Prevalence and factors associated with diabetes, hypertension, and ischemic heart disease and/or stroke multimorbidity in Morocco: Results of a national STEPS survey in 2017

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ABSTRACT

INTRODUCTION This study aimed to estimate the prevalence and associated factors of non-communicable diseases (NCDs) multimorbidity among adults in Morocco.
METHODS National data were analyzed from 6989 adults (aged 18–69 years, median 37 years) who participated in the cross-sectional 2017 Morocco STEPS survey. Logistic regressions were calculated with multimorbidity, adjusted for age, sex, education level, residence and smoking status, physical activity, sedentary behavior, and body mass index.
RESULTS The prevalence of diabetes was 10.7%, hypertension 19.5%, ischemic heart disease/stroke 3.3%, and multimorbidity 5.0%. In the adjusted logistic regression model, older age (aged ≥50 years) (AOR=5.11; 95% CI: 3.64–7.18), urban residence (AOR=1.75; 95% CI: 1.26–

2.43), moderate sedentary behavior (AOR=1.41; 95% CI: 1.08–1.85), overweight (AOR=1.74; 95% CI: 1.21–2.49) and obesity (AOR=2.34; 95% CI: 1.63–3.36) were positively associated with multimorbidity. More than primary education (AOR=0.67; 95% CI: 0.46–0.99), and high physical activity (AOR=0.70; 95% CI: 0.62–0.95) were negatively associated with multimorbidity. In addition, in unadjusted analysis, male sex and current smoking were negatively associated with multimorbidity.
CONCLUSIONS One in 20 adults in Morocco had multimorbidity and associated sociodemographic factors (older age, lower education level, and urban residence) and health factors (sedentary behavior, low physical activity, overweight and obesity) were identified that can help plan interventions.

INTRODUCTION

Most deaths (85%) from non-communicable diseases (NCDs) occur in low- and middle-income countries (LMICs)[1]. In Morocco, a lower middle-income country in the eastern Mediterranean, NCDs contributed to 80% mortality in 2016[2]. Morocco has a population of 36.6 million, 73.6 years life expectancy at birth, 64.6% urbanization, and 73.8% are literate[3]. Globally, death from NCDs is mainly caused by cardiovascular diseases (CVD), cancers, respiratory diseases, and diabetes[1]. In Morocco, the mortality rate caused by CVD is 38%, with ischemic heart disease and

stroke being the major causes of death (31.0% and 22.5%, respectively)[4]. Behavioral risk behaviors, such as smoking, hazardous alcohol use, sedentary behavior and unhealthy diets, significantly increase the risk of NCD mortality[1]. In the eastern Mediterranean region, the main CVD risk factors include tobacco use, hypertension, type 2 diabetes, physical inactivity, depression, and obesity[5]. In Morocco in 2000, the prevalence of hypertension was 33.6% and diabetes 6.6%[6]. Due to ageing, urbanization and globalization, the prevalence of multimorbidity (≥2 chronic conditions), have been increasing in LMICs[7,8], including in the eastern Mediterranean

region, and it is important to understand the local drivers of multimorbidity[4]. Against this backdrop, recent national community-based information on multimorbidity and its risk factors in Morocco are needed[7,8].

Factors associated with multimorbidity include sociodemographic factors, such as being female[8-10], older age[8-10], lower education level[10], lower socioeconomic status[9], unemployed/retired[10], and urban residence[11]. Multimorbidity behavior risk factors include obesity[8,12], physical inactivity[8,13], sedentary behavior[14], alcohol consumption[8,15], insufficient consumption of fruits and vegetables[8], and tobacco use[8,15]. The study aimed to estimate the prevalence and associated factors of non-communicable diseases multimorbidity among adults in Morocco.

METHODS
Sample and procedure
This is a secondary data analysis of the national cross-sectional Morocco STEPS 2017 survey[16]; the overall response rate to the study was 89.0%[17]. A multi-stage cluster sampling design was applied to generate representative data for adults aged ≥18 years in Morocco; more details elsewhere[18]. Men and women who were aged ≥18 years, resided in urban or rural areas, and were primarily living in regular households on the day of the survey met the inclusion criteria[17]. Exclusion criteria were people aged <18 years, people living in collective or nomadic households, people who were unable to answer questions, and those who had three unsuccessful visits within two days[17]. To account for non-responses, the sample size was multiplied by the inverse of the response rate, which was predicted to be 80%, yielding 6100 households[17] (Figure 1); further details of the sample size calculation is found in the STEPS report[17].

Figure 1. Participant flow chart, Morocco 2017 STEPS survey
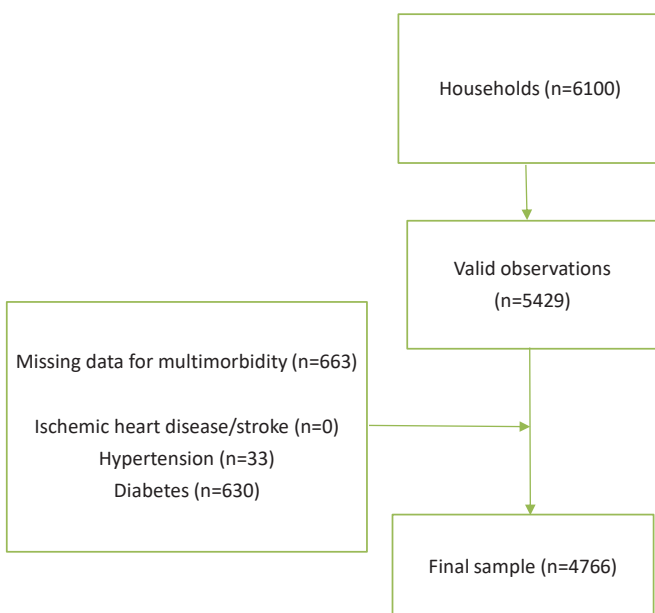
According to the STEPS survey procedures, Sociodemographic and behavioral information was collected by structured interview in Step 1. Physical measurements such as height, weight, and blood pressure were collected in Step 2. Biochemical measurements were collected to assess blood glucose in Step 3[16]. The study was approved by the Biomedical Research Ethics Committee, Faculty of Medicine and Pharmacy of Rabat. Participants provided written informed consent[17].

Measures
Outcome variable: multimorbidity
Diabetes was defined as fasting plasma glucose levels

Table 1. Sociodemographic and lifestyle sample characteristics of community dwelling adults in the Morocco STEPS 2017 cross-sectional survey (N=5429)

Characteristics	Categories	n	Weighted %
All		5429	
Age (years)	18–29	1061	29.9
	30–34	1744	31.4
	45–59	1498	22.8
	≥60	1126	15.9
Gender	Female	3538	50.9
	Male	1891	49.1
Education level	None	2696	40.5
	Primary	1158	23.1
	>Primary	1570	36.4
Residence	Rural	2040	35.9
	Urban	3389	64.1
Smoking status	Never	4613	80.2
	Past	376	8.2
	Current	440	11.6
Alcohol use	No	5373	98.3
	Current	56	1.7
Fruit/vegetable intake (servings/day)	≥5	1237	23.7
	<5	4159	76.3
Physical activity	Low	1456	25.3
	Moderate	1194	22.0
	High	2757	52.7
Sedentary behavior (h/day)	<4	3603	66.5
	4 to <8	1477	27.5
	≥8	339	6.0
Body mass index	Underweight	212	5.5
	Normal	1926	41.5
	Overweight	1835	32.9
	Obese	1278	20.1

Table 2. Distribution of diabetes, hypertension, ischemic heart disease/stroke and multimorbidity of community dwelling adults in the Morocco STEPS 2017 cross-sectional survey (N=5429)

Variable	Categories	Diabetes (N=4779) %	Hypertension (N=5396) %	Ischemic heart disease/stroke (N=5429) %	Multimorbidity (N=4766) %
All		10.7	19.5	3.3	5.0
Age (years)	18–29	4.0	7.4	2.6	0.5
	30–34	7.5	14.0	2.8	2.9
	45–59	15.0	27.4	2.8	7.0
	≥60	22.3	41.6	6.4	14.0
Gender	Female	12.5	20.3	3.8	5.7
	Male	8.8	18.6	2.9	4.3
Education level	None	14.3	26.5	3.6	7.2
	Primary	9.2	16.3	3.3	4.2
	>Primary	7.4	13.6	2.9	2.9
Residence	Rural	8.2	19.2	2.8	3.3
	Urban	12.3	19.6	3.6	6.1
Smoking status	Never	11.2	19.6	3.4	5.3
	Past	10.6	23.4	3.4	5.4
	Current	7.3	15.7	2.5	3.0
Alcohol use	No	10.8	19.6	3.3	5.1
	Current	7.9	14.1	3.2	2.6
Fruit/vegetable intake (servings/day)	≥5	10.8	20.0	3.9	5.8
	<5	10.8	19.2	3.2	4.9
Physical activity	Low	13.4	26.1	4.7	7.6
	Moderate	13.6	20.4	2.4	5.7
	High	8.4	15.9	3.0	3.5
Sedentary behavior (h/day)	<4	9.7	17.9	3.4	4.1
	4 to <8	12.6	21.1	3.1	7.0
	≥8	13.3	29.4	3.7	6.8
Body mass index	Underweight	3.9	11.0	3.1	0.0
	Normal	7.6	13.6	3.4	3.1
	Overweight	11.5	22.6	3.1	6.1
	Obese	18.2	30.1	4.1	9.1

≥7.0 mmol/L (≥126 mg/dL); or using insulin or oral hypoglycemic drugs[19]. Hypertension/raised blood pressure (BP) was based on measured blood pressure (average of two of last three measurements) and defined as systolic BP ≥140 mmHg and/or diastolic BP ≥90 mmHg or where the participant is currently on antihypertensive medication[20]. Ischemic heart disease/stroke was self-reported by response to the question: 'Have you ever had a heart attack or chest pain from heart disease (angina) or a stroke (cerebrovascular accident or incident)?' (yes, no)[17].

From the three NCDs (diabetes, hypertension, and ischemic heart disease/stroke) a composite score was calculated, with ≥2 NCDs coded as 1 (multimorbidity) and ≤1 NCD as 08.

Behavioral NCD risk factors included past and current tobacco smoking (yes/no); current alcohol use (yes/no); low (<4 h/day), moderate (4 to <8 h/day) and high (≥8 h/day) sedentary behaviour[21] based on the Global Physical Activity Questionnaire[22]; and inadequate fruit/vegetable consumption (<5 servings/day)[17]. Body mass index (BMI, kg/m²) based on measured height and weight was classified as:

Table 3. Associations between sociodemographic and behavioral factors with multimorbidity in community dwelling adults in the Morocco STEPS 2017 cross-sectional survey (N=4766)

Variable	Categories	OR (95% CI)	AOR (95% CI)[a]
Age (years)	18–49 ®	1	1
	≥50	6.17 (4.56–8.36)***	5.11 (3.64–7.18)***
Gender	Female ®	1	1
	Male	0.74 (0.56–0.97)*	1.09 (0.77–1.54)
Education level	None ®	1	1
	Primary	0.57 (0.40–0.82)**	0.91 (0.61–1.36)
	>Primary	0.38 (0.27–0.53)***	0.67 (0.46–0.99)*
Residence	Rural ®	1	1
	Urban	1.90 (1.41–2.55)***	1.75 (1.26–2.43)***
Smoking status	Never ®	1	1
	Past	1.03 (0.65–1.65)	0.84 (0.69–1.20)
	Current	0.56 (0.33–0.95)*	0.70 (0.38–1.31)
Alcohol use	No ®	1	-
	Current	0.53 (0.13–2.23)	
Fruit/vegetable intake (servings/day)	≥5 ®	1	-
	<5	0.82 (0.62–1.10)	
Physical activity	Low ®	1	1
	Moderate	0.74 (0.53–1.03)	0.84 (0.59–1.19)
	High	0.44 (0.33–0.59)***	0.70 (0.62–0.95)*
Sedentary behavior (h/day)	<4 ®	1	1
	4 to <8	1.77 (1.35–2.32)***	1.41 (1.08–1.85)*
	≥8	1.69 (1.07–2.66)*	1.03 (0.64–1.66)
Body mass index	<25 kg/m² ®	1	1
	Overweight	2.31 (1.63–3.26)***	1.74 (1.21–2.49)**
	Obese	3.58 (2.53–5.07)***	2.34 (1.63–3.36)***

a AOR: adjusted odds ratio; adjusted for all variables in the adjusted table column. ® Reference categories. ***$p<0.001$, **$p<0.01$, *$p<0.05$.

underweight (<18.5), normal (18.5–24.9), overweight (25.0–29.9), and obese (≥30.0)[19]. Sociodemographic information included education level, sex, age, and residence status[17].

Statistical analysis

The STATA software version 15.0 software (Stata Corporation, College Station, TX, USA) was used for statistical analyses, taking multistage sampling and weighting of the data into account. Descriptive statistics (frequencies and percentages) are used to describe NCDs and multimorbidity. Univariable and multivariable logistic regressions were calculated on the associations between sociodemographic and health factors and multimorbidity using odds ratios and 95% confidence intervals. Variables significant (p<0.05) in univariable analyses were included in the multivariable models. A p<0.05 was considered significant.

RESULTS

Characteristics of the participants

The sample included 5429 people aged ≥18 years (mean age=45.1 years, SD=16.3), 50.9% were female, 64.1% lived in urban areas, and 36.4% had more than primary education. Slightly more than one in ten participants (11.6%) were current tobacco smokers, 1.7% current alcohol users, 76.3% had insufficient fruit and vegetables, 25.3% had low physical activity, 27.5% moderate (4 to <8 h/day) and 6.0% high (≥8 h/day) sedentary behavior, and 53.0% were overweight or obese (Table 1).

Prevalence of diabetes, hypertension, ischemic heart disease/stroke and multimorbidity

The prevalence of diabetes was 10.7%, hypertension 19.5%, ischemic heart disease/stroke 3.3%, and multimorbidity

5.0%. Multimorbidity was highest among those aged ≥60 years (14.0%), those living in urban areas (6.1%) and those with obesity (9.1%) (Table 2).

Associations with multimorbidity
In the adjusted logistic regression model, older age (aged ≥50 years) (AOR=5.11; 95% CI: 3.64–7.18), urban residence (AOR=1.75; 95% CI: 1.26–2.43), moderate sedentary behavior (AOR=1.41; 95% CI: 1.08–1.85), being overweight (AOR=1.74; 95% CI: 1.21–2.49) and obese (AOR=2.34; 95% CI: 1.63–3.36) were positively associated with multimorbidity. More than primary education (AOR=0.67; 95% CI: 0.46–0.99), and high physical activity (AOR=0.70; 95% CI: 0.62–0.95) were negatively associated with multimorbidity. Furthermore, in the unadjusted analysis, male sex and current smoking were negatively associated with multimorbidity (Table 3).

DISCUSSION
The study found in a national sample of adults (aged ≥18 years) in Morocco that 5.0% had multimorbidity (10.7% diabetes, 19.5% hypertension, and 3.3% ischemic heart disease/stroke), which is higher than in a national survey in Botswana (3.5% hypertension, diabetes and stroke/heart attack multimorbidity)[8], but in a lower range compared to a review of studies in LMICs (3.2–90.5%)9. Compared to a national survey in Morocco 2000 (6.6% diabetes and 33.6% hypertension)6, the prevalence of diabetes (10.7%) increased and the prevalence of hypertension (19.5%) decreased in this 2017 study.

Consistent with previous findings[8-11], we found that older age, female sex, lower education level, and urban residence, increased the odds of multimorbidity. Multimorbidity increases with age because of the cumulative effects of NCDs[23]. The higher rate of multimorbidity in women may be attributed to higher survival rates in women and higher utilization of healthcare associated with higher diagnoses rates in women compared to men[9]. In addition, women have a higher rate of being overweight/obese than men, which makes them more vulnerable to NCDs and multimorbidity[8]. Participants with better education may be more aware of health issues and subsequently engaged in a healthier lifestyle, which may prevent the development of NCDs and multimorbidity[7].

In agreement with previous studies[8,12-14], this survey showed that lifestyle factors (physical inactivity, sedentary behavior, and being overweight or obese) were associated with multimorbidity. While some previous research[8,15] found an association between alcohol, tobacco use, and insufficient consumption of fruits and vegetable, and multimorbidity, we did not find any significant associations. Physical inactivity, sedentary behavior, and overweight and obesity can converge to increase vulnerability to NCDs and multimorbidity[12]. The proportion of people with inadequate physical activity in this study (25.3%) was higher than in a 2008 survey of

Moroccan adults (16.5%)[24]. Similarly, the prevalence of being overweight/obese in this study (53.0%) was higher than in a 2008 survey of Moroccan adults (43.4%)[25]. This increase in NCD risk factors may increase multimorbidity. Population programs are needed to promote physical activity, a healthy diet, and body weight control in Morocco.

Strengths and limitations
The strength of the study is the nationally representative sample of adults in Morocco. Study limitations included the cross-sectional design which precludes causative inferences, and some self-reported data, which may have been biased. The variable on household income had too many missing cases and was therefore excluded from the analysis.

CONCLUSIONS
One in 20 adults in Morocco had multimorbidity and associated sociodemographic factors (older age, female sex, low education level and urban residence) and health factors (being overweight or obese, physical inactivity and moderate sedentary behavior) were identified that can help to plan interventions.

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