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Burden of Cardiovascular Diseases in the Maghrebian Region, 1990-2017: Finding from the Global Burden Diseases Study 1990-2017

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Abstract

Background: The burden of Cardiovascular Diseases (CVD) is increasing in the Maghreb, but a systematic understanding of its distribution and time trends across the entire region is not readily available. In this report, we present a detailed analysis of how the patterns of cardiovascular diseases have changed across our region between 1990 and 2017.

Methods: We analyzed the mortality and Disability-adjusted Life-years (DALYs) due to CVD and the major component causes in the region of the Maghreb from 1990 to 2017, using all accessible data sources as part of the Global Burden of Diseases (GBD), Injuries, and Risk Factors Study 2017. We assessed heterogeneity in the burden of major CVD across the Region. We calculated 95% Uncertainty Intervals (UIs) for the point estimates.

Results: Overall, CVD contributed 41, 85% (95% UI 39, 43–46, 21) of the total deaths and 17, 70% (14, 91–19, 26) of the total DALYs in the Maghreb in 2017, from 1990 and 2017 the percentage changes of death and DALY are 30, 70% and 40, 78 %, respectively.

With 158.586, 93 (95% UI 132.854, 89-176.542, 30) death number of ischemic heart disease were estimated in the Maghreb in 2017, and 38.814, 98 (95% UI 36.254, 61-43.125, 36) death number of stroke, a 2-3 times increase in both disorders from 1990.

A total of 245.893, 80 CVD deaths (95% UI: 187.326, 99-380.258, 47) occurred in 2017 in the Maghreb, with

the highest number in Morocco (115.124, 03) and the lowest in Mauritania (3.924, 01).

Conclusion: Ischemic heart disease and stroke varies widely between the countries of the region. The age-standardized DALY rates in the Maghreb are considerably higher than the global average. These findings call for a comprehensive approach to prevent and control the burden of CVD in the region.

Keywords: Cardiovascular disease; Burden of disease; Maghrebian region; Death; Age standardized

Introduction

Cardiovascular Diseases (CVD) are the leading cause of disease burden and deaths globally [1-4]. The United Nations (UN), alarmed by the increasing burden of Non-communicable Diseases (NCDs) and high disease severity and case-fatality in low-income and middle-income countries compared with high-income countries, acknowledged in 2012 that the rising burden of NCDs was one of the major threats to sustainable development in the 21st century [5-10]. The World Health Organization (WHO) subsequently developed targets for prevention and control of NCDs in 2013, which included 25% relative reduction in overall mortality from CVD, 25% relative reduction in prevalence of high blood pressure, halting the rise in diabetes and obesity, and ensuring that at least 50% of patients with CVD have access to relevant drugs and medical counseling by 2025 [11,12]. The Sustainable Development Goals (SDG) also include a target to reduce premature deaths due to NCDs to a third of total premature deaths by 2030, emphasising the need for multisectoral national policies to

facilitate the prevention and control of burden from NCDs [13-15].

The Global Burden of Disease (GBD) study documented that CVD have been the leading cause of global mortality since 1980 (Institute for Health Metrics and Evaluation 2017; Mortality and Causes of Death 2017). CVD accounted for nearly one-third of all deaths worldwide in 2017. Meanwhile, the principal components of CVD, namely stroke and ischemic heart disease, accounted for 85.1% (95% Uncertainty Interval (UI): 84.7–85.5) of all deaths in the CVD category in 2017 (Mortality and Causes of Death 2017) [1-5]. The Maghreb region has reported a varied epidemiological transition among the all Arab and North Africa from 1990 to 2017 as part of the GBD Injuries, and Risk Factors GBD Study 2017 [1-5,16]. Here, we report time trends and heterogeneity among the five countries for CVD from 1990 to 2017 and for the major risk factors for CVD. The Maghreb region is located in North Africa comprises the countries of Algeria, Libya, Mauritania, Morocco, and Tunisia. In 2017, the total population of all Maghreb states amounted to an estimated 100 million inhabitants [17,18].

This region is part of both Africa and the Arab world; they put a Maghreb Union in place in 1989 to encourage economic amalgamation and cooperation [17,18]. This study aimed to report findings on CVD between 1990 and 2017, from the GBD, Injuries and Risk Factors Study (GBD 2017) in the 5 countries of the Maghreb. This would be help us better understand the burden of CVD and interventions needed to control these diseases.

Methods

GBD 2017 covers 195 countries, 21 regions, and seven super-regions from 1990 to 2017 for 315 diseases and injuries, 2619 unique sequelae, and 84 risk factors by age and sex. Detailed descriptions of the general methodological approach of GBD 2017 and specific methodology used for CVD have been provided elsewhere (GBD 2017 Disability-adjusted Life Years (DALYs) and Collaborators 2017; GBD 2017 Disease and Injury Prevalence Collaborators 2017; GBD 2017 Mortality and Causes of Death Collaborators 2017) [1-5].

The category of CVD includes the ten most common global causes of CVD-related death: rheumatic heart disease,

ischemic heart disease, cerebrovascular disease (ischemic stroke and hemorrhagic stroke), hypertensive heart disease, cardiomyopathy and myocarditis, atrial fibrillation and flutter, aortic aneurysm, peripheral vascular disease, endocarditis, and “other cardiovascular and circulatory diseases.”

The International Classification of Diseases (ICD-10) code is used for each of the cardiovascular causes [19,20]. To estimate the number of deaths due to CVD, we estimated all-cause mortality envelopes (total number of deaths) for each country-year during 1990–2017; we used all accessible data such as vital registration systems, sample registration data, and household recall of deaths [20].

We used the GBD comparative risk assessment approach as an overarching conceptual framework for population risk assessment across the risks over time. We report 95% Uncertainty Intervals (UI) for each estimate, including rates, numbers of deaths and DALYs. We evaluated the burden of CVD in the Maghrebian Region, which contains 5 countries: Algeria, Libya, Mauritania, Morocco, and Tunisia.

Results

Mortality

A total number of CVD death in the Maghreb increased from with a percentage change of 38.78% 137.320, 68 (95% UI: 99.873, 32-190.125, 69) in 1990 to 245.893, 80 (95% UI: 187.326, 99-380.258, 47) in 2017 (**Tables 1 and 2**). These deaths accounted for 42% (95% UI: 39.1-45.4) of all deaths in the region in 2017, compared to 32.2% (30.5–35.9) of all deaths in 1990. The **Table 1** provides the total number of deaths from all CVD categories, Ischemic Heart Disease (IHD) was 158.586, 93 (95% UI: 132.854, 89-176.542, 30) in 2017, which accounted for 28.4% of the total number of deaths due to CVD in the Maghreb. There were 744, 640 additional deaths in 2017 compared to 1990, out of which 58.5% was contributed by IHD. **Table 2** provides the total number of deaths from CVD in 2017 for all Maghreb countries. In 2017, Morocco had the highest death number from CVD, followed by Algeria and Tunisia. In most of the Maghreb countries, total CVD number death increased between 1990 and 2017, with the highest increase in Morocco, Algeria and Tunisia.

Table 1 Total number of cardiovascular diseases deaths in Maghrebian Region, 2017.

	Algeria	Morocco	Libya	Tunisia	Mauritania	Maghreb
Cardiovascular diseases	79.389, 37 (75.561, 29-83.173, 01)	115.124, 03 (99.057, 30-131.422, 77)	13.334, 42 (11.919, 52-14.949, 83)	34.122, 27 (28.811, 57-39.999, 52)	3.924, 01 (3.393, 69-4.495, 55)	245.893, 80 (187.326, 99-380.258, 47)
Rheumatic heart disease	305, 50 (243, 35-384, 30)	592,88 (419, 51-792, 47)	54,82 (34, 56-95, 03)	98, 30 (80, 12-119, 70)	55, 95 (45, 87-67, 91)	1.107, 45 (897, 33-1.276, 56)
Ischemic heart disease	49.212, 76 (45.343, 08-54.223, 13)	76.243, 11 (65.399, 14-88.130, 30)	9.179, 47 (7.988, 09-10.379, 74)	22.025, 46 (18.358, 05-25.949, 72)	1.926, 14 (1.636, 78-2.245, 16)	158.586, 93 (132.854, 89-176.542, 30)

Ischemic stroke	13.008, 01 (11.258, 87-14.848, 83)	17.716, 48 (14.496.53-21.184, 94)	1.732, 86 (1.373, 84-2.108, 58)	5.811, 17 (4.811, 59-7.021, 87)	546, 46 (439, 33-659, 85)	38.814, 98 (36.254, 61-43.125, 36)
Hemorrhagic stroke	5.184, 36 (4.358, 23-6.168, 80)	8.034, 18 (5.982, 24-10.149, 43)	805, 42 (576, 02-1.032, 17)	1.843, 22 (1.482, 86-2.265, 30)	752, 13 (600, 81-904, 37)	16.619, 31 (14.819, 58-18.921, 42)
Hypertensive heart disease	6.008, 08 (2.407, 00-8.743, 80)	6.552, 78 (2.713, 10-8.691, 27)	679, 89 (279, 84-972, 47)	2.352, 46 (935, 53-3.290, 68)	156, 87 (86, 96-223, 62)	15.750, 08 (14.123, 25-16.329, 87)
Cardiomyopathy and myocarditis	790, 24 (584, 11-984, 19)	685, 02 (541, 12-870, 56)	149, 07 (105, 32-197, 69)	241, 42 (174, 51-310, 31)	76, 51 (49, 11-111, 02)	1.942, 26 (1.832, 55-2.100, 69)
Atrial fibrillation and flutter	737, 57 (638, 93-928, 39)	636, 07 (529, 72-774, 91)	83, 27 (65, 28-107, 03)	312, 04 (257, 99-392, 72)	63, 77 (49, 01-80, 30)	1.832, 72 (1.528, 21-1.995, 52)
Aortic aneurysm	280, 75 (202, 90-382, 45)	327, 22 (240, 58-457, 08)	44, 05 (33, 09-60, 88)	116, 36 (82, 23-164, 22)	32, 46 (25, 17-42, 33)	800, 84 (684, 27-995, 26)
Peripheral artery disease	61, 69 (22, 44-105, 24)	22, 39 (14, 54-30, 79)	10, 66 (5, 34-17, 52)	17, 97 (8, 66-28, 51)	6, 54 (1, 98-11, 60)	119, 25(95, 76-135, 69)
Endocarditis	212, 63 (152, 96-271, 21)	156, 01 (113, 19-203, 39)	42, 67 (22, 98-66, 30)	69, 73 (52, 45-88, 07)	41,81(32,71-51,87)	522, 85 (429, 51-751, 66)
Other cardiovascular diseases	2.188, 93 (1.284, 77-3.800, 07)	2.348, 06 (1.274, 57-4.175, 39)	328, 09 (197, 82-532, 06)	769, 96 (436, 17-1.009, 74)	206, 01 (133, 53-498, 16)	5.841, 05 (4.312, 02-8.223, 75)

95% UIs are in parentheses.

Table 2 Total number of death for cardiovascular disease causes of death in 1990 and 2017 and percent change, Global Burden of Disease study, Maghrebian Region, 1990-2017.

Country	Number of death				% change 1990-2017
	1990		2017		
	Number	95% UI	Number	95% UI	
Algeria	42.528, 35	(39.689, 08-45.198, 47)	79.389, 07	(75.561, 29-83.173, 01)	87%
Morocco	68.113, 48	(64.166, 20-72.338, 10)	115.124, 03	(99.547, 30-131.422, 77)	69%
Libya	6.452, 15	(5.824, 95-7.154, 31)	13.334, 42	(11.911, 52-14.949, 83)	10.7%
Tunisia	16.890, 98	(16.102, 85-17.732, 88)	34.122, 27	(28.811, 57-39.999, 52)	10.2%
Mauritania	3.362, 73	(3.042, 68-3.693, 29)	3.924, 01	(3.393, 69-4.495, 55)	17%
Maghreb	137.347, 69	(99.873, 32-190.125, 69)	245.893, 80	(187.326, 99-480.258, 47)	38.78%

95% UIs are in parentheses

DALYs

Table 3 reports numbers of DALYs of CVD for different country in the Maghreb in 1990 and 2017. The number of DALYs from CVD increased from 3.367.876, 31 (95%UI:

2.856.746, 25-5.865.123, 32) in 1990 and 5.099.844, 52 (95% UI: 4.854.628, 59-7.891.962, 05) in 2017, a 50.4% increase. As shown, DALY rates increased in all Maghreb countries from 1990 to 2017; the greatest increase in DALY number was seen in Libya 75%, Tunisia 67% and Algeria 51%.

Table 3 Total disability-adjusted life years (DALY) for component cardiovascular causes of death in 1990 and 2017 and percent change, Global Burden of Disease study, Maghrebian Region, 1990-2017.

Country	Number of DALYs				% change 1990-2017
	1990		2017		
	Number	95% UI	Number	95% UI	
Algeria	1.067.194, 61	(990.460, 64-1.139.410, 81)	1.607.330, 19	(1.500.941, 33-1.703.785, 84)	51%

Morocco	1.666.257, 71	(1.568.209, 04-1.773.363, 25)	2.462.669, 42	(2.131.037, 05-2.809.149, 09)	48%
Libya	194.649, 83	(175.436, 73-214.404, 94)	340.728, 36	(303.304, 90-382.859, 19)	75%
Tunisia	357.067, 66	(336.756, 26-376.741, 45)	596.993, 98	(502.983, 59-706.211, 12)	67%
Mauritania	82.706, 50	(74.802, 64-90.690, 88)	92.122, 57	(79.947, 76-105.378, 06)	11%
Maghreb	3.367.876, 31	(2.856.746, 25-5.865.123, 32)	5.099.844, 52	(4.854.628, 59-7.891.962, 05)	50.4%
DALY: Disability Adjusted Life Years; 95% UIs are in parentheses.					

Discussion

This study shows that CVD are the leading cause of disease burden in the Maghreb as a whole and in most of the countries of the region.

A total number of CVD death in the Maghreb increased from with a percentage change of 38.78% 137.320, 68 (95% UI: 99.873, 32-190.125, 69) in 1990 to 245.893, 80(95% UI: 187.326, 99-380.258, 47) in 2017. These deaths accounted for 42% (95% UI: 39.1-45.4) of all deaths in the region in 2017, compared to 32.2% (30.5–35.9) of all deaths in 1990. Ischemic Heart Disease (IHD) was 158.586, 93 (95% UI: 132.854, 89-176.542, 30) in 2017, which accounted for 28.4% of the total number of deaths due to CVD in the Maghreb.

There were 744, 640 additional deaths in 2017 compared to 1990, out of which 58.5% was contributed by IHD. In 2017, Morocco had the highest death number from CVD, followed by Algeria and Tunisia. In most of the Maghreb countries, total CVD number death increased between 1990 and 2017, with the highest increase in Morocco, Algeria and Tunisia.

The number of DALYs from CVD increased from 3.367.876, 31(95% UI: 2.856.746, 25-5.865.123, 32) in 1990 and 5.099.844, 52 (95%UI: 4.854.628, 59-7.891.962, 05) in 2017, a 50.4% increase. DALY number increased in all Maghreb countries from 1990 to 2017; the greatest increase in DALY number was seen in Libya 75%, Tunisia 67% and Algeria 51%.

The United Nations has set targets to decrease mortality from NCD (SDG, target 3.4.1), and CVD is at the center of this target (GBD 2015 SDGs Collaborators 2016) [10-14]. The WHO has suggested a package of essential NCD interventions for primary health care in low-resource settings. These interventions include a mixture of cost-effective population-wide and individual approaches to reduce the burden of major NCD, such as methods for early detection and diagnosis using inexpensive technologies, non-pharmacological and pharmacological approaches for modification of risk factors and affordable medications for prevention and treatment of heart attacks and strokes, diabetes, cancer and asthma [10-14].

The Eastern Mediterranean Region (EMR) study of Tehrani-Banihashemi et al. [20] showed that increased blood pressure is the most important risk factor for CVD in the EMR, followed by high total cholesterol and high body mass index. A Cochrane systematic review showed that multiple risk factor

interventions may lower systolic and diastolic blood pressure, body mass index, and waist circumference in low-and middle-income countries [20,21]. Previous studies show a high percentage of undiagnosed CVD risk factors, such as diabetes and hypertension, in the region [22-26].

The evidence shows that delayed detection and undiagnosed risk factors, especially diabetes, are strong predictors of fatal CVDs [27-29]. This study on CVD mortality forecast in 2015 has shown that the MENA region will not achieve the target of 25% reduction of CVD mortality by 2025 without achieving all major targets for risk factor reduction [20] (i.e., reducing the prevalence of elevated systolic blood pressure by 25%, reducing the prevalence of smoking by 30%, halting the rise in elevated body mass index, and halting the rise in fasting plasma glucose). Moreover, reports of health system challenges in controlling and managing CVD in some of the EMR countries reemphasize the need for significant investment and improvement of access [30-32].

With globalization and urbanization of most societies, people in the Maghreb may be exposed to numerous stressors. Treatable conditions such as depression anxiety account for most of the burden in the region. Several epidemiological studies reported the effects of chronic stressors on CVD, there have been some interesting recent reports examining how chronic stress may relate to some of the physiological underpinnings of cardiac risk [33-36].

These findings call for a comprehensive approach to prevent and control the burden of CVD in the region. This approach should include a road map for better monitoring of the burden in EMR countries, with a focus on potential variations in risk and care by regions within the countries. It should also include programs for increasing awareness among the general population of the importance of controlling CVD risk factors.

Conclusion

Most of the Maghrebian countries have launched programs to reduce the burden of non-communicable disease, but they generally do not have widespread programs to combat CVD. Our study showed a large and increasing burden of CVD. This burden will increase with aging and growth of the population unless effective. CVD is a costly disease and most countries in the region spend a large percentage of their health resources on the disease. These findings call for a comprehensive

approach to prevent and control the burden of CVD in the region.

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