
- Blackwell DL, Martinez ME, Gentleman JF, Sanmartin C, Berthelot JM. 2009. Socioeconomic status and utilization of health care services in Canada and the United States: findings from a binational health survey. *Medical Care* 47(11):1136–1146 DOI 10.1097/MLR.0b013e3181adcbe9.
- Bourne R, Steinmetz JD, Flaxman S, Briant PS, Taylor HR, Resnikoff S, Casson RJ, Abdoli A, Abu-Gharbieh E, Afshin A. 2021. Trends in prevalence of blindness and distance and near vision impairment over 30 years: an analysis for the Global Burden of Disease Study. *The Lancet Global Health* 9:e130–e143 DOI 10.1093/geroni/igaa057.2935.
- Chou R, Dana T, Bougatsos C, Grusing S, Blazina I. 2016. Screening for impaired visual acuity in older adults: updated evidence report and systematic review for the US preventive services task force. *JAMA* 315(9):915–933 DOI 10.1001/jama.2022.6381.

- Colombatti R, Hegemann I, Medici M, Birkegård C. 2023. Systematic literature review shows gaps in data on global prevalence and birth prevalence of sickle cell disease and sickle cell trait: call for action to scale up and harmonize data collection. *Journal of Clinical Medicine* 12(17):5538 DOI 10.3390/jcm12175538.
- Cutler DM, Lleras-Muney A. 2010. Understanding differences in health behaviors by education. *Journal of Health Economics* 29(1):1–28 DOI 10.1016/j.jhealeco.2009.10.003.
- Dryden R, Williams B, McCowan C, Themessl-Huber M. 2012. What do we know about who does and does not attend general health checks? Findings from a narrative scoping review. *BMC Public Health* 12(1):1–23 DOI 10.1186/1471-2458-12-723.
- Egunsola O, Dowsett LE, Diaz R, Brent MH, Rac V, Clement FM. 2021. Diabetic retinopathy screening: a systematic review of qualitative literature. *Canadian Journal of Diabetes* 45(8):725–733.e712 DOI 10.1016/j.cjcd.2021.01.014.
- Ferris FL 3rd. 1993. How effective are treatments for diabetic retinopathy? *JAMA* 269(10):1290–1291 DOI 10.1001/jama.1993.03500100088034.
- Funahashi H, Nishida T, Okamura Y, Sakakibara H. 2013. Characteristics of middle-aged people who have not undergone specific health checkups. *Japanese Journal of Public Health* 60:119–127 DOI 10.11236/jph.60.3_119.
- Gosadi IM. 2019. National screening programs in Saudi Arabia: overview, outcomes, and effectiveness. *Journal of Infection and Public Health* 12:608–614 DOI 10.1016/j.jiph.2019.06.001.
- Grauslund J, Pedersen FN, Andersen N, Andresen J, Bek T, Dinesen S, Hajari J, Heegaard S, Højlund K, Laugesen CS. 2023. Presence and development of diabetic retinopathy in 153238 patients with type 2 diabetes in the Danish Registry of Diabetic Retinopathy. *Acta Ophthalmologica* 101(2):207–214 DOI 10.1111/aos.15264.
- Hammond WP, Matthews D, Corbie-Smith G. 2010. Psychosocial factors associated with routine health examination scheduling and receipt among African American men. *Journal of the National Medical Association* 102(4):276–289 DOI 10.1016/s0027-9684(15)30600-3.
- Hosmer DW Jr, Lemeshow S, Sturdivant RX. 2013. *Applied logistic regression*. John Wiley & Sons. DOI 10.1002/9781118548387.
- Kang S-W, Xiang X. 2017. Physical activity and health services utilization and costs among US adults. *Preventive Medicine* 96:101–105 DOI 10.1016/j.ypmed.2016.12.043.
- Lake AJ, Browne JL, Rees G, Speight J. 2017. What factors influence uptake of retinal screening among young adults with type 2 diabetes? A qualitative study informed by the theoretical domains framework. *Journal of Diabetes and its Complications* 31(6):997–1006 DOI 10.1016/j.jdiacomp.2017.02.020.
- Li C, Sun J. 2022. The impact of current smoking, regular drinking, and physical inactivity on health care-seeking behavior in China. *BMC Health Services Research* 22:52 DOI 10.1186/s12913-022-07462-z.
- Mackenbach JP, Stirbu I, Roskam A-JR, Schaap MM, Menvielle G, Leinsalu M, Kunst AE. 2008. Socioeconomic inequalities in health in 22 European countries. *New England Journal of Medicine* 358(23):2468–2481 DOI 10.1056/nejmsa0707519.
- Mangione CM, Barry MJ, Nicholson WK, Cabana M, Chelmow D, Coker TR, Davis EM, Donahue KE, Epling JW, Jaén CR. 2022. Screening for impaired visual acuity in older adults: US preventive services task force recommendation statement. *JAMA* 327(21):2123–2128 DOI 10.1001/jama.2022.7015.
- McCullough LB. 2008. Gender and health: the effects of constrained choices and social policies. *JAMA* 300(8):968 DOI 10.1001/jama.300.8.968.

- Ng Yin Ling C, Lim SC, Jonas JB, Sabanayagam C. 2021. Obesity and risk of age-related eye diseases: a systematic review of prospective population-based studies. *International Journal of Obesity* 45(9):1863–1885 DOI 10.1038/s41366-021-00829-y.
- Pascolini D, Mariotti SP. 2011. Global estimates of visual impairment: 2010. *British Journal of Ophthalmology* 96(5):614–618 DOI 10.1136/bjophthalmol-2011-300539.
- Pelletier AL, Rojas-Roldan L, Coffin J. 2016. Vision loss in older adults. *American Family Physician* 94:219–226.
- Saydah SH, Gerzoff RB, Saaddine JB, Zhang X, Cotch MF. 2020. Eye care among US adults at high risk for vision loss in the United States in 2002 and 2017. *JAMA Ophthalmology* 138(5):479–489 DOI 10.1001/jamaophthalmol.2020.0273.
- Scanlon PH, Nevill CR, Stratton IM, Maruti SS, Massó-González EL, Sivaprasad S, Bailey C, Ehrlich M, Chong V. 2022. Prevalence and incidence of diabetic retinopathy (DR) in the UK population of Gloucestershire. *Acta Ophthalmologica* 100(2):e560–e570 DOI 10.1111/aos.14927.
- Shih K, Lam KS, Tong L. 2017. A systematic review on the impact of diabetes mellitus on the ocular surface. *Nutrition & Diabetes* 7:e251 DOI 10.1038/nutd.2017.4.
- Shin H-Y, Kang H-T, Lee JW, Lim H-J. 2018. The association between socioeconomic status and adherence to health check-up in Korean adults, based on the 2010–2012 Korean National Health and Nutrition Examination Survey. *Korean Journal of Family Medicine* 39(2):114 DOI 10.4082/kjfm.2018.39.2.114.
- Starbuck C. 2023. Logistic regression. *The fundamentals of people analytics: with applications in R*. Springer, 223–238 DOI 10.1007/978-3-031-28674-2_12.
- Umberson D, Karas Montez J. 2010. Social relationships and health: a flashpoint for health policy. *Journal of Health and Social Behavior* 51:S54–S66 DOI 10.1177/0022146510383501.
- Van Der Heide I, Wang J, Droomers M, Spreeuwenberg P, Rademakers J, Uiters E. 2013. The relationship between health, education, and health literacy: results from the Dutch adult literacy and life skills survey. *Journal of Health Communication* 18:172–184 DOI 10.1080/10810730.2013.825668.
- Warburton DE, Bredin SS. 2017. Health benefits of physical activity: a systematic review of current systematic reviews. *Current Opinion in Cardiology* 32(5):541–556 DOI 10.1097/hco.0000000000000437.
- Wasnik RN, Györi-Dani V, Vincze F, Papp M, Pálkás A, Sándor J. 2023. Screening for patients with visual acuity loss in primary health care: a cross sectional study in a deprived Hungarian population. *Healthcare: MDPI* 11:1941 DOI 10.3390/healthcare11131941.
- Williamson J. 2022. Screening, surveillance and case-finding. In: *Health Care of the Elderly*. Routledge, 194–213.
- Yagi BF, Luster JE, Scherer AM, Farron MR, Smith JE, Tipirneni R. 2022. Association of health insurance literacy with health care utilization: a systematic review. *Journal of General Internal Medicine* 37:375–389 DOI 10.1007/s11606-021-06819-0.