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

Khaira Boussouf1, Zoubida Zaidi2, Saadia Benkobbi3, Cherifa Bitat-Aouati4, Sabah Ben Boudiaf5, Fatima Kaddour1 and Azzouz Djelaoudji6

1Department of Cardiology, University Hospital of Setif, Algeria
2Department of Epidemiology, University Hospital of Setif, Algeria
3Department of Legal Medicine, University Hospital of Setif, Algeria
4Department of Genetics, University Hospital of Setif, Algeria
5Department of Toxicology, University Hospital of Setif, Algeria
6Genetic and Nutritional Cardiovascular Diseases Laboratory, Medical Faculty of Setif, University of Ferhat Abbas, Setif, Algeria

*Corresponding author: Zoubida Zaidi, Department of Epidemiology, University Hospital of Setif, Algeria, Tel: 00213561728758; E-mail: zozaidi@yahoo.fr

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

Copyright: © 2019 Boussouf K, et al. This is an open-access article distributed under the terms of the creative commons attribution license, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

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].

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 |
|----------------|------------------------|---------------|------------------------|
| 1990           | 604.53 (296.45-878.66) | 10.824        | 5.20 (3.00-7.77)       |
| 2017           | 192.17 (90.46-303.09)  | 4.622         | 5.59 (3.39-8.79)       |
| Percent change  | -68%                   | -66%          | -19%                   |
| 1990           | 578.18 (315.69-8153.61)| 97.48         | 6.10 (3.39-8.79)       |
| 2017           | 2282.60 (1300.61-3429.08) | 47.50 | 7.54 (3.87-11.50) |
| Percent change  | -61%                   | -66%          | -19%                   |

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).
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              | 1990                       | 2017                       | 1990                       | 2017                       |
| *Percent change 1990-2017* |                       |                   | *Percent change 1990-2017* |                       | *Percent change 1990-2017* |                       |
| Algeria       | 781.64 (668.93-898.98)     | 787.90 (676.92-922.35) | 167.21 (148.53-187.17) | 129.61 (115.72-144.86) | -22% | 124.20 (111.11-13 8.18) | 127.76 (114.25-142.78) | 3% |
| Morocco       | 889.06 (770.74-1026.91)    | 862.78 (745.53-998.01) | 161.84 (144.19-181.06) | 120.93 (108.52-134.68) | -25% | 129.32 (115.74-14 4.41) | 129.86 (116.32-145.36) | 0% |
| Libya         | 692.00 (587.21-815.28)     | 754.24 (637.50-883.68) | 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) | 148.48 (132.58-165.28) | 124.69 (111.86-139.28) | -27% | 122.86 (110.09-13 6.32) | 124.69 (111.86-139.28) | 1% |
| Mauritania    | 1331.13 (1157.04-1539.85)  | 1301.87 (1140.70-1483.26) | 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 9,45) | 4,452.92 (1,987.23-8,32 7,95) | 896.39 (527.78-1,203.81) | 727.01 (631.28-1,098.29) | -21.6% | 669.71 (598.30-964.70) | 681.45 (648.74-852.49) | 1.8% |

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 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.
<1 year | All Ages | Age-standardized
--- | --- | ---
1990 | 2017 | Percent change 1990-2017 | 1990 | 2017 | Percent change 1990-2017 | 1990 | 2017 | Percent change 1990-2017

| Country | <1 year | All Ages | Age-standardized | <1 year | All Ages | Age-standardized | <1 year | All Ages | Age-standardized |
|---------|---------|---------|-----------------|---------|---------|-----------------|---------|---------|-----------------|
| 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 (256,82-670,25) | -66% |
| Morocco | 27,111.62 (13,407.54-42,471.65) | 19,693.09 (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 (3,420.53-7,851.91) | -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 (163,15-2,80) | -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 (13,297.98-25,646.10) | -88% | 1,417,12 (789,88-1,951,99) | 222,73 (156,16-2,59) | -84% |
| Mauritania | 5,204.60 (2,866.85-11,247.21) | 7,863,46 (369,58-11,526,22) | 51% | 6,278,58 (3,177,70-12,405,02) | 12,374,53 (8,664,80-17,449,82) | 97% | 168,73 (91,87-31,41) | 228,80 (161,14-52,07) | 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 (220,367,12-685,127,96) | -31.2% | 4,401,98 (2,396,8-8,752,30) | 1,651,98 (0,88-2,363,20) | -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.

References

1. Murray CJL, Callender CSKH, Kulikoff XR (2018) Population and fertility by age and sex for 195 countries and territories, 1950–
2017: a systematic analysis for the Global Burden of Disease Study 2017. The Lancet 392: 1995-2051.

2. Dicker D, Nguyen G, Abate D (2018) Global, regional and national age-sex-specific mortality and life expectancy, 1950–2017: a systematic analysis for the Global Burden of Disease Study 2017. The Lancet 392: 1684-1735.

3. Roth GA, Abate D, Abate KH (2018) Global, regional, and national age-sex-specific mortality for 282 causes of death in 195 countries and territories, 1980–2017: a systematic analysis for the Global Burden of Disease Study 2017. The Lancet 392: 1736-1788.

4. James SL, Abate D, Abate KH (2018) Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. The Lancet 392: 1789-1858.

5. Kyu HH, Abate D, Abate KH (2018) Global, regional, and national disability-adjusted life-years (DALYs) for 359 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. The Lancet 392: 1859-922.

6. Ralston J, Reddy KS, Fuster V, Narula J (2016) Cardiovascular diseases on the global agenda: the United Nations high level meeting, Sustainable Development Goals and the way forward. Glob Heart 11: 375-379.

7. Joshi P, Islam S, Pais P, Reddy S, Dorairaj P, et al. (2007) Risk factors for early myocardial infarction in South Asians compared with individuals in other countries. JAMA 297: 286-294.

8. Xavier D, Pais P, Devereaux PJ (2008) Treatment and outcomes of acute coronary syndromes in India (CREATE): a prospective analysis of registry data. Lancet 371: 1435-1442.

9. Yusuf S, Rangarajan S, Teo K (2014) Cardiovascular risk and events in 17 low, middle, and high-income countries. N Engl J Med 371: 818-827.

10. UN General Assembly (2012) Resolution adopted by the General Assembly on 27 July 2012: the future we want (A/RES/66/288).

11. Vvan der Linde D, Konings EE, Slager MA, Witsenburg M, Helbing WA, et al. (2011) Birth prevalence of congenital heart disease worldwide: a systematic review and meta-analysis. J Am Coll Cardiol 58: 2241-2247.

12. Bernier PL, Stefanescu A, Samoukovic G, Tchervenkov CI (2010) The challenge of congenital heart disease worldwide: epidemiologic and demographic facts. Semin Thorac Cardiovasc Surg Pediatr Card Surg Annu 13: 26-34.

13. Hoffman JI, Kaplan S (2002) The incidence of congenital heart disease. J Am Coll Cardiol 39: 1890-1900.

14. Wren C (2012) The epidemiology of cardiovascular malformations. In: Moller J and H J, (Eds). Pediatric Cardiovascular Medicine. Wiley-Blackwell.

15. Hoffman JI (2013) The global burden of congenital heart disease. Cardiovasc J Afr 24: 141-145.

16. Hoffman JI (1995) Incidence of congenital heart disease: II. Prenatal incidence. Pediatr Cardiol 16: 155-165.

17. Jorgensen M, McPherson E, Zaleski C, Shivaram P, Cold C (2014) Stillbirth: the heart of the matter. Am J Med Genet A 164A: 691-699.

18. Marelli AJ, Ionescu-Ittu R, Mackie AS, Guo L, Dendukuri N, et al. (2014) Lifetime prevalence of congenital heart disease in the general population from 2000 to 2010. Circulation 130: 749-756.

19. Moons P, Bovijn L, Budts W, Belmans A, Gewillig M (2010) Temporal trends in survival to adulthood among patients born with congenital heart disease from 1970 to 1992 in Belgium. Circulation 122: 2264-2272.

20. Atz AM, Zak V, Mahony L, Uzark K, Shrader P, et al. (2015) Pediatric heart network investigators. Survival data and predictors of functional outcome an average of 15 years after the Fontan procedure: the pediatric heart network Fontan cohort. Congenit Heart Dis 10: E30-E42.

21. Fraser CD, Jaquiss RD, Rosenthal DN, Humpil T, Canter CE, et al. (2012) Berlin Heart Study Investigators. Prospective trial of a pediatric ventricular assist device. N Engl J Med 367: 532-541.

22. Almond CS, Morales DL, Blackstone EH, Turrentine MW, Imamura M, et al. (2013) Berlin Heart EXCOR pediatric ventricular assist device for bridge to heart transplantation in US children. Circulation 127: 1702-1711.

23. Donofrio MT, Moon-Grady AJ, Hornberger JK, Copel JA, Sklansky MS, et al. (2014) Diagnosis and treatment of fetal cardiac disease: a scientific statement from the American Heart Association. Circulation 129: 2183-2242.

24. Moon-Grady AJ, Morris SA, Belfort M, Chmait R, Dangel J, et al. (2015) International fetal cardiac intervention registry. International fetal cardiac intervention registry: A worldwide collaborative description and preliminary outcomes. J Am Coll Cardiol 66: 388-399.

25. Pasquali SK, Burstein DS, Benjamin DK, Smith PB, Li JS (2010) Globalization of pediatric research: analysis of clinical trials completed for pediatric exclusivity. Pediatrics 126: e687-e692.

26. Weinberg J, Beaton A, Aliku T, Iwabi P, Sable C (2016) Prevalence of rheumatic heart disease in African school-aged population: extrapolation from echocardiography screening using the 2012 World Heart Federation Guidelines. Int J Cardiol 202: 238-239.

27. Zuhlke L, Engl ME, Karchikeyan G, Rangarajan S, Mackie P, et al. (2015) Characteristics, complications and gaps in evidence-based interventions in rheumatic heart disease: the Global Rheumatic Heart Disease Registry (the REMEDY study). Eur Heart J 36: 1115-1122.

28. Balachandran R, Kappanyil M, Sen AC, Sudhakar A, Nair SG, et al. (2015) Impact of the international quality improvement collaborative on outcomes after congenital heart surgery: a single center experience in a developing economy. Ann Card Anaesth 18: 52-57.

29. Raj M, Paul M, Sudhakar A, Varghese AA, Haridas AC, et al. (2015) Micro-economic impact of congenital heart surgery: results of a prospective study from a limited-resource setting. PLoS One 10: e0131348.

30. Stevens GA, Alkema L, Black RE, Boerma TJ, Collins GS, et al. (2016) Guidelines for accurate and transparent health estimates reporting: the gather statement. PLOS Med 13: e1002056.

31. Attane IV, Courbage Y (2001) Demography in the Mediterranean, the papers of the blue plan, 1, Paris, Economica, pp: 249-260.

32. Data Base of Arab Maghreb Union (2000).

33. Health Canada (2002) Congenital anomalies in Canada a perinatal health report 2002. Ottawa: Minister of Public Works and Government Services Canada, pp: 15-19.
34. Boneva RS, Botto LD, Moore CA, Yang Q, Correa A, et al. (2001) Mortality associated with congenital heart defects in the United States: trends and racial disparities, 1979-1997. Circulation 103: 2376-2381.
35. Gilboa SM, Salemi JL, Nembhard WN, Fixler DE, Correa A (2010) Mortality resulting from congenital heart disease among children and adults in the United States, 1999 to 2006. Circulation 122: 2254-2263.
36. Billett J, Majeed A, Gatzoulis M, Cowie M (2008) Trends in hospital admissions, in-hospital case fatality and population mortality from congenital heart disease in England, 1994 to 2004. Heart 94: 342-348.