

Trends in Prediabetes and Diabetes Prevalence in Kosovo: A Comparison of the Results of Steps Survey From 2011 and 2019

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Abstract

Background: Some years ago, chronic diseases were considered to be a problem for the wealthy and elderly population. Today, chronic conditions affect the poor, young, and middle-aged people in high-income countries. The global prevalence of diabetes mellitus (DM) has been continuously growing for over half a century and has reached pandemic proportions. In the present study, we aimed to estimate the trends in prediabetes and DM prevalence and to determine related risk factors among Kosovo people from 2011 to 2019.

Methods and Results: A population-based survey was conducted among people aged 18-69 from April 2018 to June 2019 and those aged 15-64 using the WHO STEPs instrument. Detailed findings on the magnitude of DM and impaired fasting blood glucose (FBG) are presented in this paper.

Prevalence of prediabetes in 2011 at 15-64 years was 6.0% (95% CI: 4.6% - 7.9%), and in 2019 at 18-69 years was 6.1% (95% CI: 5.3% - 7.1%), not a significant difference ($P>0.05$). To avoid bias from different ages, we compared prevalence by age groups. Only in the age group of 35-44 we found a significant difference in the prevalence of prediabetes. In this age group, the prevalence of prediabetes was 2.4% (95% CI: 0.9% - 6.1%) in 2011 and 2.7% (95% CI: 0.9% - 6.1%) in 2019. In 2019, the prevalence of prediabetes was higher among males than in 2011, when females prevailed.

Prevalence of DM in 2011 at 15-64 years was 7.7% (95% CI: 6.0% - 9.7%), and in 2019 at 18-69 years was 7.9% (95% CI: 6.9% - 9.0%), not a significant difference ($P>0.05$). In the age groups of 45-54 and 55-64, we found a significant difference in the prevalence of DM by years. The prevalence of DM at 45-54 years was 13.5% (95% CI: 9.2% - 19.5%) in 2011 and 7.8% (95% CI: 6.0% - 10.2%) in 2019 ($P=0.032$). The prevalence of DM at 55-64 years was 21.6% (95% CI: 15.8% - 28.9%) in 2011 and 13.2% (95% CI: 10.6% - 16.3%) in 2019 ($P=0.015$). The prevalence of DM was higher among females in 2011 and 2019.

Conclusion: Results from 2 STEPS in Kosovo show that we have no significant increase in the prevalence of prediabetes and DM in total. At the same time, we found a significant decrease in DM in the age group 45-64. (**International Journal of Biomedicine. 2023;13(1):47-53.**)

Keywords: prediabetes • diabetes • Kosovo adults • STEPS survey

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Abbreviations

DM, diabetes mellitus; **FBG**, fasting blood glucose; **IFG**, impaired fasting glycemia; **NCDs**, non-communicable diseases; **WHO**, World Health Organization.

Introduction

Diabetes mellitus (DM) has emerged as one of the most severe and prevalent chronic diseases of our time, causing potentially fatal, disabling, and expensive complications and reducing life expectancy.⁽¹⁾ The global DM prevalence in 20-79-year-olds in 2021 was estimated to be 10.5% (536,6 million people), and is predicted to rise to 12.2% (783,2 million) in 2045. A large proportion of diabetics (80.6%, 432,7 million) live in low- and middle-income countries. Global DM-related health expenditures were estimated at 966 billion USD in 2021 and are projected to reach 1,054 billion USD by 2045.⁽²⁾ The rising prevalence of DM has been attributed primarily to population aging, rapid urbanization, and the increasing prevalence of risk factors such as obesity, poor diet, smoking, and alcohol consumption.⁽³⁻⁵⁾ To combat the growing threat of DM, the United Nations Resolution 61/225 in 2006 encouraged all nations to develop national policies for DM prevention, care, and treatment.⁽⁶⁾ The ability to measure the distribution of DM (prevalence and incidence) and its determinants and consequences, including complications and premature death, is a common denominator for achieving this goal and demonstrating the impact of new policies. DM is the leading non-communicable disease in Kosovo, according to annual reports from the Department of Statistics at the National Institute of Public Health of Kosovo.⁽⁷⁾ Type 2 diabetes affects more than 90% of people with DM. After cardiovascular diseases and cancers, the most common cause of premature death among Kosovo residents is DM.⁽⁸⁾

The WHO created the STEPwise approach⁽⁹⁾ to address the need for standardized data on a few key risk factors, allowing countries to have small amounts of high-quality data for comparison between and within countries, as well as the ability to measure trends in these risk factors over time. In this context, the WHO STEPS approach to NCD risk-factor surveillance is an excellent example of an integrated and phased approach that many countries have used and tested. It enables countries to create a detailed risk profile for their national populations. STEPS in Kosovo was conducted for the first time in 2011,⁽¹⁰⁾ and the second time in 2019.

In the present study, we aimed to estimate the trends in prediabetes and DM prevalence and to determine related risk factors among Kosovo people from 2011 to 2019.

Materials and Methods

The survey was conducted using the WHO STEPwise approach to NCD risk-factor surveillance (STEPS). In each of the 2 STEPS (2011 and 2019), we used 3 STEPS to gather information. STEP 1 measures behavioral risk factors, STEP 2 covers physical measurements, and STEP 3 includes the measurement of biochemical characteristics (blood glucose and total cholesterol). In this paper are presented only results from STEP 3 glucose measurement.

In STEPS-2011, STEP 3 was planned for 1000 participants, and 796(79.6%) agreed to participate. In STEPS-2019, 2800 residents aged 18-69 years were randomly selected for the survey, and 2539(90.7%) agreed to participate.

Sampling

Two-stage probability sampling using stratification procedures was used to prepare the sample. The sample size will be calculated using the following formula and assumptions:

$$n = \frac{Z^2 \times P \times (1 - P)}{d^2}$$

d - margin of error 0.05, P - probability 0.5, Z - confidence level 95%; design effect of 1.5.

For STEPS 2019, we used 4 groups; for STEPS 2011, we used 8 groups. A 75% response rate is expected.⁽¹¹⁾

Biochemical Measurements

A mobile laboratory was used in data collection. The mobile laboratory contained the logistics and human resources required, including an Accutrend Plus and all materials required for blood glucose testing. Fasting samples were taken to measure blood glucose using the dry method. Participants were instructed to fast overnight for 12 hours, and diabetic patients on medication were reminded to bring their medicine/insulin with them and take their medicine after providing the blood sample.

IFG was defined as either capillary whole blood value ≥ 5.6 mmol/L – < 6.1 mmol/L. Raised FBG was defined as either capillary whole blood value ≥ 6.1 mmol/L.

Data collection and quality control

The questionnaires were adapted and translated into Albanian and back translated into English to ensure their validity. To ensure the high quality of data, the group of 45 field workers (public health professionals of NIPHK) conducted three days of training for field data collectors and supervisors.

Statistical analysis

For STEPS-2011, statistical analysis was undertaken using SPSS version 22.0. Data are presented as percentage and 95% confidence interval (CI). Mann-Whitney U test was used to compare means of 2 groups of variables not normally distributed. The frequencies of categorical variables were compared using Pearson's chi-squared test or Fisher's exact test (2-tail), when appropriate. A probability value of $P < 0.05$ was considered statistically significant.

Data for STEPS-2019 were weighted. Weights were assigned to account for the following factors: selection probability, nonresponse, and gender and age differences between the sample and the target population. Data analysis was conducted in Epi Info,⁽¹²⁾ version 3.5.1 (Centers for Disease Control and Prevention, Atlanta, Ga), and prevalence rates with corresponding 95% CIs were estimated. The results were considered statistically significant if there was no overlap between 2 CIs of the compared groups (e.g., males vs. females) or $P < 0.05$ if they were tested with the Chi test or Fisher exact test.

Results

A population-based survey was conducted among people aged 18-69 from April 2018 to June 2019 and those aged 15-64 using the WHO STEPs instrument. Detailed findings on the magnitude of DM and impaired FBG are presented in this

paper. By gender, more respondents were female than male (50.3% in 2011 vs. 59.0% in 2019); adults aged 25-44 were 39.5% in 2011 and 32.6% in 2019; rural residents were 56.5% in 2011 and 59.0% in 2019; illiteracy was 2.9% in 2011 and 3.8% in 2019 (Table 1).

Table 1.
Socio-demographic and behaviors characteristics of the study population, Kosovo STEPS survey 2011 and 2019.

Characteristics	STEPS 2011	STEPS 2019
	n=796 (%)	n=2539 (%)
Age groups (years)		
15-24	163 (20.5)	*229 (9.0)
25-34	165 (20.7)	328 (12.9)
35-44	150 (18.8)	500 (19.7)
45-54	170 (21.4)	613 (24.1)
55-64	148 (18.6)	539 (21.2)
65-69	-	330 (13.0)
Gender		
Male	396 (49.7)	1042 (41.0)
Female	400 (50.3)	1497 (59.0)
Residence		
Rural	450 (56.5)	1499 (59.0)
Urban	346 (43.5)	1040 (41.0)
Educational status		
Illiterate	23 (2.9)	96 (3.8)
Up to primary education	222 (27.9)	1064 (41.9)
Up to secondary education	398 (50.0)	868 (34.2)
Higher education	153 (19.2)	510 (20.1)
Marital status		
Never married	224 (28.1)	386 (15.2)
Currently married	546 (68.6)	1945 (76.6)
Separated/divorced	3 (0.4)	20 (0.8)
Widowed and cohabitating	23 (2.9)	188 (7.4)
BMI		
Underweight	-	33 (1.3)
Normal weight	363 (45.6)	669 (26.3)
Overweight	138 (17.3)	1045 (41.2)
Obese	295 (37.1)	767 (30.2)
Current smoking		
Yes	197 (24.7)	648 (25.5)
No	599 (75.3)	1891 (74.5)
Current alcohol use**		
Yes	61 (7.7)	294 (11.6)
No	735 (92.3)	2245 (88.4)

*18-24 years; **One who has drunk alcohol in the past 30 days

In 2011, 27.9% of respondents had finished primary school, and 68.6% were married. In 2019, 41.9% had completed primary school, and 76.6% were married. In 2019, we had more overweight people (41.2% vs. 17.4%) and current alcoholic drinkers (7.4% vs. 11.6%) than in 2011.

When interpreting the results of the previous 2011 study, it should be noted that the target population in 2011 was different from that of the current STEPS survey (15-64 years in the 2011 survey, 18-69 years in the 2019 survey) and that the 2011 survey was not weighted. To compare the prevalence trend of prediabetes and DM from 2011 to 2019 in Kosovo, we used unweighted data from STEPS-2011 and STEPS-2019. Tables 2 and 3 contain unweighted data. To compare the prevalence of prediabetes and DM in Kosovo with other countries, we used weighted data from STEPS-2019 (Tables 4-6).

Table 2.
Prevalence of prediabetes in Kosovo, stratified by socio-demographic and behavioral characteristics, 2011 and 2019 (unweighted data).

Characteristics	Prevalence of prediabetes				
	STEPS 2011 n=796		STEPS 2019 n=2539		P
	Total n	n (%; 95% CI)	-	n (%; 95% CI)	
Age groups (years)					
15-24	163	1 (0.6; 0.1-3.4)	*229	2 (0.9; 0.2-3.1)	0.999
25-34	165	4 (2.4; 0.9-6.1)	328	9 (2.7; 1.5-5.1)	0.834
35-44	150	11 (7.3; 4.1-12.7)	500	16 (3.2; 2.0-5.1)	0.046
45-54	170	13 (7.6; 4.5-12.6)	613	41 (6.7; 5.0-8.9)	0.790
55-64	148	19 (12.8; 8.4-19.2)	539	51 (9.5; 7.3-12.2)	0.294
65+	-	-	330	37 (11.2; 8.2-15.1)	-
Gender					
Male	396	22 (5.6; 3.7-8.3)	1042	70 (6.7; 5.4-8.4)	0.494
Female	400	26 (6.5; 4.5-9.4)	1497	86 (5.7; 4.7-7.0)	0.652
Residence					
Rural	450	26 (6.5; 4.0-8.3)	1499	85 (5.7; 4.6-7.0)	0.931
Urban	346	22 (5.6; 4.2-9.4)	1040	71 (6.8; 5.4-8.5)	0.858
BMI					
Underweight	-	-	33	1 (3.0; 0.5-15.3)	-
Normal	363	11 (3.0; 1.7-5.3)	669	23 (3.4; 2.3-5.1)	0.866
Overweight	138	24 (17.4; 12.0-24.6)	1045	62 (5.9; 4.7-7.5)	0.000
Obese	295	13 (4.4; 2.6-7.4)	767	68 (8.9; 7.1-11.1)	0.020
Current smoking					
Yes	197	12 (6.1; 3.5-10.3)	648	40 (6.1; 4.6-8.3)	0.966
No	599	36 (6.0; 4.4-8.2)	1891	116 (6.1; 5.1-7.3)	0.989
Current alcohol use**					
Yes	61	4 (6.6; 2.6-15.7)	294	14 (4.8; 2.9 -7.8)	0.526
No	735	44 (6.0; 4.5-7.9)	2245	142 (6.3; 5.4 -7.4)	0.809
Total	796	48 (6.0; 4.6-7.9)	2539	156 (6.1; 5.3 -7.1)	0.974

**One who has drunk alcohol in the past 30 days

Prevalence of prediabetes in 2011 at 15-64 years was 6.0% (95% CI: 4.6% - 7.9%), and in 2019 at 18-69 years was 6.1% (95% CI: 5.3% - 7.1%), not a significant difference ($P>0.05$). To avoid bias from different ages, we compared prevalence by age groups. Only in the age group of 35-44 we found a significant difference in the prevalence of prediabetes. In this age group, the prevalence of prediabetes was 2.4% (95% CI: 0.9% - 6.1%) in 2011 and 2.7% (95% CI: 0.9% - 6.1%) (95% CI: 0.9% - 6.1%) in 2019. In 2019, the prevalence of prediabetes was higher among males than in 2011, when females prevailed (Table 2).

Table 3.

Prevalence of diabetes in Kosovo, stratified by socio-demographic and behavioral characteristics, 2011 and 2019 (unweighted data)

Characteristics	Prevalence of diabetes					P
	STEPS 2011 n=796		STEPS 2019 n=2539		-	
	Total n	n (%; 95% CI)	n (%; 95% CI)	n (%; 95% CI)		
Age groups (years)						
15-24	163	-	229	3 (1.3; 0.4- 3.8)	-	-
25-34	165	2 (1.2; 0.3 - 4.3)	328	6 (1.8; 0.8-3.9)	0.724	
35-44	150	4 (2.7; 1.0-6.7)	500	16 (3.2; 2.0 - 5.1)	0.950	
45-54	170	23 (13.5; 9.2 - 19.5)	613	48 (7.8; 6.0 - 10.2)	0.032	
55-64	148	32 (21.6; 15.8 - 28.9)	539	71 (13.2; 10.6-16.3)	0.015	
65+	-	-	330	56 (17.0; 13.3-21.4)	-	
Gender						
Male	396	25 (6.3; 4.3 - 9.2)	1042	79 (7.6; 6.1-9.3)	0.474	
Female	400	36 (9.0; 6.6 -12.2)	1497	121 (8.1; 6.8-9.6)	0.624	
Residence						
Rural	450	41 (5.2; 6.8 - 12.1)	1499	123 (8.2; 6.9 - 9.7)	0.610	
Urban	346	20 (2.5; 3.8 - 8.8)	1040	77 (7.6; 6.0 - 9.2)	0.366	
BMI						
Underweight	-	-	33	2 (6.1; 1.7 - 19.6)	-	
Normal	363	13 (3.6; 2.1-6.0)	669	20 (3.0; 1.9 - 4.6)	0.740	
Overweight	138	20 (14.5; 9.6-21.3)	1045	80 (7.7; 6.2 - 9.4)	0.010	
Obese	295	28 (9.5; 6.6-13.4)	767	98 (12.8; 10.6-15.3)	0.168	
Current smoking						
Yes	197	18 (9.1; 5.9-14.0)	648	41 (6.3; 4.7 - 8.5)	0.231	
No	599	43 (7.2; 5.4-9.5)	1891	159 (8.4; 7.2-9.7)	0.381	
Current alcohol use**						
Yes	61	4 (6.6; 2.6-15.7)	294	9 (3.1; 1.6 - 5.7)	0.250	
No	735	57 (7.8; 6.0-9.9)	2245	191 (8.5; 7.4 - 9.7)	0.572	
Total	796	61 (7.7; 6.0 - 9.7)	2539	200 (7.9; 6.9 - 9.0)	0.904	

**One who has drunk alcohol in the past 30 days

Prevalence of DM in 2011 at 15-64 years was 7.7% (95% CI: 6.0% - 9.7%), and in 2019 at 18 - 69 years was

7.9% (95% CI: 6.9% - 9.0%), not a significant difference ($P>0.05$). To avoid bias from different ages, we compared prevalence by age groups. In the age groups of 45-54 and 55-64, we found a significant difference in the prevalence of DM by years. The prevalence of DM at 45-54 years was 13.5% (95% CI: 9.2% - 19.5%) in 2011 and 7.8% (95% CI: 6.0%-10.2%) in 2019 ($P=0.032$). The prevalence of DM at 55-54 years was 21.6% (95% CI: 15.8% - 28.9%) in 2011 and 13.2% (95% CI: 10.6% - 16.3%) in 2019 ($P=0.015$). The prevalence of DM was higher among females in 2011 and 2019 (Table 3).

The age-sex standardized population-based mean FBG for 2539 participants was 4.6mmol/L (95% CI: 4.5-4.7 mmol/L). There were no significant differences in mean FBG by age and gender (Table 4).

Table 4.

Fasting blood glucose (mmol/L): Kosovo STEPS survey 2019 (weighted data)

Mean fasting blood glucose (mmol/L)									
Age Group (years)	Men			Women			Both Sexes		
	n	Mean	95% CI	n	Mean	95% CI	n	Mean	95% CI
18-44	420	4.3	4.2 - 4.4	637	4.4	4.2 - 4.5	1057	4.3	4.2-4.4
45-69	622	5.3	5.1 - 5.6	860	5.5	5.2 - 5.8	1482	5.4	5.2-5.6
18-69	1042	4.6	4.5 - 4.7	1497	4.7	4.5 - 4.8	2539	4.6	4.5-4.7

The overall age-sex standardized population-based prevalence of IFG (prediabetes) in 2542 participants was 3.7% (95% CI: 2.7% - 4.6%). The IFG prevalence was higher in men than women, 4.0% (95% CI: 2.4% - 5.7%) vs 3.3% (95% CI: 2.3% - 4.2%), (Table 5).

Table 5.

Prevalence of IFG: Kosovo STEPS survey 2019

Age Group (years)	Men			Women			Both Sexes		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
18-44	420	2.6	0.4 - 4.7	637	1.8	0.8-2.7	1057	2.2	0.9-3.4
45-69	622	7.9	6.5 -10.1	863	7.1	5.2-8.9	1485	7.5	6.0-8.9
18-69	1042	4.0	2.4 - 5.7	1500	3.3	2.3-4.2	2542	3.7	2.7-4.6

In both men and women participants, the prevalence of raised FBG or currently on medication for DM was 4.3% (95% CI: 3.3% - 5.4%). Although the prevalence was higher in women than men, 5.1% (95% CI: 3.5 - 6.8%) vs. 3.5% (95% CI: 2.4% - 4.6%), the differences were not statistically significant ($P>0.05$). The prevalence of the raised FBG increased with age (Table 6).

Table 6.**Prevalence of raised FBG or currently on medication for DM.**

Raised blood glucose or currently on medication for diabetes									
Age Group (years)	Men			Women			Both Sexes		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
18-44	420	1.2	0.3-2.1	637	2.2	0.2-4.1	1057	1.7	0.6-2.8
45-69	622	9.5	6.9-12.1	863	12.6	10.1-15.2	1485	11.1	9.1-13.0
18-69	1042	3.5	2.4-4.6	1500	5.1	3.5-6.8	2542	4.3	3.3-5.4

Currently on medication for diabetes									
Age Group (years)	Men			Women			Both Sexes		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
18-44	458	0.2	-0.1-0.5	682	1.3	-0.5-3.0	1040	0.7	-0.2-1.6
45-69	657	7.0	4.7-9.2	898	8.9	6.8-10.9	1555	7.9	6.3-9.5
18-69	1115	2.0	1.4-2.7	1580	3.3	1.8-4.8	2695	2.7	1.8-3.5

Discussion

According to the WHO, one of the significant development challenges of the twenty-first century is the mortality and morbidity caused by NCDs. More than 36 million people die each year due to NCDs worldwide, with 15 million of them dying very young, between the ages of 30 and 70. Most premature deaths result from 4 main NCDs: cardiovascular diseases, cancer, DM, and chronic obstructive pulmonary disease.⁽¹³⁾ The diabetes disease burden is high and rising in every country, fueled by a global increase in obesity and unhealthy lifestyles. According to the most recent estimates, the prevalence of DM was 11.1% in 2019 and is expected to rise to 13% by 2045.⁽¹⁴⁾ Results from 2 STEPS in Kosovo show that we have no significant increase in the prevalence of prediabetes and DM in total. The prevalence of prediabetes in 2011 among those 15-64 years old was 6.0% (95% CI: 4.6% - 7.9%) and 6.1% (95% CI: 5.3% - 7.1%), respectively, and there were no significant changes among 18-69 years in 2019 ($P>0.05$). Also, we have no significant increase in the prevalence of DM in total. The prevalence of DM in 2011 among 15-64 years was 7.7% (95% CI: 6.0% - 9.7%), and 7.9% (95% CI: 6.9% - 9.0%) among 18-69 years in 2019.

We have a 0.2% increase in the prevalence of DM. This increase was attributed to the older age group of adults included in STEPS-2019. Because we compare the prevalence by age groups, we found a significant decrease in DM in the age group 45-64.

The overall age-sex standardized population-based prevalence of prediabetes in 2019 was 3.7% (95% CI: 2.7%-4.6%), higher in men than women [4.0% (95% CI: 2.4% - 5.7%) vs 3.3% (95% CI: 2.3% - 4.2%)]; but the weighted prevalence of DM in 2019 was 4.3% (95% CI: 3.3% - 5.4%), higher in women than men, 5.1% (95% CI: 3.5 - 6.8%) vs 3.5% (95%

CI: 2.4% - 4.6%), $P>0.05$. The prevalence of DM increases with age. The prevalence of DM in Kosovo, according to weighted 2019 data, was lower than the global DM prevalence in adults aged 20-79 years, standardized to 2021: 10.5% (95% CI: 8.3% - 12.0%), 10.8% in men, and 10.2% in women. In our study the higher prevalence of DM was among women. In IDF Diabetes Atlas 2021, it was presented that prevalence increases with age, with the highest prevalence (24.0%) observed at 75-79 years.

Our study also showed an increase in the prevalence of DM with age. By 2030 and 2045, world-age standardized DM prevalence is projected to increase to 13.3% and 13.9% in the Middle East and North Africa region and 5.1% and 5.2% in the African region. The region-stratified DM prevalence is calculated for several countries, displaying the countries with the most diabetic patients in 2019. Kosovo has a DM prevalence like the prevalence in low-income countries.⁽¹⁵⁾

According to the CDC,⁽¹⁶⁾ the age-adjusted prevalence of total DM increased significantly among adults aged 18 and older between 2001 and 2020. Estimates of total DM prevalence ranged from 10.3% in 2001-2004 to 13.2% in 2017-2020.

According to the diabetes registry for 2019, the number of new cases of DM in the Republic of North Macedonia was 5,378, a rate of 259,24/100,000, while the total prevalence was 89,964 cases, a rate of 4336.66/100,000.⁽¹⁷⁾ It is assumed that this figure is much higher. Every year, up to 4000 new cases are investigated in Albania, with a total prevalence of approximately 80,000.⁽¹⁸⁾

As in other European countries, an increase in the prevalence of DM with age resulted in growing morbidity and mortality due to NCDs and, accordingly, increasing financial and social requirements for the national health system. These problems will become more severe if the health systems are not adequately adapted and relevant measures are not taken.

According to gender, the prevalence for both types of DM was the highest among women at over 50%, and the most affected age group for both types of DM was over 60 years old.

The focus of public health in the future will continue to be directed toward scientific research, supervision, development, and implementation of techniques to eliminate or reduce the action of factors harmful to health, as well as laws to preserve and enhance the progress of individual and community health.

NCDs now make up 7 of the world's top 10 causes of death, according to WHO's 2019 Global Health Estimates.⁽¹⁹⁾ This is an increase from 4 of the 10 leading causes in 2000. The new data cover the period from 2000 to 2019, inclusive. These 7 causes accounted for 44% of all deaths or 80% of the top 10. However, all NCDs together accounted for 74% of deaths globally in 2019. Lower-middle-income countries have the most disparate top 10 causes of death: five non-communicable, 4 infectious, and one injury. DM is a rising cause of death in this income group: it has moved from the 15th to the ninth leading cause of death, and the number of deaths from this disease has nearly doubled since 2000.

Conclusion

This research provides reliable evidence regarding the high burden of DM among the adult population in Kosovo. It is urgent to treat this critical burden on the health system. Newly diagnosed cases of DM in people should not be neglected, and early treatment should be offered to avoid complications. The reasons for uncontrolled DM in Kosovo require further research and innovative strategies for addressing this population. The prevention of DM should have a high priority in the development plans of public health in Kosovo to prevent increased economic costs. Effective preventive interventions are required, and healthcare systems must be prepared to detect and manage DM and its complications.

Limitations of the study

There are some limitations to this study. It is a cross-sectional study design that restricts the causality of relationships. However, the study's large sample size makes the results conclusive. Another limitation was that we used capillary blood samples instead of venous blood glucose estimations and measured blood glucose with a glucometer device.^(20,21) However, blood glucose quality-control checks were performed on a regular basis. Furthermore, only FBG levels were used to diagnose DM and prediabetes.

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Ethical considerations

Ethical Approval for STEPS 2011 received from Ethical Committee of Medical Faculty, University of Prishtina, number 4483. For STEPS 2019, the protocol was approved by the Committee on Ethical Issues, Kosovo Doctors Chamber nr. 06/2018. Written informed consent was obtained before participants were enrolled in the study, in accordance with ethical norms [WHO. Standards and operational guidance for ethics review of health-related research with human participants. Guidance document. 29 September 2011].

Competing Interests

The authors declare that they have no competing interests.

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