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Prevalence and Factors Associated with Diabetes Screening Uptake among Adults in Zambia: Evidence from The 2024 Zambia Demographic and Health Survey

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Abstract

Background

The prevalence of diabetes has been on the rise over the years, posing global public health concerns. The World Health Organization (WHO) recommends screening for early detection of prediabetes to prevent complications. Uptake of screening services is, however, still low in Africa, attributed to socioeconomic and health infrastructure disparities in the region. This study examined the prevalence and factors associated with diabetes screening uptake in Zambia.

Methods

We conducted a secondary analysis of the 2024 Zambia Demographic and Health Surveys (ZDHS) involving 26,508 respondents. Diabetes screening was defined based on self-reported history of blood glucose measurement by a doctor or other healthcare worker. A weighted analysis was performed to determine the prevalence and factors associated with screening. Descriptive statistics, including frequencies and percentages, were used to summarise sample characteristics, and prevalence estimates with 95% confidence intervals (CIs) were computed. Both univariable and multivariable logistic regression analyses were performed to identify factors associated with diabetes screening uptake.

Results

The weighted prevalence of diabetes screening was 14.7% (95% CI: 13.9–15.4). Screening prevalence was higher among females (15.3%), respondents aged 45 years and above (28.9%), those with higher education (37.5%), those in the richest wealth quintile (26.1%), respondents with health insurance (38.1%), urban residents (19.9%), and individuals with hypertension (31.4%). From the multivariable analysis, respondents aged 45 years and above (aOR = 3.32, 95% CI: 2.84–3.90), those with higher education (aOR = 1.89, 95% CI: 1.45–2.47), living with hypertension (aOR = 1.70, 95% CI: 1.49–1.94), and those in the richest wealth quintile (aOR = 1.44, 95% CI: 1.11–1.85), had higher odds of screening. Conversely, males (aOR = 0.75, 95% CI: 0.65–0.85) and smokers (aOR = 0.84, 95% CI: 0.71–1.00) had lower odds of screening. Residents of all other regions had lower odds of screening compared to those in Lusaka.

Conclusion

Diabetes screening uptake in Zambia remains low at approximately 15%, indicating gaps in preventive service utilisation. We found out that diabetes screening is associated with socioeconomic status, health system access, and health risk profiles. Strengthening integration of diabetes screening into

primary healthcare services, expanding health insurance coverage, and improving targeted awareness campaigns may improve screening uptake.

Introduction

Diabetes represents one of the most urgent public health challenges of the 21st century, affecting an estimated 830 million adults worldwide and contributing to over 6.7 million deaths annually [1,2]. With a projected increase in burden to over 12.2% of adults globally by 2045, diabetes is estimated to be one of the steadily growing diseases affecting adults aged 20–79 years old [3]. This is backed up by the Global Burden of Disease (GBD), which ranked the disease as the eighth leading cause of all deaths [4,5]. According to the International Diabetes Federation (IDF), the number of adults with diabetes rose to approximately 589 million in 2024, compared with 537 million in 2021 and 151 million in 2000, with lower- and middle-income countries (LMICs) disproportionately affected [2,3].

Sub- Saharan Africa (SSA) bears a significant and rapidly growing burden of diabetes. The prevalence of diabetes among adults in SSA has been estimated to rise from 19.8 million in 2013 to 41.5 million by 2035, [6,7], representing an increase of over 110% in less than four decades [8,9]. Within the Southern African region, the International Diabetes Federation (IDF) estimates the burden at 4.2 million adults[3,10], with approximately 1.9 million cases remaining undiagnosed across the region as of 2021 [3]. Addressing the increasing burden of diabetes requires the scale-up of various prevention and screening interventions.

Overall, the WHO approximates that over 230 million people still live with undiagnosed diabetes worldwide, which could point to suboptimal screening uptake [3]. More than 80% of people living with diabetes reside in LMICs, with over half of the population undiagnosed [11]. In Africa, screening for diabetes remains largely opportunistic, attributed to socioeconomic and healthcare infrastructure disparities within the region [7]. Additionally, the growing burden of infectious diseases, such as HIV and tuberculosis, within the region has shifted screening focus from population-wide screening to only targeting these specific clinical cohorts [12].

Several programs have been implemented to address the growing burden of NCDs. In 2021, the WHO launched the Global Diabetes Compact, which aims to ensure that at least 80% of people living with diabetes are diagnosed [13,14]. To amplify these efforts, the United Nations High-Level Meeting (HLM4) on NCDs emphasized the need to strengthen healthcare systems to improve the prevention, screening, and treatment of NCDs, such as diabetes, by 2030 [15]. Through these initiatives, many countries, including Zambia, introduced proactive screening into their National NCDs screening guidelines to detect the disease early, [16], inform effective treatment [17], and improve management outcomes [18].

Zambia, a low-income country in Southern Africa, continues to be significantly affected by the rising diabetes burden. It is estimated that, as of 2021, out of the approximately 18 million adults in Zambia, over 725,000 lived with diabetes [3,17]. These statistics rank the country third-highest in diabetes burden

within Africa [19]. Moreover, Zambia has a high rate of undiagnosed diabetes estimated at 386,900 adults, which is approximately 53% of all diabetes cases[17]. The high rate of undiagnosed diabetes in Zambia necessitates the scale-up of screening interventions to ensure early detection and management, which ultimately improves the treatment outcomes.

Zambia's screening uptake mirrors broader African patterns and remains critically insufficient despite national screening guidelines. The 2017 national STEPS survey revealed that over 75% of diabetic patients in the country were previously unaware[20]. Moreover, other studies in Lusaka, the country's capital, also showed critically low screening uptake among people living with HIV, with less than 10% of that population reported to have been screened [21]. This is despite over 40% of adults reporting having at least one indicative symptom of diabetes [16]. Similar findings from HIV centres within Kabwe and Kitwe revealed that despite the high correlation between HIV and diabetes, barely 8% of the population were screened [16].

Previous studies in SSA have highlighted socioeconomic, sociodemographic, contextual, behavioural, clinical, and exposure to media as key determinants of diabetes screening uptake [21–29]. For example, a study conducted in four sub-Saharan African countries linked older age, semi-rural residents, secondary education, and hypertension status to an increased likelihood of screening [22]. Female sex, being in marital union, perceived susceptibility, higher education attainment, higher income, and being employed have been associated with higher screening uptake and being within the region [24,25]. Conversely, limited awareness of the disease outcomes, low socioeconomic background, and younger age have consistently been associated with reduced likelihood of undergoing screening [24,25,27,28].

Although several studies have provided insights into the global and regional burden of diabetes, there is limited research focusing on screening, especially in Zambia. Existing literature in Zambia is often fragmented, with limited evidence on population-level factors associated with screening uptake [16,21]. For instance, Baumgartner and colleagues focused their study on finding out how diabetes screening has been integrated among people living with HIV (PLWH) within two urban HIV clinics in Kabwe and Kitwe [16]. Moreover, Flowoshi et al. restricted their study to diabetes screening among patients with tuberculosis within a tertiary hospital in Zambia [21]. Findings from these two studies elaborated screening among high-risk clinical populations, without producing evidence of screening uptake in the entire Zambian context. Moreover, the 2017 national STEPS survey conducted in Zambia focused on the burden and associated risk factors of diabetes and prediabetes, without examining the prevalence of screening and the relationship between screening and demographic predictors [20]. To address this gap, the current study utilised the nationally representative 2024 ZDHS to examine factors associated with diabetes screening. By identifying population-level facilitators of screening, the study aims to inform targeted investigations to increase early detection, reduce the burden of undiagnosed diabetes, and ultimately improve health outcomes and reduce diabetes-related mortality in Zambia and similar settings.

Methods

Study Setting

Zambia is a low-income country in Southern Africa, with an estimated population of 21.9 million as of 2025 [30]. The country is divided into ten administrative provinces, 116 districts, and 156 constituencies, and consists mainly of a young population, with the majority (54.5%) living in rural areas [30,31]. Although the country's economy is heavily dependent on copper mining and agriculture [32,33], Zambia has faced major socioeconomic challenges and was ranked 6th-highest in global poverty rates in 2022[34]. The healthcare system in the country is organised into a three-tiered referral structure, including primary, secondary, and tertiary levels, and healthcare provision heavily relies on government funding, donor support, health insurance, and out-of-pocket expenditure [35]. The country adopted policies such as the National Strategic Plan (NHSP) 2022 to 2026 and the National Health Policy to strengthen universal health coverage and boost efforts towards eliminating diseases in the region [35]. However, Zambia continues to experience major epidemiological challenges, and was ranked as having the third-highest burden of diabetes in Africa, with an average age-standardised burden of 10% among adults aged 20–79 years[19].

Study Design and Data Source

We performed a secondary analysis of the 2024 Zambia Demographic and Health Survey (ZDHS). The 2024 ZDHS employed a two-stage stratified cluster design, involving the selection of enumeration areas in the first stage, followed by the sampling of households from each enumeration area in the second stage [31]. In the first stage, 545 clusters representing enumeration areas were selected, followed by the selection of 13,625 households in the second stage, out of which 12,808 were interviewed successfully [31]. The response rates were 97% for women aged 15–49 and 94% for men aged 15–59. Additional details regarding the ZDHS are described elsewhere [31].

Study Population and Sample Size

The study included women (aged 15–49) and men (aged 15–59) in Zambia who had complete information on diabetes screening status and the selected covariates. We appended the Male Recode (MR)– 12,585 observations for males– datasets and the Individual Recode (IR)–13,951 observations for women– datasets, resulting in 26,536 observations in the combined dataset. The final sample consisted of 26,508 adults after excluding 28 missing observations on the outcome and independent variables.

Outcome variable

We used the question "ever had blood sugar measured by a doctor or other healthcare worker" to construct the outcome variable "Diabetes Screening". Individuals who answered “no” and “don't know” were coded as "0" for "Not Screened," while those who answered “yes” were coded as "1" for "Screened". We considered this approach to ensure that screening results fully reflected those who had memorable contact with diabetes screening services to avoid overestimating findings or introducing bias.

Independent variables

Independent variables were selected based on empirical literature and their availability in the dataset [21–29]. The selected variables were used to develop a conceptual framework, which included sociodemographic, socioeconomic, contextual, behavioural/clinical, and media exposure factors (Fig. 1). Sociodemographic factors included sex, age group, education level, marital status, and religion, while socioeconomic factors included working status, wealth status, and health insurance. For contextual factors, residence and region were included, while behavioural and clinical factors entailed smoking status, alcohol use status, and hypertension status. On the other hand, media exposure factors included exposure to radio, television, newspapers or magazines, and the internet (Table 1).

Table 1
Operational Definition of Explanatory Variables

Domain	Variable	Categories
Sociodemographic factors	Sex	Female, male.
	Age	15–24, 25–34, 35–44, 45 + years.
	Education level	No education, primary, secondary, higher.
	Marital status	Not in union, in union
	Religion	Catholic, Protestant, Muslim, Other.
Socioeconomical factors	Working status	Not working, Informal work, Formal work.
	Wealth status	Poorest, poorer, middle, richer, richest.
	Health insurance	Not covered, covered.
Contextual factors	Residence	Urban, rural.
	Region	Lusaka, Central, Copperbelt, Eastern, Luapula, Muchinga, Northern, North Western, Southern, Western.
Behavioural/ clinical factors	Smoking status	Not smoking, smoking.
	Alcohol use status	Never consumed, consumed.
	Hypertension status	Normotensive, hypertensive.
Media Exposure	Exposure to newspaper or magazine	Not exposed, exposed.
	Exposure to radio	Not exposed, exposed.
	Exposure to television	Not exposed, exposed.
	Exposure to the internet	Not exposed, exposed.

Statistical Analysis

We used Stata version 17 (Stata Corporation, College Station, Texas) [36] to clean and analyse data. Frequencies and percentages were used to describe the distribution of sample characteristics. We performed weighted analysis using the "svy" command in Stata and applied sample weights to account for the clustered sampling design. Weighted proportions and confidence intervals (CIs) were used to summarise the prevalence of diabetes screening by predictors. Before performing the multivariable logistic regression analysis, multicollinearity was assessed using the Variance Inflation Factor (VIF) and tolerance (1/VIF), where a VIF value < 10 and tolerance > 0.1 indicated no multicollinearity [37]. Univariable

logistic regression analysis was used to assess the crude relationship between each independent variable and the outcome, and crude odds ratios (cOR) and 95% CIs were reported. Based on a *p*-value of ≤ 0.25 and clinical relevance [38], all variables from the univariable analysis were included in the multivariable logistic regression and used to identify factors associated with diabetes screening in Zambia. Adjusted odds ratios (aOR) and 95% CIs were reported, with statistical significance determined using a p-value <0.05. We used the likelihood ratio test (LRT), Hosmer- Lemeshow test, Akaike information criterion (AIC), and Bayesian Information Criterion (BIC) to assess goodness of fit and select the final model.

As a sensitivity analysis, we performed multi-level logistic regression analyses to examine the factors associated with diabetes screening, after inter-cluster variations. We fitted five models, which included: 1) the null model; 2) a model with individual-level factors only; 3) a model with household factors only; 4) a model with community-level factors only, and; 5) a full model combining all factors. We used the inter-class correlation coefficient (ICC) to measure the cluster-level variation in diabetes screening uptake. We then used AIC and BIC to select the best model. Results were presented using aORs and 95% CIs.

Results

Sample Characteristics

This study included 26,508 adults, most of whom were female (52.6%), aged 15–24 (41.8%), and had a secondary level of education (45.7%). The majority of the respondents were informal workers (51.9%), in marital union (52.5%), lived in rural areas (58.4%), and were not exposed to a newspaper or magazine (83.6%). Nearly all participants were not covered by health insurance (91.1%), normotensive (92.5%), and did not smoke (90.6%). Wealth distribution was relatively equal across quintiles, with the middle class slightly higher (20.9%) **(**Table 2**)**

Table 2
Sample Characteristics (N = 26,508)

Variable	Frequency (n)	Percentage (%)
Sex	**13,941**	**52.6**
Female	**12,567**	**47.4**
Male		
Age	**11,088**	**41.8**
15–24	**7,104**	**26.8**
25–34	**5,298**	**20.0**
35–44	**3,018**	**11.4**
45+		
Education level	1,536	5.8
No formal	10,910	41.2
Primary	12,100	45.7
Secondary	1,962	7.4
Higher		
Marital status	12,593	47.5
Not in union	13,915	52.5
In union		
Religion	3,891	14.7
Catholic	22,300	84.1
Protestant	127	0.5
Muslim	190	0.7
Other		
Working status	9,158	34.6
Not working	13,763	51.9
Informal work	3,587	13.5
Formal work		
Wealth status	5,413	20.4
Poorest	5,495	20.7

Poorer	5,528	20.9
Middle	5,074	19.1
Richer	4,998	18.9
Richest		
Health insurance	24,157	91.1
Not covered	2,351	8.9
Covered		
Residence	11,032	41.6
Urban	15,476	58.4
Rural		
Region	3,120	11.8
Lusaka	3,209	12.1
Central	2,929	11.1
Copperbelt	3,085	11.6
Eastern	2,355	8.9
Luapula	1,950	7.4
Muchinga	2,446	9.2
Northern	2,214	8.4
North western	3,058	11.5
Southern	2,142	8.1
Western		
Smoking status	24,027	90.6
Not smoking	2,481	9.4
Smoking		
Alcohol status	20,134	76.0
Never consumed	6,374	24.1
Consumed		

Hypertension status	24,509	92.5
Normotensive	1,999	7.5
Hypertensive		
Exposure to newspaper or magazine	22,161	83.6
Not exposed	4,347	16.4
Exposed		
Exposure to radio	13,462	50.8
Not exposed	13,046	49.2
Exposed		
Exposure to television	15,283	57.7
Not exposed	11,225	42.4
Exposed		
Exposure to the internet	18,216	68.7
Not exposed	8,292	31.3
Exposed		

Prevalence of Diabetes Screening in Zambia

The weighted prevalence of diabetes screening in Zambia was 14.7% (95% CI:13.9–15.4). The highest screening rates were observed among females (15.2%), individuals aged 45 years and above (26.3%), those with higher education (37.5%), and those in union (18.9%). Notably high uptake was also seen among muslims (24.9%), those in formal work (26.5%), individuals from the richest wealth quintile (26.1%), and those with health insurance coverage (38.1%). Geographically, Lusaka (24.5%) recorded the highest regional screening prevalence, with urban residents (19.9%) also recording higher screening estimates compared to the rural residents (9.6%) (Table 3**).**

Table 3
Prevalence of Diabetes Screening in Zambia

Variable	%	95% CI
Sex	**15.2**	**14.3, 16.1**
Female	**14.1**	**13.0, 15.2**
Male		
Age	**6.9**	**6.2, 7.6**
15–24	**16.3**	**15.2, 17.4**
25–34	**21.8**	**20.3, 23.3**
35–44	**26.3**	**24.4, 28.3**
45+		
Education level	9.6	7.9, 11.6
No formal	10.6	9.8, 11.4
Primary	14.5	13.5, 15.5
Secondary	37.5	34.9, 40.1
Higher		
Marital status	10.0	9.2, 10.9
Not in union	18.9	17.9, 19.9
In union		
Religion	15.9	14.2, 17.9
Catholic	14.4	13.7, 15.1
Protestant	24.9	13.5, 41.5
Muslim	14.0	9.4, 20.3
Other		
Working status	10.3	9.4, 11.3
Not working	14.1	13.3, 15.0
Informal work	26.5	24.4, 28.6
Formal work		
Wealth status	7.5	6.6, 8.6
Poorest	8.9	8.0, 9.8
Poorer	11.2	10.2, 12.3

Middle	16.2	15.0, 17.5
Richer	26.1	24.3, 27.9
Richest		
Health insurance	12.0	11.4, 12.7
Not covered	38.1	35.6, 40.7
Covered		
Residence	19.9	18.6, 21.2
Urban	9.6	8.9, 10.4
Rural		
Region	24.5	22.0, 27.2
Lusaka	13.8	12.2, 15.5
Central	16.8	14.7, 19.2
Copperbelt	12.4	10.5, 14.7
Eastern	9.7	8.0, 11.7
Luapula	10.7	9.1, 12.5
Muchinga	7.6	6.1, 9.5
Northern	16.5	13.6,19.9
North western	12.0	10.5, 13.6
Southern	7.2	6.0, 8.7
Western		
Smoking status	14.9	14.2, 15.6
Not smoking	12.2	10.5, 14.1
Smoking		
Alcohol status	13.4	12.7,14.2
Never consumed	18.3	16.9,19.9
Consumed		
Hypertension Status	13.2	12.5, 14.0
Normotensive	31.4	28.9, 33.9
Hypertensive		
Exposure to newspaper or magazine	13.26	12.54, 14.0

Not exposed	21.38	19.9, 23.0
Exposed		
Exposure to radio	11.43	10.6,12.3
Not exposed	17.72	16.7, 18.8
Exposed		
Exposure to television	10.34	9.6, 11.1
Not exposed	19.59	18.4, 20.8
Exposed		
Exposure to the internet	10.08	9.5, 10.7
Not exposed	22.97	21.5, 24.5
Exposed		

Factors Associated with Diabetes Screening in Zambia

From the univariable regression analyses, being older, having a higher education, being in a marital union, having formal employment, and being from a richer wealth quintile were among the factors associated with diabetes screening in the general population. In multivariable logistic regression analysis, males had 25% (aOR: 0.75, 95% CI: 0.65, 0.85) lower odds of screening compared to females. The odds of screening increased progressively with age: Compared to individuals aged 15–24 years, those aged 45 years and above had 3.3 times higher odds of screening (aOR: 3.32, 95% CI: 2.84, 3.90). Compared to having no formal education, respondents with secondary and higher education had 30% (aOR: 1.30, 95% CI: 1.03, 1.63) and more than one-fold (aOR: 1.89, 95% CI: 1.45, 2.47) increased odds of diabetes screening, respectively. Those exposed to newspaper, radio, and internet had 16% (aOR: 1.16, 95% CI: 1.04, 1.29), 17% (aOR: 1.17, 95% CI: 1.06, 1.29) and 36% (aOR: 1.36, 95% CI: 1.20, 1.53) higher odds of screening, respectively, compared to those not exposed to any of those media. Additionally, those in marital union were more than 1.3 times (aOR: 1.36, 95% CI: 1.23, 1.51) highly likely to be screened compared to those not in union. Wealth quintiles recorded progressively increasing odds in screening, with the richest having 44% (aOR: 1.44, 95% CI: 1.11, 1.85) increased likelihood of screening compared to the poorest wealth category. Respondents covered by health insurance had 76% (aOR: 1.76, 95% CI: 1.54, 2.02) higher odds of screening compared to those without. Those living with hypertension had 70% (aOR 1.70, 95% CI 1.49, 1.94) increased odds of screening than those without hypertension, while respondents smoking had 16% (aOR 0.84, 95% CI 0.71, 1.00) reduced odds of diabetes screening compared to non-smokers. Regional variations persisted with adjustment, where, compared to Lusaka, all other regions recorded lower odds of screening (Table 4).

Table 4
Factors associated with Diabetes Screening in Zambia

Variable	Bivariate logistic regression analysis	Multivariable logistic regression analysis
	cOR (95% CI)	aOR (95% CI)
Sex	**1**	**1**
Female	**0.92 [0.82, 1.03]**	**0.75 [0.65, 0.85]*** **
Male		
Age	1	1
15–24	**2.63 [2.34, 2.95]*** **	**1.70 [1.49, 1.94]*** **
25–34	**3.76 [3.31, 4.28]*** **	**2.45 [2.11, 2.84]*** **
35–44	**4.82 [4.21, 5.53]*** **	**3.32 [2.84, 3.90]*** **
45+		
Education level	1	1
No formal	1.12 [0.90, 1.39]	1.21 [0.98, 1.50]
Primary	**1.60 [1.27, 2.01]*** **	**1.30 [1.03, 1.63]***
Secondary	**5.66 [4.47, 7.17]*** **	**1.89 [1.45, 2.47]*** **
Higher		
Marital status	1	1
Not in union	**2.08 [1.90, 2.28]*** **	**1.36 [1.23, 1.51]*** **
In union		
Religion	1	1
Catholic	0.89 [0.77, 1.02]	0.94 [0.81, 1.09]
Protestant	1.75 [0.85, 3.62]	1.26 [0.66, 2.38]
Muslim	0.86 [0.53, 1.38]	0.90 [0.55, 1.46]
Other		
Working status	1	1
Not working	**1.43 [1.28 1.60]*** **	**1.12 [0.99, 1.26]**

Note: Bold represents statistically significant values. * represent p-value ≤ 0.05, while ** represents p-value < 0.01 and * represents p-value < 0.001**

Variable	Bivariate logistic regression analysis	Multivariable logistic regression analysis
	cOR (95% CI)	**aOR (95% CI)**
Sex	**1**	**1**
Female	**0.92 [0.82, 1.03]**	**0.75 [0.65, 0.85]*** **
Male		
Informal work	**3.14 [2.74, 3.60]*** **	**1.13 [0.98, 1.31]**
Formal work		
Wealth status	1	1
Poorest	**1.19 [1.01, 1.41]***	1.02 [0.87, 1.21]
Poorer	**1.55 [1.30, 1.84)*** **	**1.17 [0.98, 1.40]**
Middle	**2.37 [2.00, 2.81]*** **	**1.24 [1.00, 1.53]***
Richer	**4.32 [3.63, 5.14]*** **	**1.44 [1.11, 1.85]** **
Richest		
Health insurance	1	1
Not covered	**4.52 [4.01, 5.09]*** **	**1.76 [1.54, 2.02]** * *
Covered		
Residence	1	1
Urban	**0.43 [0.38, 0.48]*** **	0.88 [0.75, 1.02]
Rural		
Region	1	1
Lusaka	**0.49 [0.40, 0.60]*** **	**0 .70 [0.56, 0.86]** **
Central	**0.62 [0.50, 0.77]*** **	**0.63 [0.52, 0.76]*** **
Copperbelt	**0.44 [0.35, 0 .55]*** **	0.85 [0.66,1.10]
Eastern	**0.33 [0.26, 0.43]*** **	**0.57 [0.44, 0.75]*** **
Luapula	**0.37 [0.29,0.46]*** **	**0.62 [0.48, 0.79]*** **
Muchinga	**0.25 [0.19, 0.34]*** **	**0.43 [0.33, 0.56]*** **

Note: Bold represents statistically significant values. * represent p-value ≤ 0.05, while ** represents p-value < 0.01 and * represents p-value < 0.001**

Variable	Bivariate logistic regression analysis	Multivariable logistic regression analysis
	cOR (95% CI)	aOR (95% CI)
Sex	**1**	**1**
Female	**0.92 [0.82, 1.03]**	**0.75 [0.65, 0.85]*** **
Male		
Northern	**0.61 [0.47, 0 .80]*** **	0.97 [0.76, 1.24]
North western	**0.42 [0.34, 0.51]*** **	**0.61 [0.50, 0 .75]*** **
Southern	**0.24 [0.19, 0.31]*** **	**0.39 [0.31, 0.50]*** **
Western		
Smoking status	1	1
Not smoking	**0.79 [0.68, 0 .93]** **	**0.84 [0 .71, 1.00]***
Smoking		
Alcohol status	1	1
Never consumed	**1.45 [1.30, 1.60]*** **	1.08 [0.97, 1.20]
Consumed		
Hypertension Status	1	1
Normotensive	**3.00 [2.66, 3.39]*** **	**1.70 [1.49, 1.94]*** **
Hypertensive		
Exposure to newspaper or magazine	1	1
Not exposed	**1.78 [1.61, 1.96]*** **	**1.16 [1.04, 1.29]** **
Exposed		
Exposure to radio	1	1
Not exposed	**1.67 [1.51, 1.85]*** **	**1.17 [1.06, 1.29]** **
Exposed		
Exposure to television	1	1
Not exposed	**2.11 [1.90, 2.35]*** **	0.98 [0.87, 1.10]

Note: Bold represents statistically significant values. * represent p-value ≤ 0.05, while ** represents p-value < 0.01 and * represents p-value < 0.001**

Variable	Bivariate logistic regression analysis	Multivariable logistic regression analysis
	cOR (95% CI)	aOR (95% CI)
Sex	**1**	**1**
Female	**0.92 [0.82, 1.03]**	**0.75 [0.65, 0.85]*** **
Male		
Exposed		
Exposure to the internet	1	1
Not exposed	**2.66 [2.39, 2.96]*** **	**1.36 [1.20, 1.53]*** **
Exposed		
Note: Bold represents statistically significant values. * represent p-value ≤ 0.05, while ** represents p-value < 0.01 and * represents p-value < 0.001**		

Model Diagnostics

Following Spearman's correlation coefficient, the highest correlation coefficient (r) was − 0.7214, with no r value > 0.8 [39]. The mean VIF was also 1.50, and the least tolerance was 0.301875, indicating no problematic multicollinearity among predictor variables [37] (Supplementary Table 1). Having produced the lowest AIC (18250.94), BIC (18545.61), and Log Likelihood Ratio p-value of 0.0000, and highest goodness of fit (0.2541), model 5 was selected as the best model (Supplementary Table 2).

Sensitivity Analysis Results

The full model of our multilevel analysis was the best-fitting model, and the results were consistent with those of our primary multivariable logistic regression analysis. Those aged 45 years and above, having secondary and higher education level, being in a union, having health insurance, being hypertensive, having exposure to newspapers, radio, or internet were associated with increased odds of diabetes screening. Conversely, males and smokers had reduced odds of diabetes screening. Contrary to our primary multivariable logistics regression analysis, in the multilevel analysis, working in formal work was associated with increased odds of diabetes screening, while wealth status did not have any statistical significance regarding diabetes screening (Supplementary Table 3) and (Supplementary Table 4)

Discussion

This study examined the prevalence and factors associated with uptake of diabetes screening in Zambia. The weighted prevalence of diabetes screening in Zambia is approximately 14.7% screened. However, screening uptake was slightly higher among older populations, females, individuals with higher

education, those in marital unions, those with higher socioeconomic status, individuals covered by health insurance, respondents living with hypertension, and those with higher media exposure. Compared to Lusaka, other regions had lower odds of screening.

Studies in Africa have documented similar patterns in screening: for instance, in South West Nigeria, 31% of the study population had been screened [40]. In Ethiopia, the pooled prevalence of undiagnosed diabetes was 5.75% (95% CI: 3.9–7.59), suggesting that proactive screening has not been fully implemented [26]. Previous studies in Lusaka also revealed a similar pattern, where, out of 4.7% of all participants who were found to have diabetes, 2.3% of that total were discovered during the study [21]. Our established prevalence was, however, lower than results from similar DHS findings in Lesotho, where 29.2% (95% CI: 27.7, 30.8) had been screened, although the focus population was women only [27]. The variations in screening rate could be attributed to the lack of integration of diabetes screening into primary health care frameworks, resulting in missed opportunities for diagnosis [20]. Moreover, screening for diabetes in Zambia has been concentrated on high-risk populations, such as PLWH and those with diabetes, an approach that limits universal screening and calls for the scale-up of more community-based screening approaches [16,21].

The odds of diabetes screening increased with advancing age, with those aged 45 and older having more than three times the likelihood of screening compared to the younger groups. These results align with findings from Lesotho, Burkina Faso, and Ethiopia, where older age was highly associated with screening uptake [26,27,41]. Wade and colleagues argued that increased age was directly related to exposure to diabetes knowledge, which could, in turn, increase diabetes screening uptake [22]. Additionally, older adults are more likely to interact with healthcare systems due to age-related health conditions and routine medical care, increasing opportunities for provider-initiated screening [22,41]. Advancing age is also associated with increased risk of comorbidities such as hypertension and obesity, which may heighten both individual risk perception and clinical recommendation for screening [41]. Screening uptake is possibly lower among younger populations since they may lack urgency, as lifestyle diseases like diabetes have, over time, been associated with older people, and the young may feel safe as symptoms have not yet manifested [24].

Our study found that men were less likely to undergo diabetes screening compared to women, congruent with other studies in Africa [26,27,41]. In their study, Wade et al. established that women were at a higher risk of developing diabetes compared to men (6.1% vs 4.9%), respectively, and this may increase their perceived biological risk of contracting NCDs such as diabetes, prompting many women to seek preventive services [22]. Additionally, women have a high contact with primary healthcare services, especially when seeking maternal and gynaecological services, exposing them to provider-initiated screening to rule out risks related to pregnancy and childbirth [27]. Men are, however, disadvantaged by sociocultural expectations of masculinity, which expect them to hide any sign of weakness, reducing their health-seeking behavior [42]. Some study findings have highlighted the scarcity of male healthcare providers as a limiting factor to the uptake of preventative services among men, as they are ashamed to

expose their vulnerability to female primary service providers, citing fear of facing stigma or being gossiped about in the communities for their weaknesses [23,42].

Higher educational attainment was associated with an increased likelihood of screening. This finding is consistent with other studies conducted in Kenya, Nigeria, and Namibia, which also reported higher screening uptake among educated individuals [28,40,43]. Level of education was, however, not a statistically significant predictor of screening uptake in a study in Tanzania [23]. As a determinant, literature has established that having a secondary level of education or higher increases exposure to health knowledge and literacy of non-communicable diseases, such as diabetes, improving their awareness of the importance of preventive healthcare and early detection, hence the high uptake [22]. In Nigeria, for instance, individuals with no formal education were not aware of the existence of screening compared to postgraduates, reducing their willingness to be screened for diabetes [40]. Higher education attainment is also often linked to better socioeconomic status, enabling educated individuals to subscribe to premium medical schemes and afford financial allowances that can cater for indirect costs such as transport to health facilities, which together enhance access to advanced, quality healthcare services, including diabetes screening [44]. Those with no formal education could, however, find services unaffordable or enrol in health insurance schemes that do not provide adequate coverage of preventative services such as diabetes screening due to a lack of adequate information on the best options [24,40,44].

Marital status was a proxy measure for diabetes screening uptake in Zambia. Those in union had higher odds of screening than those not in union (aOR: 1.36, 95% CI: 1.23, 1.51), findings that are consistent with other NCD studies in Africa [24,45]. Some studies have, however, found that screening was higher among the divorced, while others did not establish a statistical association between marital status and uptake of diabetes screening [22,25]. Higher screening uptake among those in unions can be attributed to financial support from marital partners, which reduces fear and anxiety of medical debts, increasing proactive health-seeking behaviour, such as screening for diabetes [24,29,45]. Moreover, partners offer social and psychological support, such as accompanying their spouses to primary health facilities, which may increase screening uptake, as empirical literature has established that lack of company to health facilities is associated with high drop-offs in uptake of preventive health services [25].

Wealth status was a key predictor of diabetes screening in Zambia, with individuals in wealthier quintiles having a higher likelihood of screening than those in the poorest quintile. Our findings align with those from other studies in Sub-Saharan Africa, where higher wealth status was a protective factor against missed opportunities in diabetes screening [23,27,28]. According to Mekonen and the team, the rich can afford better health services, which enable them to seek the most current treatments proactively, including screening for NCDs such as diabetes [27]. The poorest-poor groups, however, tend to prioritise day-to-day tasks that can make them earn a meal over their health [28]. Wealthier quintiles are also associated with a sedentary urban or periurban lifestyle and physical inactivity, which may increase their perceived risk of acquiring diabetes, hence the increased urge to screen [25,46,47].

Health insurance (HI) coverage was an important factor associated with diabetes screening uptake in Zambia. These findings mirror other studies from Tanzania and Kenya, where health insurance financing improved access to diabetes and hypertension care [44,48]. Medical schemes provide financial security by reducing out-of-pocket costs, increasing consistent access to healthcare services, including preventative services such as diabetes screening [26,48]. In Kenya, the utilisation of outpatient NCD services increased among those with insurance due to better health-seeking behaviour and ability to subscribe to premiums, which enhanced their management compared to uninsured individuals, where financial constraints posed barriers to using healthcare services [44]. In Zambia, the majority of those who lack health insurance live in extreme poverty and are often unempowered, as they depend on financial support from other people, making them unable to make health decisions by themselves, including diabetes screening [16,21].

Compared to Lusaka, other Zambian regions had a reduced likelihood of diabetes screening uptake. These results match those observed in earlier studies in Kabwe and Kitwe, towns found in the Central and Copperbelt regions, respectively, where screening was generally low [16]. As the capital city of Zambia, Lusaka has been given an urban focus, making it a focal point for preventive healthcare services due to its large population[49]. For instance, the Lusaka region has many well-equipped healthcare facilities staffed by highly specialised healthcare providers, making it easier to deliver centralised, advanced diagnostic services [49]. Additionally, diabetes screening has been integrated with HIV care within Lusaka, efforts that have intensified onboarding specialised staff required to handle population-wide screening of both infectious and NCDs within the region, unlike other rural and periurban regions in Zambia [21].

Smoking was inversely associated with diabetes screening. Although many African studies have identified smoking as a risk factor to diabetes [50,51], victims tend to skip screening [52]. This could be attributed to the poor health seeking behaviour among smokers due to a belief that what they do not know will not kill them, making them avoid screening [45]. Moreover, the smoking population may perceive themselves to be at a greater risk of diabetes, making them fear screening, as any instance of diagnosis would mean their lifestyle may be modified, and they may be forced to cease smoking [25,45]. Smoking behavior is also more common among the male population, and due to stereotypes of masculinity, the population may avoid screening to protect their dignity [22,42]. Concerted efforts are required to ramp up diabetes screening among the smoking population due to their already increased risk of diabetes in order to reduce the epidemiological and economic burden of diabetes in Zambia.

We found a significant correlation between hypertension status and uptake of diabetes screening, with people living with hypertension having the highest uptake. This result is consistent with those from previous studies in the Democratic Republic of Congo, Burkina Faso, Namibia, and South Africa, where hypertension positively correlated with screening for diabetes [28,41,53]. Traoré and colleagues illustrated that living with hypertension increased the risk of diabetes (aOR: 2.92, 95% CI: 1.64–5.19), which may prompt health service providers to integrate diabetes screening into hypertension services, increasing chances of opportunistic diabetes screening for patients seeking hypertension care [41]. Patients with

hypertension could also have self-perceived susceptibility to diabetes, and increased knowledge of diabetes, which may influence their self-initiated routine glucose level checkups and wellness clinic visits [22].

Exposure to radio, newspaper and internet was also associated with increased likelihood of screening uptake. These results are consistent with those in Ghana, where exposure to health messages through television and social media recorded 1.7 times (aOR 1.77, 95% CI:1.12– 2.58) and 15% (aOR 1.15, 95% CI: 1.05, 1.68) higher likelihood to uptake diabetes screening services, respectively [54]. Exposure to NCD knowledge and campaigns increases awareness of the condition and its complications, igniting a desire to seek preventive services to remain healthy [29]. Moreover, the media could disseminate diabetes information, breaking some beliefs that people may have associated diabetes with witchcraft or a curse, shaping their perceptions, hence increasing screening uptake [43,54]. On the contrary, a majority of those lacking exposure to any media usually miss firsthand information about the benefits of screening, leading to delays in seeking conventional medical services such as diabetes screening [25,45].

Strengths and Limitations

To the best of our knowledge, this study is among the first to assess factors associated with diabetes screening in Zambia using the 2024 nationally representative DHS dataset. The study contributes to the evidence needed to improve the uptake of diabetes screening within Zambia and similar settings. The use of a nationally representative dataset makes our findings generalisable to the Zambian population while still pinpointing the real status of screening uptake among individual groups.

However, the study also has limitations. Being cross-sectional makes it impossible to infer causality. Additionally, diabetes screening was self-reported, predisposing findings to response and recall bias. Our DHS analysis was also restricted to men aged 15–59 years and women aged 15–49 years, which could result in missed screening opportunities among the older population who are at the greatest risk of diabetes, and possibly the greatest users of screening services. There could also be miscalculations, since 0.95% of participants who reported “don't know” were recoded as not screened. However, this percentage is low and would not have a substantial effect on the analysis results. Despite the above limitations, this study provides useful insights for informing the design and scaleup of targeted interventions for improving the uptake of diabetes screening in Zambia.

Policy Implications

This study highlights challenges in diabetes screening uptake in Zambia. Findings underscore the need for tailored policies to address each identified gap. First, diabetes screening should be integrated into other structured health programs. Since Zambia has made massive efforts to advance HIV care among its population, linking diabetes screening to the HIV care package would improve screening. Secondly, diabetes care packages should be expanded beyond healthcare settings and regions around the capital city by incorporating community outreach activities to ensure that even those outside the Lusaka region have access to efficient and consistent diabetes education and care. Policymakers should also design

culturally plausible and gender sensitive screening initiatives to help overcome sociocultural barriers that may hinder screening uptake, especially among men. In addition, there is a need to strengthen active surveillance among those living with other NCDs, such as hypertension, at all socioeconomic levels, to ensure knowledge is disseminated to all groups. Lastly, Zambia would benefit from subsidised screening costs and introducing a national health insurance targeting NCDs to address socioeconomic disparities in screening. These multifaceted interventions will enhance diabetes knowledge among the population, improve health-seeking behaviour, and ultimately improve diabetes screening uptake and outcomes in the country and similar contexts.

Conclusion

Results from this study revealed that Zambia still has gaps in diabetes screening that hinder it from meeting the WHO-set targets. Advanced age, female sex, higher education, marital union, higher socioeconomic status, possessing health insurance, having hypertension, and having exposure to newspapers, radio, and the internet were associated with higher odds of diabetes screening. However, there were lower odds of screening among smokers, men, and in many regions within Zambia. These findings emphasise the need to leverage population data to inform evidence-based health policies in Zambia. Context-specific interventions, such as integrating diabetes screening with other primary healthcare services and subsidizing screening costs, will improve access and minimise missed opportunities in screening. Ultimately, there will be an improvement in diabetes prevention, diagnosis, and early initiation of treatment, efforts that will reduce the rates of morbidity and mortality contributed to by diabetes.

Abbreviations

AIC
Akaike Information Criterion
aOR
Adjusted Odds Ratio
BIC
Bayesian Information Criterion
cOR
Crude Odds Ratio
CI
Confidence Interval
DHS
Demographic and Health Survey
HICs
High-income countries
LRT
Likelihood ratio test

LMICs
Lower and middle-income countries
NCDs
Non-communicable Diseases
PLH
People living with HIV
VIF
Variance Inflation Factor
ZDHS
Zambia Demographic and Health Survey

Declarations

The authors have no competing interests to declare.

Ethical approval and consent to participate

We conducted secondary analysis using the 2024 Zambia Demographic and Health Survey, approved by institutional review boards (IRBs) at ICF and the Zambia Government/Medical Research Council (MRC) Joint Ethics Committee in Zambia. Permission to use the data was granted following a formal data request to the program. Since the data are anonymised, this secondary analysis did not require additional ethical approval.

Consent for publication

Not applicable

Competing interests

The authors declare no competing interests.

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Authors' contributions

JOO and CA conceived the study. JOO, CA, CN, DNK, LN, IM, NMN, and CM supervised the study under the Kuza Mentorship Program. NAO analysed the data with inputs from DMM, JOO, CA, CN, DNK, LN, IM, and NMN. NAO drafted the first version of the manuscript, which was subsequently revised by DMM, DNK, LN, IM, NMN, CN, JOO, and CA. All authors critically read and approved the final manuscript for publication.

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Availability of data and materials

Data used in this study can be accessed from the DHS Program website at https://dhsprogram.com/data/available-datasets.cfm.

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Figures

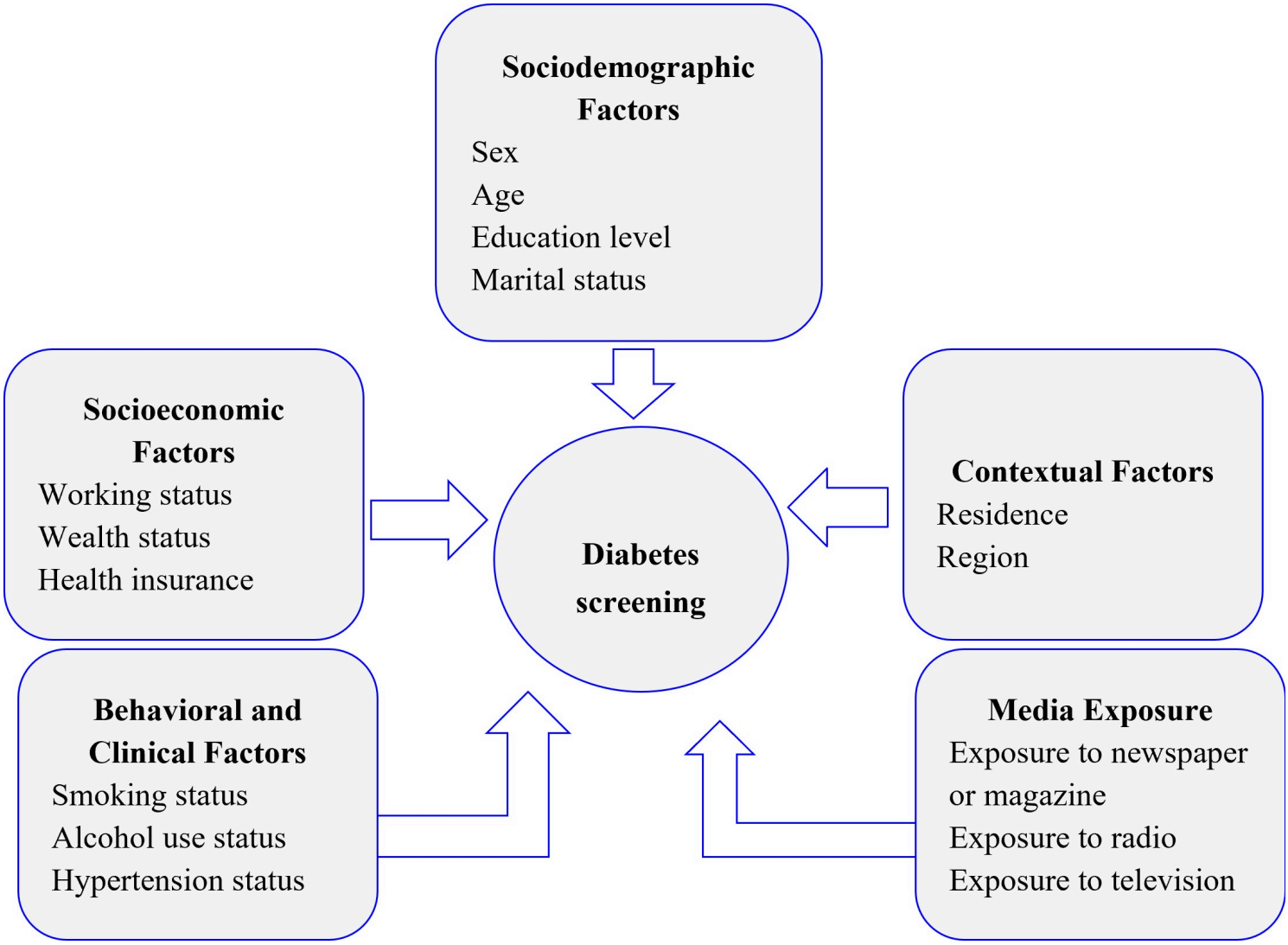


Figure 1

Conceptual Framework for the Association between Diabetes Screening and Independent Variables

Supplementary Files

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- DiabetesScreeninginZambiaSupplementaryTables.pdf