

DOI: 10.21767/1791-809X.1000631

Trends in Burden of Congenital Heart Disease in the Maghrebian Region 1990-2017

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Received date: 02 January 2019; Accepted date: 21 February 2019; Published date: 28 February 2019

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Citation: Boussouf K, Zaidi Z, Benkobbi S, Bitat-Aouati C, Boudiaf SB, et al. (2019) Trends in Burden of Congenital Heart Disease in the Maghrebian Region 1990-2017. Health Sci J Vol.13.No.1:631.

Abstract

Background and objectives: Congenital Heart Disease (CHD) is the most common class of major congenital malformations. It is also the leading cause of mortality from birth defects.

We used the Global Burden of Disease (GBD) 2017 study results to explore the burden of CHD in five countries of the Maghrebian region.

Methods: We estimated the most comprehensive of CHD mortality, prevalence, and disability among children (0–1 year), all ages and age standardized for the Maghrebian countries from 1990 to 2017. The burden of disease related to CHD was calculated using the GBD comparative risk assessment approach.

Results: CHD caused 4.622,87 (95% UI 3.801,24–7.580,28) all age deaths in Maghreb in 2017, a 50% decline from 1990, 661,02 (95% UI 310,96–933,58) rate per 100.000, among children (0-1 year) CHD deaths, a 42.4% decline from 1990 and 19,37 (95% UI 11,88–45,68) in age standardized CHD deaths a 40.6% decline from 1990.

Leading to a 21.6% decrease from 1990 to 2017 in the number of people living with CHD to 727.01 (95% UI 631,28–1.098,29), causing a total of 397.060,97 (220.367,12–685.127,98) years lived with disability.

Conclusion: This is the first study to estimate trends in CHD burden for the Maghreb from 1990 to 2017. These findings highlight the large inequities in CHD in the region

and can serve as a starting point for policy changes leading to improved screening, treatment, and data collection. We call for Maghreb countries to invest more resources in prevention and health promotion efforts to reduce this burden.

Keywords: Congenital heart disease; Burden of disease; Maghrebian region; Death; Prevalence; Age standardized

Introduction

Cardiovascular diseases are the leading cause of disease burden and deaths globally [1-3]. 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 [4-10]. Congenital Heart Disease (CHD) is the most common class of major congenital malformations. Although there is slight variation between many population-based studies, CHD occurs in ≈ 1% of live births, with similar prevalence throughout world, [11-14] and in 10% of aborted fetuses [15]. It is also the leading cause of mortality from birth defects [16]. The expected surgical outcomes for patients with simpler congenital cardiovascular lesions (eg. typical forms of septal defects) have continually improved and have long since reached a very high level of excellence [16,17].

Management of CHD has been further refined by the design of catheter-delivered devices to close septal defects and replace insufficient valves. Cardiac advanced imaging

techniques have allowed unparalleled noninvasive quantification of anatomy and function, and the electrophysiological sequelae have been treated with catheter ablation and implantable cardioverter defibrillators and other cardiac rhythm management devices. Other devices originally designed for adults, such as ventricular assist devices, are being adapted to infants and children [18-22].

The development of fetal echocardiography has provided a window into the evolution of CHD in utero, and fetal intervention, the possibility to potentially alter its course [23-25]. As mortality attributable to infectious diseases has very gradually been reduced by advances in development, nutrition, public health practices, and vaccination, the global burden of NCDs in children has become a target for international health policy [26,27]. As more countries progress through a transition from predominantly communicable diseases to NCDs, health systems are increasingly burdened with the detection, treatment, and management of NCDs.

CHD remains a major cause of serious morbidity and mortality, the important prevalence of rheumatic heart disease in many developing countries alters the necessary mix of resources and therapy to address the cardiac needs of the young population [28,29].

The design of high-value solutions will foster unique models of care, capable of providing excellent outcomes in the developing world.

The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) is an international collaboration of researchers who annually produce internally consistent estimates of death and disability throughout the world [1-4]. It incorporated many different data sources on mortality, prevalence and DALYs employed a variety of statistical approaches to maximize the robustness of the final results. We report here on the GBD 2017 approach and results, to describe the temporal trends of CHD in the Maghreb from 1990 to 2017 [1-4].

Methods

Detailed methods for each analytic step in GBD 2017 are described elsewhere [1-4]. Reporting is compliant with the Guidelines for Accurate and Transparent Health Estimates Reporting (GATHER) [30].

All input data are available online at the GBD Input Data Sources Tool of the Global Health Data Exchange (GHDx; <http://ghdx.healthdata.org>).

The Maghreb region is situated in North Africa comprises the countries of Algeria, Libya, Mauritania, Morocco and Tunisia. In 2017, the total population of all Maghreb countries amounted to an estimated 100 million inhabitants. 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 [31,32].

We estimated the most comprehensive of CHD mortality, prevalence, and disability among children (0–1 year), all ages and age standardized for the Magrebian countries from 1990 to 2017. The burden of disease related to CHD was calculated using the GBD comparative risk assessment approach.

Results

Cause-specific mortality due to CHD

Congenital heart disease was the underlying cause of death for an estimated 4.622, 87 (95% UI 3.801, 24-7.580, 28) Maghrebian people in 2017, a 50% decline from 1990 when the number was 10.824, 69 (95% UI 6.060,58-13.125,96) (**Table 1**).

Of all CHD deaths, 661.02 (95% UI 31.96-933.58) occurred in infants under 1 year of age. The numbers of CHD deaths and mortality rates were highest in Algeria and Morocco (**Table 1**).

Table 1 GBD 2017 CHD All Age Death number, <1 Year Death Rate, Age-standardized Death Rates with Mean Percent Change for 1990 to 2017 in Maghrebian countries.

	Deaths Rate Per 100,000			Deaths Number			Deaths Rate Per 100,000		
	<1 year			All Ages			Age-standardized		
	1990	2017	Percent change 1990-2017	1990	2017	Percent change 1990-2017	1990	2017	Percent change 1990-2017
Algeria	604.53 (296.45-878.66)	192.17 (90.46-303.09)	-68%	5798.18 (3153.69-8153.61)	2282.60 (1300.61-3429.08)	-61%	15.09 (8.28-21.13)	5.20 (3.00-7.77)	-66%
Morocco	308.97 (152.65-484.19)	226.50 (122.80-339.72)	-27%	2606.36 (1336.74-3982.27)	1801.05 (1011.90-2578.63)	-31%	7.54 (3.87-11.50)	6.10 (3.39-8.79)	-19%
Libya	354.39 (195.72-520.06)	59.18 (38.83-86.18)	-83%	598.09 (336.97-850.19)	178.43 (131.89-240.81)	-70%	10.00 (6.15-14.19)	2.85 (2.10-3.84)	-71%

Tunisia	653.82 (337.71-962.22)	93.82 (65.04-129.62)	-86%	1750.83 (975.51-2413.43)	218.30 (155.26-297.19)	-88%	16.29 (9.11-22.44)	2.52 (1.79-3.49)	-84%
Mauritania	58.74 (32.10-127.78)	89.35 (60.54-131.11)	52%	71.23 (36.06-144.22)	142.49 (99.27-198.91)	0%	1.97 (1.05-3.95)	2.70 (1.89-3.74)	37%
Maghreb	1.980.46(1.230.55-2.345.62)	661.02 (310.96-933.58)	-42.4%	10.824.69 (6.060,58-13.125, 96)	4.622,87 (3.801,24-7.580,28)	-50%	48,92 (26,12-72,58)	19,37 (11,88-45,68)	-40,6%

95% UIs are in parentheses.

Non-fatal burden of CHD

For children under 1 year, a total of 4.452, 92 (95% UI 1.987,23-8.327,95) rate per 100.000 Maghrebian people were estimated to be living with CHD in 2017, a 0.8% increase from

4.446, 28 (95% UI 2.358,12-7.369,45) prevalent cases in 1990. The increase is related to improved survival and population growth. All ages prevalence CHD was 727.01 (95% UI 631,28-1.098,29) in 2017, which has declined by 21% since 1990 (Table 2).

Table 2 GBD 2017 prevalence of congenital heart anomalies at <1 year, all ages and age-standardized with mean percent change for 1990 to 2017 in Maghrebian countries.

	Prevalence Rate Per 100,000			Prevalence Number			Prevalence Rate Per 100,000		
	<1 year			All Ages			Age-standardized		
	1990	2017	Percent change 1990-2017	1990	2017	Percent change 1990-2017	1990	2017	Percent change 1990-2017
Algeria	781.64 (668.93-898.98)	787.90 (676.92-922.35)	1%	167.21 (148.53-187.17)	129.61 (115.72-144.88)	-22%	124.20 (111.11-138.18)	127.76 (114.25-142.78)	3%
Morocco	889.06 (770.74-1026.91)	862.78 (745.53-998.01)	-3%	161.84 (144.19-181.06)	120.93 (108.52-134.68)	-25%	129.32 (115.74-144.41)	129.86 (116.32-145.36)	0%
Libya	692.00 (587.21-815.28)	754.24 (637.50-883.68)	9%	157.13 (139.52-177.59)	123.64 (110.32-139.16)	-21%	119.94 (107.36-134.48)	127.52 (113.54-143.87)	6%
Tunisia	752.45 (643.24-879.14)	746.13 (645.08-868.81)	-1%	148.48 (132.58-165.28)	124.69 (111.86-139.28)	-27%	122.86 (110.09-136.32)	124.69 (111.86-139.28)	1%
Mauritania	1331.13 (1157.04-1539.85)	1301.87 (1140.70-1483.26)	-2%	261.73 (233.04-291.96)	228.14 (204.23-252.90)	-13%	173.39 (155.97-192.16)	171.62 (154.27-189.41)	-1%
Maghreb	4.446.28 (2.358,12-7.369,45)	4.452,92 (1.987,23-8.327,95)	0.8%	896.39 (527.78-1.203,81)	727.01 (631.28-1.098,29)	-21.6%	669.71 (598.30-956.47)	681.45 (468.74-852.49)	1.8%

95% UIs are in parentheses.

DALYs (Disability-adjusted Life Years)

The number of DALYs from CHD population decreased from 941.937,08 (95% UI: 502.465, 27-1.013.259, 53) in 1990 -397.060,97 (95% UI: 220.367, 12-685.127,98) in 2017 with a percentage change of 31.2% (Table 3).

The age-standardized DALY rate also decreased 41.4% during 1990–2017 (Table 3). Table 3 reports numbers and age standardized rates of DALYs for different CHD in the Maghreb in 1990 and 2017. The age-standardized DALY rate of CHD 2017 was higher in Algeria and Morocco.

Table 3 GBD 2017 CHD All Age Disability-adjusted Life Years (DALYs) number, <1 Year Death Rate, Age-standardized Death Rates with Mean Percent Change for 1990 to 2017 in Maghrebian countries.

	DALYs Rate Per 100,000	DALYs number	DALYs Rate Per 100,000
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	<1 year			All Ages			Age-standardized		
	1990	2017	Percent change 1990-2017	1990	2017	Percent change 1990-2017	1990	2017	Percent change 1990-2017
Algeria	52.960,92 (26.006,06-77.013,45)	16.875,98 (7.972,46-26.599,16)	-68%	503.612,19 (272.390,70-708.605,55)	197.567,40 (111.566,69-296.984,20)	-61%	1.305,83 (710,16-1.834,76)	449,24 (256,82-672,65)	-66%
Morocco	27.111,62 (13.407,54-42.471,65)	19.893,09 (10.804,91-29.824,04)	-27%	228.014,11 (117.002,67-348.167,37)	153.991,91 (86.480,12-221.314,10)	-32%	658,65 (338,91-1.003,89)	524,15 (292,10-759,36)	-20%
Libya	31.069,62 (17.175,71-45.569,37)	5.215,81(3.420,53-7.585,91)	-83%	51.558,53 (31.182,88-73.417,58)	14.270,32 (10.296,31-19.505,87)	-72%	851,65 (517,98-1.211,27)	226,93 (163,15-312,80)	-73%
Tunisia	57.290,20 (29.612,26-81.112,84)	8.255,21(5.726,25-11.387,26)	-86%	152.473,67 (84.822,58-210.109,87)	18.856,81 (13.297,98-25.646,19)	-88%	1.417,12 (789,88-1.951,99)	222,73 (156,16-302,59)	-84%
Mauritania	5.204,60 (2.866,85-11.264,23)	7.883,46(5.369,58-11.526,22)	51%	6.278,58(3.317,70-12.494,02)	12.374,53 (8.664,80-17.443,82)	97%	168,73 (91,87-331,41)	228,80 (161,14-320,79)	36%
Maghreb	173.636,96(81.289,65-212.567,80)	58.123,55 (32.674,27-90.583,29)	-42.6%	941.937,08 (502.465,27-1.013.259,53)	397.060,97 (220.367,12-685.127,98)	-31.2%	4.401,98 (2.395,88-7.526,30)	1.651,98(990,88--2.363,20)	-41.4%

95% UIs are in parentheses.

Discussion

Knowledge of a country's mortality patterns is essential to understand a country's public health needs and properly implement public health programs. However, Maghreb's CHD monitoring system is incomplete, making it difficult to document temporal changes in mortality rates. Yet, before our study no data had been available to describe temporal trends in CHD prevalence and mortality rates mortality rates.

Our study demonstrates the most comprehensive and up-to-date estimates of CHD in Arab and Maghrebian countries, children under on year prevalence of CHD has remained relatively stable from 1990 to 2017, with some variability at the country levels. In our region CHD was the underlying cause of death for an estimated 4.622, 87 (95% UI 3.801, 24-7.580, 28) in 2017, a 50% decline from 1990. Of all CHD deaths, 661.02 (95% UI 310.96-933.58) occurred in infants under 1 year of age. The numbers of CHD deaths and mortality rates were highest in Algeria and Morocco.

The absolute prevalence of less severe CHD has increased in all countries, likely to increased detection and diagnosis a combination of population aging and lack of access to the most advanced surgical services in countries in high income developed regions [33-36]. With differential access to care, the survival rate of children with severe and critical heart disease beyond one year of life is very low, except in high-income countries [33-36]. Several studies which analyzed data from

the largest and longest running health registration system, they found that the rate of change of CHD mortality in significantly increased over time [33-36]. Previous reports have shown that there has been a decline in CHD mortality in the American and Canadian populations during the past 3 decades [33-36].

This report gives countries more accurate data to leverage resources and advocate for policy change while also providing accurate baseline data to better track effectiveness of future interventions.

Conclusion

GBD estimates of mortality, prevalence, and disability due to CHD provide a critically important advance in our understanding of the global impact of CHD. This is the first study to estimate trends in CHD burden for the Maghreb from 1990 to 2017. These findings highlight the large inequities in CHD in the region and can serve as a starting point for policy changes leading to improved screening, treatment, and data collection. We call for Maghreb countries to invest more resources in prevention and health promotion efforts to reduce this burden.

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