Scientific Research Publishing

Open Journal of Epidemiology, 2026, 16(1), 27-44
https://www.scirp.org/journal/ojepi
ISSN Online: 2165-7467
ISSN Print: 2165-7459

Baseline Report on Geographical and Sociodemographic Disparities in Diabetes Screening, and Compared Lifestyles and Body-Related Features between Ever and Never Screened Adults in Burkina Faso

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How to cite this paper: Diendéré, J., Coulibaly, A., Lanou, H.B., Garanet, F., Zeba, A.N. and Diallo, A.H. (2026) Baseline Report on Geographical and Sociodemographic Disparities in Diabetes Screening, and Compared Lifestyles and Body-Related Features between Ever and Never Screened Adults in Burkina Faso. *Open Journal of Epidemiology*, **16**, 27-44.
https://doi.org/10.4236/ojepi.2026.161003

Received: October 3, 2025
Accepted: December 28, 2025
Published: December 31, 2025

Abstract

Problem Considered: To determine the baseline rate of diabetes screening uptake in Burkina Faso and compare sociodemographic features, lifestyles, and anthropometric and glycaemic characteristics of adults who had ever and never been screened, using the first nationally representative community survey. **Methods**: Secondary-analysis of the cross-sectional study using the first Burkina Faso WHO STEPS survey. The sociodemographic factors, lifestyle awareness and practices and anthropometric and glycaemic features were compared between ever and never screened adults, using Chi-quare, Fisher's Exact and Student tests and logistic regressions, in the sample of 4125 adult participants. **Results**: Only 5.6% (with a wide range from 1.0% to 15.0% across the country's 13 regions) of participants have ever been screened and more frequently by urban people (17.0%), educated (22.7%) earn workers (34.6%), participants who had previously received at least a healthy lifestyle advice from a health professional (10.1%), overweight participants (10.9%), obese (19.5%) and those with abdominal obesity (12.7%). The prevalence of hyperglycaemia was 5.4 % (9.5% and 5.2% in ever and never screened participants, respec-

tively, p = 0.0001). In logistic regression, the un-favourable sociodemographic factors for screening uptake were living in rural area, being young, un-educated, occupied without regular or formal income, while having received at least a healthy lifestyle advice (aOR = 2.1, p = 0.0001), adequate fruit and vegetables consumption (aOR = 1.9, p = 0.028), cleaning the teeth at least twice a-day (aOR = 1.5, p = 0.016), overweight or obese (aOR = 1.5, p = 0.016), increased BMI (aOR = 1.06, p = 0.0001) and abdominal obesity (aOR = 2.1, p = 0.0001) were favourable factors. **Conclusion**: The profile of sociodemographic disparities in diabetes screening matched that observed for hypertension and cervical cancer in Burkina Faso. Efficient dissemination of healthy lifestyles is useful for increasing screening attendance. People with normal or low body weight also need to be specifically encouraged to undergo screening. Community engagement combined with health insurance should help address unmet needs.

Keywords

Diabetes Screening, Disparities, Lifestyles, Overweight, Obesity, WHO STEPS, Burkina Faso

1. Introduction

In the context of the epidemiological transition, diabetes has now become firmly established in low- and middle-income countries (LMICs) and particularly, it is having a dramatically increasing impact and is becoming increasingly prevalent in sub-Saharan Africa (SSA) [1]. This region faces challenges in tackling the disease, including a paucity of funding for non-communicable diseases and a limited availability of population-specific studies and guidelines [2]. Diabetes management is a process, its detection is the crucial stage [3]. If detected and treated early, the outcome is better and the burden is lower. The International Diabetes Federation (IDF) reports that SSA has the highest level of undiagnosed diabetes [4]. Therefore, specific, efficient policies for its diagnosis should be designed for LMICs, including SSA. Sociodemographic, socioeconomic and lifestyle factors interact with diabetes, especially with regard to its prevalence and access to screening and care [5]-[7]. In apparently healthy or asymptomatic subjects, the literature suggests that the uptake of cardiovascular disease (CVD) screening can be impacted by perceived threats [8], including the self-perception of having healthy body traits [9].

The World Health Organization (WHO) recommends the implementation in LMICs, of a national surveillance system for the risk factors for the noncommunicable diseases (stepwise approach to surveillance [STEPS]), especially those for CVD [10]. The WHO STEPS surveys use a standardized tool for data collection, including sections for sociodemographic features, healthy lifestyle awareness and practices, anthropometric and blood glucose measurements [10]. The STEPS survey should regularly be conducted and thus, the first survey can provide the initial

overview focused on diabetes screening uptake, as undertaken for hypertension and cervical cancer screenings [9] [11].

This study aimed to determine the baseline rate of diabetes screening uptake in Burkina Faso and compare sociodemographic features, lifestyle awareness and practices, and anthropometric and glycaemic characteristics of adults who had and had never been screened. The first national community survey was used for this study.

2. Methods

2.1. Description of the First Burkina Faso STEPS Survey

The WHO STEPS surveys use a standardized tool for data collection which includes specific sections on behavioural risk factors (tobacco and alcohol consumption, fruits and vegetables intake, physical activity); anthropometric [body mass index (BMI) and waist circumference (WC)] and fasting blood biochemistry (including glycemia) [10].

The first WHO STEPS survey in Burkina Faso, conducted from 3 September to 24 October 2013, was nationally representative and covered all the country's 13 administrative regions. It involved interviews on behavioural or lifestyle factors as well as anthropometric and FBG measurements [10]. Previous reports on methodology, including sample size calculation, sampling procedure and anthropometric and blood measurements are available elsewhere [9] [11], and only a brief description will be presented for this secondary data analysis study. The survey enrolled 4800 adults aged 25 - 64 years, and face-to-face interviews were conducted in a language spoken by the participant and data captured using personal digital assistants pre-loaded with eSTEPS software.

2.2. Study Area and Geographical Disparities' Examining

Geographical disparities were also examined across the country's 13 administrative regions. Each region has its own specific urbanisation rate, which has been shown in the previous study [11], including a supplementary figure https://ars.els-cdn.com/content/image/1-s2.0-S0398762023004261-mmc1.zip. The nationwide mean rate is 23.3% (minimum = 6.6%, maximum = 85.4%). The three most densely urbanized regions are "Centre" (which includes the political capital, Ouagadougou), "Hauts-Bassins" (which includes the economic capital, Bobo-Dioulasso) and "Cascades", with respective rates of urbanisation of 85.4%, 37.6% and 19.3%.

2.3. Variables Extracted for the Present Analysis

Table 1 specifies details for the variables used in analyses.

The dependent variable was the uptake of diabetes screening by response to the yes/no question, have you ever been screened for diabetes in your lifetime? [10]. The independent variables were: The six sociodemographic factors (sex, age, residency, education level, marital status and occupation). An SSA system-

atic review included lifestyle practices, such as substance (alcohol and tobacco) consumption, fruit and vegetable consumption, physical activity and cleaning the teeth at least twice a-day. We assumed healthy practices can be derived from healthy lifestyle advice. For awareness, the yes/no question on the previously received of the seven healthy lifestyle awareness (advice) during the last 12 months ware asked: the abstention or cessation of i) tobacco, ii) alcohol, iii) reduced sugar diet, iv) adequate fruit and vegetables consumption, v) reduced fat diet, vi) more physical activity and vii) weight control. The lifestyle practices considered have been reported elsewhere [12], but exclusively for the hypertensive participants and were: i) use or not of at least one substance, tobacco/alcohol, ii) the practice or not of a physical activity, iii) the intake or not of at least five fruits and/or vegetables in the typical week and the iv) weight control defined using body mass index (BMI). The last independent variable to be considered is hyperglycaemia [13].

Table 1. Details on the dependent and independent variables extracted from the WHO STEPS baseline survey, for the present secondary analyses.

	Variables	Categorisation	
	Have been ever screened for diabetes, in lifelong (Used as the dependent variable in the multivariate† analyses)	Yes	
		No	
	Sociodemographic characteristics		†
1	Sex	Male	Ref
		Female	
2	Residency	Rural area	Ref
		Urban area	
3	Age range (in years)	25 - 34	Ref
		35 - 49	
		50 or more	
4	Marital status	Singles, divorced	Ref
		Married/cohabiting	
5	Education levels	Primary or more	Ref
		No education/illiteracy	
6	Occupation	Occupation without formal and regular salary	Ref
		Public or private earn workers	
	Lifestyles awareness		
	Have previously received at least one of the following seven lifestyle advice, detailed below	No	Ref
		Yes	

Continued

1	Quit using tobacco or don't start or have you stopped tobacco due to health reasons, or on the advice of your doctor or other health worker?	Yes	
		No	
2	Have you stopped drinking alcohol due to health reasons, or on the advice of your doctor or other health worker?	Yes	
		No	
3	Reduce salt in your diet	Yes	
		No	
4	Eat at least five servings of fruit and/or vegetables each day	Yes	
		No	
5	Reduce fat in your diet	Yes	
		No	
6	Start or do more physical activity	Yes	
		No	
7	Maintain healthy body weight or lose weight	Yes	
		No	
	Lifestyle practices		
1	Use of tobacco	No	*Ref*
		Yes	
2	Use of alcohol	Not users	*Ref*
		Moderate users	
		Bing drinkers	
3	Practice a physical activity	Yes (or physically active)	*Ref*
		No (or physically inactive)	
4	Consumption of at least five fruits and/or vegetables	No (or inadequate consumption)	*Ref*
		Yes (adequate consumption)	
5	Cleaning the teeth at least twice a-day	No	*Ref*
		Yes	
	Anthropometric characteristics		
1	Body weight categories	BMI 18.5 - 25 kg/m^2	*Ref*
		BMI under 18.5 kg/m^2	
		Overweight (25 - 29.9)	
		Obesity (30 or more)	

Continued

2	Presence of abdominal obesity if waist circumference ≥ 94 (in men) and 80 cm (in women)	No Yes	*Ref*
	Fasting blood glucose		
	Presence of hyperglycaemia when fasting blood glucose ≥ 6.1 mmol/l	No Yes	*Ref*

†: Multivariable analysis, Ref: reference when preforming multivariable analysis.

The controlled or healthy body weight was BMI under 25 kg/m^2. The BMI (in kg/m^2) is derived from weight (in kg) and height (in m) using the formula weigh/height^2. Height was measured to the nearest 0.1 cm using a stadiometer (SECA 214) on a subject without shoes while weight was measured to the nearest 0.1 kg with a personal scale (SECA 813) on a lightly clothed subject without shoes. The WC was measured to the nearest 0.1 cm (as per WHO recommendations) with a measuring tape (SECA 203) at the midpoint between the last rib and the iliac crest, with the subjects standing upright and breathing normally.

There was abdominal obesity if waist circumference was 95/80 cm or more in men/women. The fasting blood glucose (in mmol/l) was measured and value of 6.1 mmol/l or more was hyperglycaemia. All measurement devices were provided by the WHO. Physical measurements were carried out on the same day.

2.4. Participants Included for the Analyses

Individuals with complete data on sociodemographic parameters, lifestyle awareness and practices, BMI, WC and FBG variables were included for analyses. Thus, data from 4125 participants were analysed.

2.5. Statistical Analysis

We used StataCorp Stata Statistical Software for Windows (Version 16.0, College Station, Texas, US) to analyse the data. The continuous variables were expressed as the means ± standard deviations, while the categorical variables were expressed as percentages (%) with 95% confidence intervals (CIs). The student's t test was used to compare continuous variables, and the chi-square or the Fishers exact tests were used to compare categorical variables. In the stepwise logistic regression models, the dichotomized (yes/no) variable as had ever been screened for diabetes was the dependent variable. The sociodemographic factors (sex, age, residence, marital status, level of education and occupation) were among the independent variables. All the other independent variables, which included lifestyle awareness, lifestyle practices and the presence or absence of hyperglycaemia, are presented in Table 1.

2.6. Ethical Considerations

All methods were carried out in accordance with relevant guidelines and regulations. The protocol of the primary STEPS survey was approved by the Ethics Com-

mittee for Health Research of the Ministry of Health of Burkina Faso (deliberation No: 2012-12092; December 05, 2012). Written informed consent was systematically obtained from each participant in the STEPS survey. The database for this secondary analysis, is freely available from the Ministry of Health of Burkina Faso on request.

3. Results

Table 2 describes rates for diabetes screening uptake, in each of the country 13 geographic regions. The national diabetes screening uptake rate was 5.6% (95% CI: 4.9 - 6.4) and there was a significantly wide range in screening uptake, from 1.0 % to 15.0 % ($p < 0.0001$). For the "Centre" "Cascades" and "Hauts-Bassins" regions, the screening uptake rates were 15.0 %, 13.2 % and 8.4%, respectively. These three regions have a pooled frequency of 11.8 % (95 % CI: 10.0 - 13.9), which was 3.3 % (95 % CI: 2.8 - 4.1) for the ten remaining regions ($p = 0.0001$).

Table 2. Rate of diabetes screening uptake by the country geographic regions.

Country geographic Region	Participants included	Participants who had been screened for diabetes	
	N (%)	n (%)	95% CI
Centre	490 (11.9)	72 (15.0)	11.7 - 18.1
Est	328 (8.0)	7 (2.1)	0.9 - 4.3
Centre-Est	362 (8.9)	18 (5.0)	3.0 - 7.7
Centre-Sud	207 (5.0)	5 (2.4)	0.8 - 5.5
Centre-Nord	393 (9.5)	4 (1.0)	0.3 - 2.6
Sahel	297 (7.2)	7 (2.4)	1.0 - 4.8
Plateau Central	216 (5.2)	3 (1.4)	0.3 - 4.0
Cascades	129 (3.1)	17 (13.2)	7.9 - 20.3
Sud-Ouest	202 (4.9)	12 (5.9)	3.1 - 10.1
Boucle du Mouhoun	440 (10.7)	22 (5.0)	3.2 - 7.5
Centre-Ouest	293 (7.1)	11 (3.8)	1.9 - 6.6
Nord	314 (7.6)	16 (5.1)	2.9 - 8.1
Hauts-Bassins	454 (11.0)	38 (8.4)	6.0 - 11.3
Total/National	4125 (100.0)	232 (5.6)	4.9 - 6.4

Overall, 50.9% of participants were female, with a mean age of 38.6 ± 11.1 years. Most participants were from rural areas (79.7%), illiterate (86.9%), and had occupation without regular and formal income (94.3%). Table 3 provides a statistical comparison of the sociodemographic parameters, lifestyles, anthropometric measurements and FBG values between individuals who had ever and never been screened for diabetes.

Table 3. Comparison of sociodemographic factors, lifestyle awareness and practices, anthropometric and glycemia values between the participants who had ever and never been screened for diabetes.

Independent variables	Overall adult participants			Participants who had never been screened for diabetes			Participants who had ever been screened for diabetes			
	N = 4125			N = 3893			N = 232			
	N	%	95% CI	N	%	95% CI	N	%	95% CI	P
	Sociodemographic factors description			Prevalence of participants who have been screened and not, by sociodemographic category						
Residence										0.0001
- Rural area	3288	79.7	78.4 - 80.9	3198	97.3	96.6 - 97.8	90	2.7	02.2 - 03.4	
- Urban area	837	20.3	19.1 - 21.6	695	83.0	80.3 - 85.5	142	17.0	14.5 - 19.7	
Sex										0.08
- Male	2026	49.1	47.6 - 50.7	1925	95.0	94.0 - 95.9	101	5.0	04.1 - 06.0	
- Female	2099	50.9	49.3 - 52.4	1968	93.8	92.6 - 94.8	131	6.2	05.2 - 07.4	
Mean age (±standard deviation), in years		38.6 (11.1)	38.3 - 38.9		38.4 (11.1)	38.1 - 38.8		41.2 (10.8)	39.8 - 42.6	0.0002
Age range (years)										0.0001
- 25 - 34	1823	44.2	42.7 - 45.7	1750	96.0	95.0 - 96.8	73	4.0	03.2 - 05.0	
- 35 - 49	1464	35.5	34.0 - 37.0	1362	93.0	91.6 - 94.3	102	7.0	05.7 - 08.4	
- 50 or more	838	20.3	19.1 - 21.6	781	93.2	91.3 - 94.8	57	6.8	05.2 - 08.7	
Marital status										0.007
-Married/cohabitating	3576	86.7	85.6 - 87.7	3389	94.8	94.0 - 95.5	187	5.2	04.5 - 06.0	
- Single	549	13.3	12.3 - 14.4	504	91.8	89.2 - 94.0	45	8.2	06.0 - 10.8	
Education level										0.0001
- No formal education	3583	86.9	85.8 - 87.9	3474	97.0	96.3 - 97.5	109	3.0	02.5 - 03.7	
- Primary school or more	542	13.1	12.1 - 14.2	419	77.3	73.5 - 80.8	123	22.7	19.2 - 26.5	
Occupation										0.0001
- Employees without formal & regular income	3891	94.3	93.6 - 95.0	3740	96.1	95.5 - 96.7	151	3.9	03.3 - 04.5	
- Public or public earn workers	234	5.7	5.0 - 6.4	153	65.38	58.9 - 71.5	81	34.6	28.5 - 41.1	
Prevalence of participants who received healthy lifestyle advice from health professionals in overall participants, and in those who have never and ever been screened for diabetes										
Abstention or cession of tobacco use: Yes										0.009
- No	3477	84.3	83.1 - 85.4	3296	94.8	94.0 - 95.5	181	5.2	04.5 - 06.0	
- Yes	648	15.7	14.6 - 16.9	597	92.1	89.8 - 94.1	51	7.9	05.9 - 10.2	
Reduction of salt consumption: Yes										0.0001
- No	3266	79.2	77.9 - 80.4	3105	95.1	94.3 - 95.8	161	4.9	04.2 - 05.7	
- Yes	859	20.8	19.6 - 22.1	788	91.73	89.7 - 93.5	71	8.3	06.5 - 10.3	
Consumption of at least five fruits and/or vegetables: Yes										0.0001
- No	3507	85.0	83.9 - 86.1	3354	95.64	94.9 - 96.3	153	4.4	03.7 - 05.1	
- Yes	618	15.0	13.9 - 16.1	539	87.2	84.3 - 89.7	79	12.8	10.3 - 15.7	

Continued

Reduction of fatty food consumption: Yes										0.0001
- No	3512	85.1	84.0 - 86.2	3363	95.8	95.0 - 96.4	149	4.2	03.6 - 05.0	
- Yes	613	14.9	13.8 - 16.0	530	86.5	83.5 - 89.1	83	13.5	10.9 - 16.5	
Practice of more physical activity: Yes										0.0001
- No	3589	87.0	85.9 - 88.0	3458	96.3	95.7 - 96.9	131	3.7	03.1 - 04.3	
- Yes	536	13.0	12.0 - 14.1	435	81.2	77.6 - 84.4	101	18.8	15.6 - 22.4	
Weight control: Yes										0.0001
- No	3765	91.3	90.4 - 92.1	3609	95.9	95.1 - 96.5	156	4.1	03.5 - 04.8	
- Yes	360	8.7	07.9 - 09.6	284	78.9	74.3 - 83.0	76	21.1	17.0 - 25.7	
Participants who have received at least one healthy lifestyle advice: Yes										0.0001
- No	2736	66.3	64.9 - 67.8	2644	96.6	95.9 - 97.3	92	3.4	02.7 - 04.1	
- Yes	1389	33.7	32.2 - 35.1	1249	89.9	88.2 - 91.5	140	10.1	08.5 - 11.8	
Lifestyle practices, in overall participants and in those who have never and ever been screened for diabetes										
Tobacco use										0.001
- Did not use tobacco	3282	79.6	78.3 - 80.8	3078	93.8	92.9 - 94.6	204	6.2	05.4 - 07.1	
- Used tobacco	843	20.4	19.2 - 21.7	815	96.7	95.2 - 97.8	28	3.3	02.2 - 04.8	
Alcohol use										0.49
- Not alcohol user	2970	72.0	70.6 - 73.4	2809	94.6	93.7 - 95.4	161	5.4	04.6 - 06.3	
- Moderate alcohol users	605	14.7	13.6 - 15.8	565	93.4	91.1 - 95.2	40	6.6	04.8 - 08.9	
- Excessive alcohol users	550	13.3	12.3 - 14.4	519	94.4	92.1 - 96.1	31	5.6	03.9 - 07.9	
Physical lifestyle (frequency of physical activity per week)										0.0001
- Physically active	3853	93.4	92.6 - 94.1	3657	94.9	94.2 - 95.6	196	5.1	04.4 - 05.8	
- Physically inactive	272	6.6	05.9 - 07.4	236	86.8	82.2 - 90.6	36	13.2	09.4 - 17.8	
Fruit and vegetables consumption										0.082
- Inadequate FV intake	3925	95.1	94.5 - 95.8	3710	94.5	93.8 - 95.2	215	5.5	04.8 - 06.2	
- Adequate FV intake	200	4.9	04.2 - 05.5	183	91.5	86.7 - 95.0	17	8.5	05.0 - 13.3	
Cleaning the teeth at least twice a day										
- No	2846	69.0	67.6 - 70.4	2739	96.2	95.5 - 96.9	107	3.8	03.1 - 04.5	
- Yes	1279	31.0	29.6 - 32.4	1154	90.2	88.5 - 91.8	125	9.8	08.2 - 11.5	
Prevalence of overweight, obesity and abdominal obesity and hyperglycaemia in overall participants and in participants who have never and ever been screened for diabetes										
Body mass index (BMI) categories										0.0001
- Underweight	462	11.2	10.3 - 12.2	448	97.0	95.0 - 98.3	14	3.0	01.7 - 05.0	
- Normal BMI	2935	71.2	69.7 - 72.5	2812	95.8	95.0 - 96.5	123	4.2	03.5 - 05.0	
- Overweight	549	13.3	12.3 - 14.4	489	89.1	86.2 - 91.6	60	10.9	08.4 - 13.8	
- Obese	179	4.3	03.7 - 05.0	144	80.5	73.9 - 86.0	35	19.5	14.0 - 26.1	

Continued

Mean (±standard deviation) in body weight in kg		61.6 (11.8)	61.2 - 61.9		61.1 (11.3)	60.7 - 61.5		69.4 (15.7)	67.3 - 71.4	0.0001
Mean (±standard deviation) in BMI		22.2 (3.8)	22.1 - 22.4		22.1 (3.6)	22.9 - 22.2		25.1 (5.6)	24.4 - 25.8	0.0001
Raised waist circumference or abdominal obesity (≥94/80 cm in Men/women): Yes										0.0001
- Absent	3233	78.4	77.1 - 79.6	3114	96.3	95.6 - 96.9	119	3.7	03.1 - 04.4	
- Present	892	21.6	20.4 - 22.9	779	87.3	85.0 - 89.4	113	12.7	10.6 - 15.0	
Mean (±standard deviation) in waist circumference		78.1 (11.8)	77.7 - 78.5		77.7 (11.5)	77.3 - 78.1		84.7 (13.8)	82.9 - 86.5	0.0001
Raised fasting blood glucose or hyperglycaemia (≥6.1 mmol/l):										0.01
- Absent	3900	94.5	93.8 - 95.2	3690	94.6	93.9 - 95.3	210	5.4	04.7 - 06.1	
- Present	225	5.5	04.8 - 06.2	203	90.2	85.6 - 93.8	22	9.8	06.2 - 14.4	
Mean (±standard deviation) in fasting blood glucose		3.88 (1.57)	3.84 - 3.94		3.87 (1.54)	3.82 - 3.92		4.22 (1.96)	3.96 - 4.47	0.011

Difference in kg 8.3 kg (Std Err = 0.8), 3.0 kg/m^{2}in BMI (Std Err = 0.3), 7.0 cm in waist circumference (Std Err=0.8), and 0.35 mmol/L in fasting blood glucose (Std Err = 0.11).

Compared with participants who had never been screened for diabetes, those who had ever been screened were more likely to have received advice on healthy lifestyle for each of the advice we considered. The participants who have previously received at least a healthy lifestyle advice from a health professional represented 33.8% (95% CI: 32.2-35.1), from whom 10.1% (95% CI: 8.5 - 11.8) had ever been screened, while only 3.4% (95% CI: 2.7 - 4.1) in those who had never been screened (p = 0.0001). Those who were abstinent with tobacco more frequently underwent for screening (6.2% vs 3.3% for smokers, p = 0.001), as well as those who clean the teeth at least twice a-day (9.8% vs 3.8% who did not brush at least twice a-day, p = 0.0001). But physically inactive participants were more frequently screened (13.2% vs 5.1% for physically active participants, p = 0.0001).

Compared to those who had never been screened, those who had ever been screened had an average weight increase of 8 kg (p = 0.0001), an increase in BMI of 3 kg/m^2 (p = 0.0001), an increase in waist circumference (WC) of 7 cm (p = 0.0001), and an increase in FBG of 0.35 mmol/L (p = 0.011). Overweight participants (10.9%) or obese (19.5%) more frequently underwent for screened, compared to those BMI under 25 kg/m^2 (5.7 %), p = 0.0001, as well as those with abdominal obesity (12.7% vs 3.7% in those without abdominal obesity, p = 0.0001).

Those who had ever been screened had an increase in FBG of 0.35 mmol/L (p = 0.011) and higher rate of hyperglycaemia (9.8%) than those who had never been screened (5.4%, p = 0.011).

Table 4 reports the associated factors with the uptake of diabetes screening in logistic regression analysis.

The associated factors with the screening uptake were living in rural area (aOR= 2.7, 95% CI: 1.9 - 3.7), being female (aOR= 1.7, 95% CI: 1.2 - 2.3), educated (aOR= 3.4, 95% CI: 2.3 - 5.0), older age of 34-49y (aOR= 2.0, 95% CI: 1.4 - 2.9) or 50 y or

more (aOR= 2.8, 95% CI: 1.8 - 4.2), profession providing regular and formal income (aOR= 3.5, 95% CI: 2.3 - 5.3), having received at least a healthy lifestyle advice (aOR= 2.1, 95% CI: 1.6 - 2.9), adequate fruit and vegetables consumption (aOR= 1.9, 95% CI: 1.1 - 3.5), tooth cleaning at least twice a-day (aOR= 1.5, 95% CI: 1.1 - 2.0), overweight or obesity (aOR= 1.5, 95% CI: 1.1 - 2.1), or an increased BMI (aOR= 1.06, 95% CI: 1.03 - 1.10). When the WC replaced the BMI in the model, presence abdominal obesity was significantly associated with screening uptake (aOR= 2.1, 95% CI: 1.6 - 2.9).

Table 4. Socio-demographic factors, lifestyle, anthropometric and fasting blood glucose associations with the uptake of diabetes screening in Burkina Faso (N = 4125).

Independents variables	Univariable analysis			Multivariable analysis		
	cOR	95% CI	p-value	aOR	95% CI	p-value
Residency: Urban area, vs Rural (ref)	7.3	5.5 - 9.6	0.001	2.7	1.9 - 3.7	0.002
Gender: Women, vs Men (Ref)	1.3	1.0 - 1.7	0.081	1.7	1.2 - 2.3	0.0001
Age range (in years)						
- 25 - 34 (Ref)	1			1		
- 35 - 49	1.8	1.3 - 2.4	0.0001	2.0	1.4 - 2.9	0.0001
- 50 or more	1.7	1.2 - 2.5	0.002	2.8	1.8 - 4.2	0.0001
Marital status: Singles, vs Married/cohabitating (Ref)	1.6	1.2 - 2.3	0.005	0.8	0.6 - 1.2	0.33
Educational level: No formal education, vs Primary school or more (Ref)	9.4	7.1 - 12.3	0.001	3.4	2.3 - 5.0	0.0001
Occupation: Public and private earn workers vs occupation without formal and regular salary (Ref)	13.1	9.6 - 18	0.0001	3.5	2.3 - 5.3	0.0001
Have received at least a healthy lifestyle advices: Yes, vs No (Ref)	3.2	2.5 - 4.2	0.0001	2.1	1.6 - 2.9	0.0001
Alcohol use						
- Not users						
- Moderate users	1.2	0.9 - 1.8	0.25	-	-	-
- Binge drinkers	1.0	0.7 - 1.5	0.84	-	-	-
Tobacco use: Not users vs users (Ref)	1.9	1.3 - 2.9	0.001	1.3	0.8 - 2.1	0.25
Physical activity: Inactive, vs Active (Ref)	2.8	1.9 - 4.2	0.0001	1.6	0.1 - 2.5	0.054
Adequate fruit and vegetables consumption: Yes, vs No (Ref)	1.6	1.0 - 2.7	0.073	1.9	1.1 - 3.5	0.028
Clean the teeth at least twice a day: Yes, vs No (Ref)	2.8	2.1 - 3.6	0.0001	1.5	1.1 - 2.0	0.016
BMI categories[a]						
- Normal BMI (Ref)	1			1		

Continued

- Underweight BMI	0.7	0.4 - 1.3	0.24		0.4 - 1.4	0.42
- Overweight or obesity	3.4	2.6 - 4.5	0.0001	1.5	1.1 - 2.1	0.016
BMI (in kg/m^2)[b]	1.2	1.1 - 1.3	0.0001	1.06	1.03 - 1.10	0.0001
Abdominal obesity[c]: Yes, vs No (Ref)	3.8	2.9 - 5.0	0.0001	2.1	1.6 - 2.9	0.0001
Hyperglycaemia[d] (≥6.1 mmol/l): Yes, vs No (Ref)	1.9	1.2 - 3.0	0.006	1.4	0.8 - 2.5	0.20
Glycaemia[e] (in mmol/l)	1.13	1.05 - 1.22	0.001	1.05	0.96 - 1.14	0.27

[a]: When BMI was used as a categorial independent variable but not as a numeric value, and without waist circumference (categorized into yes/no abdominal obesity). [b]: When BMI was used as a numeric (in kg/m^2) independent variable but not as a categorial variable, and without waist circumference (categorized into yes/no abdominal obesity). [c]: When waist circumference (categorized into yes/no abdominal obesity) was used as a categorial, and without BMI (in numeric or categorial) [d]: When fasting blood sugar was introduced as a categorial variable (categorized into yes/no hyperglycaemia) but not as a numeric (mmol/L). [e]: When fasting blood sugar was introduced as a numeric variable (mmol/L), but not as a categorial variable.

4. Discussion

The fraction of the Burkinabe population ever screened for diabetes is low, given the epidemiological transition.

4.1. Geographical, Sociodemographic Disparities in Screening Uptake

The uptake rate for diabetes screening among adults in Burkina Faso was low (5.6%; 95% CI: 4.9 - 6.4), even we found a pooled rate of 11.8% in the three mostly urbanized regions. Low screening uptake is common in Africa [14] and there was a decreased pooled rate of 3.3% for the Burkina Faso 10 regions. However, the rate of 73.1% was found in Singapore [15]. Despite the high mean FBG and hyperglycaemia rate found among those who had been screened in the bivariate analysis, there was no association between hyperglycaemia and screening uptake in the multivariable analysis, regardless of sociodemographic factors. Therefore, the weight of sociodemographic components in screening seemed consistent. Most of the socio-demographic parameters were associated with diabetes screening uptake and were consistent with the common socio-demographic or socio-economic correlates of inequalities in undiagnosed diabetes in LMICs [2], and those we identified were also addressed in South Africa [16], and elsewhere in SSA [17]. The geographic disparity as well as the unfavourable sociodemographic features identified (rural and young subjects, uneducated, occupation without regular or formal income) were also reported concerning hypertension [9] and cervical cancers [11] in Burkina Faso. In SSA, low levels of education were usually associated with low economic levels, limited access to healthcare facilities and expertise [18]. Therefore, it is appropriate to draw up coordinated interventions aimed at reducing disparities in the screening of these diseases, which can be extended to other non-communicable diseases. This may require community involvement supported by health insurance scheme. Due to the low uptake of screening for hypertension

(41.6%; 95% CI: 40.0 - 43.1) [9] and cervical cancer (6.2%; 95% CI: 5.3 - 7.3) in Burkina Faso [11], an integrated cost-effective response is required [19].

4.2. Healthy Lifestyle Awareness and Practice

Individuals who have ever been screened demonstrated better knowledge on healthy lifestyle. Awareness of the healthy lifestyle driven by the health professionals to the community reflects the performance of the health care system in preventing non-communicable diseases. A third of adults have received at a least healthy lifestyle advice and this rate should be raised, considering the benefit observed on screening uptake. Indeed, the multivariable analyses confirmed that having previously received at least a healthy lifestyle advice was associated with the screening uptake. Furthermore, those who ever been screened were most likely to consume at least five portions of fruit and vegetables a day and brush their teeth at least twice a day. People who used to clean the teeth seemed to be more concerned about their physical appearance, including the whiteness of their teeth. Regular tooth cleaning may indicate a higher income level [20], a higher socioeconomic position [21] or a higher level of education, including oral health literacy [22]. The physically inactive participants were more frequently screened, as the previous analysis reported a similar trend among aware hypertensive, versus unaware hypertensive subjects in Burkina Faso [12]. This suggests that physical inactivity may co-occur with other health conditions that increase contact with the healthcare system. The urgent need for policies to increase awareness of diabetes and to expand coverage of preventive counselling was addressed [17]. Relevant strategies for disseminating and adopting healthy practices should be considered, as even those aware of the benefits of a healthy lifestyle, such as physical activity and weight-loss diets, were no more likely to adhere to them. Effective education to promote healthy lifestyles was identified as an unmet need in diabetes management [23]. This need should be addressed at a national level within the healthcare system [23] [24].

4.3. Overweight, Global Obesity and Abdominal Obesity in Ever and Never Screened

Compared to those who had never been screened, those who had had an average increase in weight of 8 kg, an increase in BMI of 3 kg/m^2 and an increase in waist circumference of 7 cm. More frequent screening was observed among overweight (10.9%), obese (19.5%) and abdominal obese (12.7%) participants, suggesting that increasing anthropometric measures are a motivating factor for screening uptake. The hypothesis that thin people are less likely to be screened for hypertension has been endorsed [9], in line with the present findings regarding diabetes. Although this may be commendable, it should be acknowledged that metabolic disorders in adults with low or normal BMI (about more than four-fifths of the population) are not uncommon. Despite having a normal BMI, the excessive accumulation of fat mainly visceral, can adversely affect the lipid profile, blood pressure and inten-

sifies inflammatory, thrombotic processes and oxidative stress. That is a type of obesity defined as metabolically obese normal weight (MONW) [25]. The MOWN among the Burkinabe population, reached 16% in women in the final quartile [26] of normal BMI. It is important to raise awareness among people with a normal or low BMI, or who consider themselves to be a normal weight, of their potential vulnerability to metabolic disorders, particularly hypertension and diabetes. Despite their conditions, they should be encouraged to undergo screening. This can be achieved by providing specific, tailored recommendations that do not cause panic or stress.

4.4. Raising Community Engagement for Diabetes Screening

Recommendations of The Lancet Commission on Diabetes, include "building community capacity in diabetes requires empowering a large workforce to deliver diabetes care in an effort to reach medically underserved communities and mitigate social determinants of health [27]". There was evidence for the community-based screening policy in sub-Saharan Africa [28]. The contribution of healthcare professionals working in care centers in Burkina Faso, should be completed with community-based health workers, to increase the rate for healthy lifestyle awareness and screening attendance. Community-based interventions to boost diabetes screening were successfully implemented in Ghana [29]. In Ethiopia, an effective policy integrating diabetes, hypertension and cervical cancer screening was supported [30].

4.5. Strength and Limitations Screened

As the studies using the STEPS methodology should be replicated, these baseline results should be used alongside the following studies, to compute reviews' data in national and international meta-analyses. They can also potentially contribute to developing an accurate prediction equation for updated data [31], which can further serve to outline the unmet need, with intangible cost to the health coverage system. This study shows geographic areas where urgent interventions are needed and priory targets to the stakeholders involved in tackling non-communicable diseases. The limitation of this study is the age of the data, despite which its potential value for estimating current health insurance needs has just been outlined, and the baseline evidence enables us to examine changes and make predictions. As the study is cross-sectional, it is not possible to establish whether the modifiable determinants identified preceded screening uptake, or vice versa.

5. Conclusion

The profile of geographical and sociodemographic disparities in diabetes screening matched that observed for hypertension and cervical cancer in Burkina Faso. Efficient dissemination of information about healthy lifestyles is useful for increasing screening attendance. People with a normal or low body weight as well as those who subjectively consider themselves to be a normal weight, need to be

specifically encouraged to undergo screening. Community engagement in diabetes screening and the implementation of health insurance should help to identify and address unmet needs, thereby reducing sociodemographic and socioeconomic disparities. In addition to diabetes, cost-effective interventions should address hypertension and other non-communicable diseases, including cervical cancer. National health coverage is experiencing in Burkina Faso, and the present purpose is crucial, given the combined epidemiological and demographic transitions.

Acknowledgements

The authors thank the Ministry of Health for providing them with the STEPS survey database.

Authors' Contribution

Diendéré J, Coulibaly A and Lanou HB contributed to drafting the manuscript; Diendéré J, conducted statistical analysis, Garanet F initiated the first interpretation of the results; Diendéré J, Lanou HB, Zeba AN and Diallo AH reviewed the last version. All authors reviewed and approved the final manuscript.

Conflicts of Interest

The authors of this manuscript declare that they have no conflicts of interest that are directly or indirectly related to the work submitted for publication.

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