

Coronary Artery Disease: *The Culprit behind the Trounced Productivity with Special Reference to India*

Sadiqa Shafiq¹ and Moonisa Aslam Dervash^{2*}

¹*Institute of Home Science, University of Kashmir,
Hazratbal, Srinagar, J & K. India*

²*Division of Environmental Sciences, Sher-e-Kashmir University of Agricultural Sciences and Technology,
Shalimar, Kashmir-190025*

*E-mail: *moonisadervash757@gmail.com*

Abstract—Cardiovascular disease is a group of interrelated and coexisting diseases including Hypertension, Ischaemic heart diseases, Peripheral vascular diseases, Heart failure and atherosclerosis. Coronary artery disease is caused by an underlying process involving the narrowing and hardening of inner layer of the arteries. It is the leading cause of death worldwide and leads to disability and loss of productivity. It has been observed that developing countries are the worst hit and Indians are ethnically predisposed to this disease with higher average of age standardized death rate as compared to other parts of the world. It affects the people in the most productive years of their life irrespective of social class, dwelling and gender, leading to economic loss.

Introduction

Coronary artery disease (CAD) is caused by an underlying process involving the narrowing and hardening of inner layer of the arteries which in turn is caused by atherosclerosis, resulting in the formation of thrombus called plaque, and eventually leading to the blockage or rupture of the arteries (Mahan.,2017). It results in the development of one of the following syndromes i.e., angina pectoris, acute myocardial infarction, sudden cardiac death, and chronic ischemic heart disease with congestive heart failure (Kumar *et al.*, 2016). Technically speaking, a chronic local inflammatory exposure to risk factors, such as elevated levels of LDL cholesterol that is injurious to the arterial wall causes this disease (Badimon *et al.*, 2006).

CAD is a chronic disorder developing insidiously from the first decade of life and progressing to an advanced stage by the time symptoms reflect..Despite the fact that CVD mortality has fallen considerably over recent decades in many European Countries, it still continues to remain the major cause of premature deaths in Europe. Intense research has indicated that the burden of CVD is increasing in the developing countries which can be strengthened by the current estimate i.e., around 80% of all CVD deaths occur in such countries. In terms of the disease causing mass disability, it is projected that in the coming decades, the disability-adjusted life years (DALYs) the trend is expected to rise from a loss of 85 million DALYs in 1990 to a loss of 150million DALYs globally in 2020, thereby becoming the most serious cause of loss of productivity (SIGN 2007).

Risk factors:

The cause of CVD is multifactorial, no single factor is an absolute cause (Naget al., 2013). Analysis of the risk factors reveal that smoking (Keto *et al.*, 2016), a strong family history, (Bittencourt *et al.*, 2018), Diabetes Mellitus (Hajar *et al.*, 2017), Hypertension (Milane *et al.*, 2014), physical in activity (Piepoli, 2016) and Hyperlipidemia (Peters *et al.*, 2016), being overweight (Alkhwam, 2016) are major risk factors globally. There is a higher prevalence of hypertension and diabetes in Asian Indian population, thereby; making them susceptible to high rate of stroke and heart attack (Hassan *et al.*, 2014) .The increasing incidence of CVD may be explained by the high rates of other risk factors including adverse lipid profile.

Overview of the disease:

The trend and global burden of disease has evolved considerably over the last two decades from primarily communicable, maternal, and perinatal causes to non communicable disease (NCD). CVD's has become the most important and largest cause of NCD deaths worldwide, at over 50% (McAloonetal., 2016)

World Health Organizations, WHO, 2017, reports that CVD is the topmost cause of death throughout the globe and every year, higher numbers of people die from CVD'S than from any other cause. Statistically speaking, about 17.9 million people died of CVD in 2016; accounting for 31% of all global deaths and out of these deaths, 85% is attributed to heart attack and stroke. Over three quarters of CVD deaths take place in low and middle income countries.

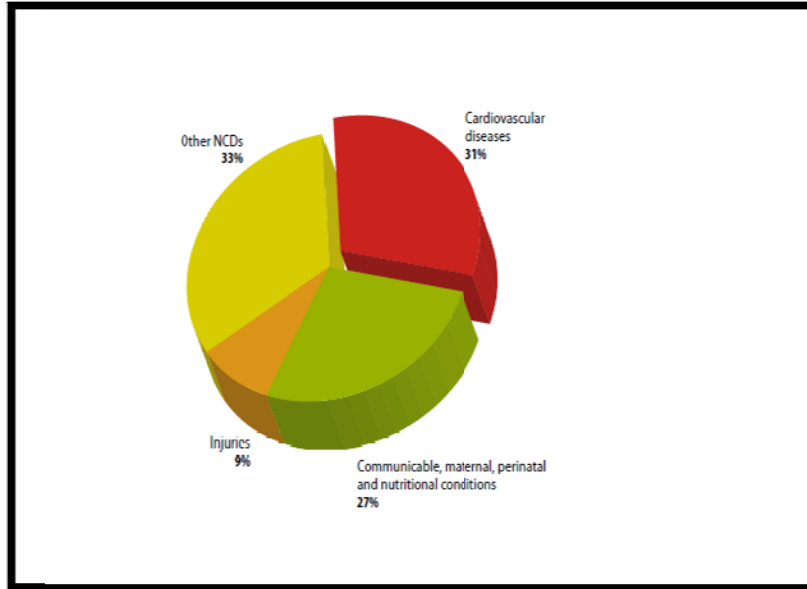


Fig. 2a. “Distribution as per major causes of death including CVDS.”
 “Source: Global atlas on CVD prevention and control, 2011.”

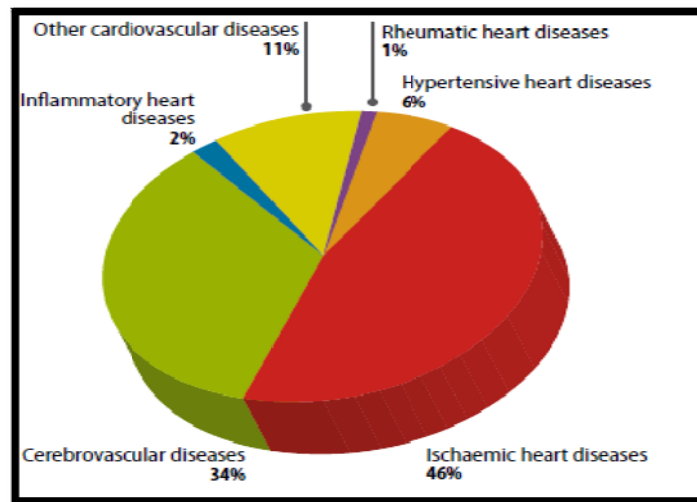


Fig. 2b. “Distribution of CVD deaths as per heart attacks, strokes and other types of cardio vascular disease, males.”
 “Source: Global atlas on CVD prevention and control, 2011.”

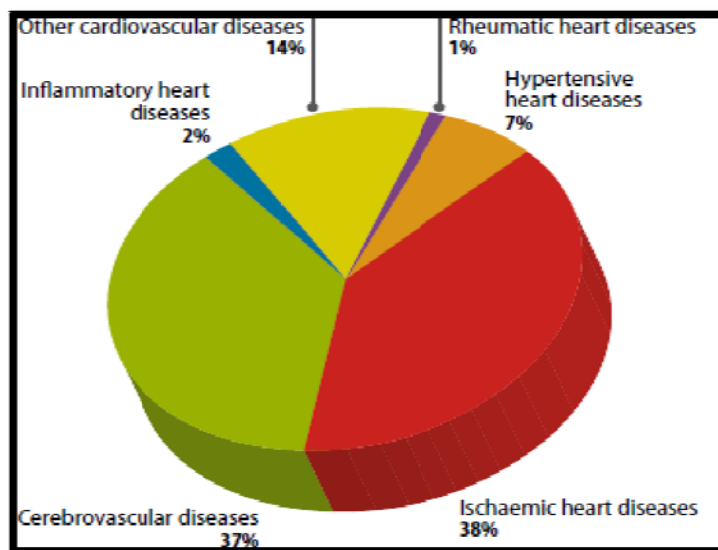


Fig. 2c. “Distribution of CVD deaths as per heart attacks, strokes and other types of cardio vascular disease, females.”
“Source: *Global atlas on CVD prevention and control, 2011.*”

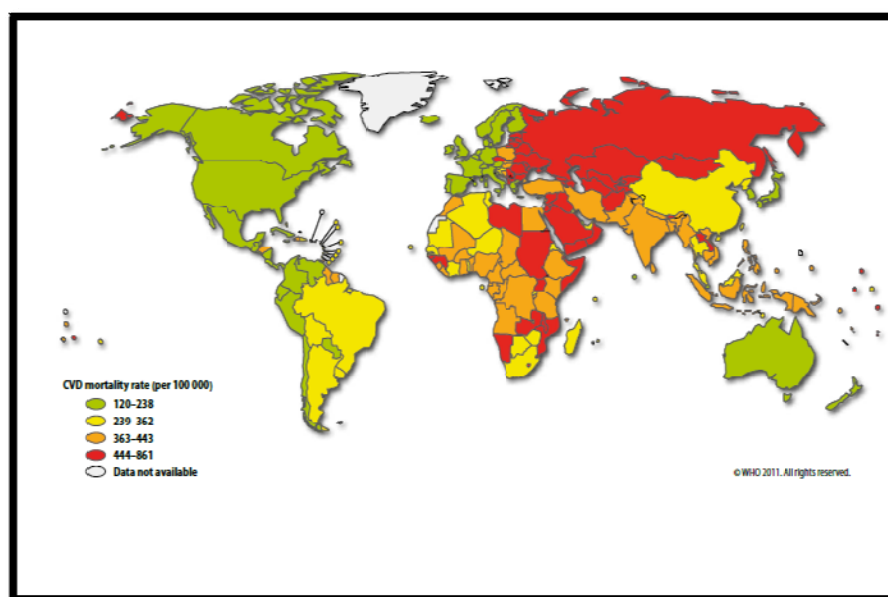


Fig. 2d. “World map showing the distribution of CVD mortality rates in males (age standardised, per 100000)”
“Source: *Global atlas on CVD prevention and control, 2011.*”

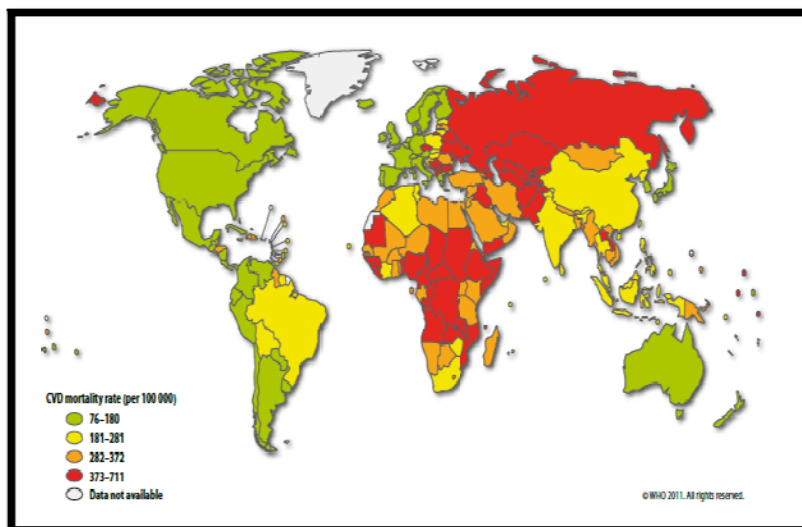


Fig. 2e. “World map showing the distribution of CVD mortality rates in females (age standardised, per100000)”

“Source: Global atlas on CVD prevention and control, 2011.”

The burden of CVD’S is disputed in many countries of the world. As per GBD (Global Burden of Disease) study, there were 422.7 million cases of CVD and 17.92 million CVD deaths with Ischemic heart disease being the leading cause of CVD health lost, followed by stroke (Leeder et al., 2004), in their study estimated that 9.2 billion productive years of life lost in Indian adults are secondary to overall CVD contributing to the economic decline, and this is directly proportional to escalation in the incidence of disease, as the disease rate increases. Data reveals that the prevalence of CVD’s in India is higher than other countries of the same region and is affecting all categories of society, from educated to less educated and affluent to less affluent (Chauhan et al., 2013). CVD affects Indians at least ten years earlier than their European counterparts and that too in the most productive years of their life (Joshi et al., 2007; Xavier et al., 2008) which can be ascertained from the fact that in west only 23% of CVD deaths occur before the age seventy (70 years) as compared to 52% in India (Harikrishnan et al., 2014).

Table 1: “Coronary heart disease (CHD) Epidemiological studies on Coronary artery disease (CAD) its prevalence (%) in India”

“Primary authorship”	“Study site”	“Year”	“Sample size”	“Age group”	“Known CHD”	“Known CHD ±ECG Q waves”	“Known CHD ±ECG±ST-T Changes”
Urban population							
“Sarvotham SG”	Chandigarh	1968	2030	30-70+	2.07	-	6.60
“Gupta SP”	Rohtak	1975	1407	30-60+	-	-	3.63
“Chadha SL”	Delhi	1990	13723	25-64	3.19	-	9.67
“Sinha PR”	Varansi	1990	648	30-70	-	-	6.48
“Reddy KS”	Delhi	1994	1400	35-64	4.00	-	-
“Gupta R”	Jaipur	1995	2212	20-70+	1.26	1.57	7.59
“Mohan V”	Chennai	2001	1150	20-70+	1.25	-	11.0
“Gupta R”	Jaipur	2002	1123	20-70+	1.99	2.67	8.12
“Pinto VG”	Panjim	2004	371	35-64	-	-	13.21
“Kumar R”	Chandigarh	2006	1012	35+	-	-	7.30
“Kumar R”	MandiGobindgarh	2006	3598	35+	-	-	2.95
“Kamili M”	Srinagar	2007	1576	40+	1.58	-	8.37
“Latheef SA”	Tirupati	2007	1519	20+	1.19	-	12.63
“Murthy PD”	Tenali	2012	534	20+	3.56	-	5.43
Rural population							
“Dewan B”	Haryana	1972	1504	30-69	-	-	2.06
“Jaipoo UN”	Maharashtra	1988	2433	30-70	-	-	1.69
“Chaddha SL”	Haryana	1989	1732	35-65	-	-	2.71
“Kutty VR”	Kerala	1993	1253	25-64	-	1.28	7.43

“Reddy KS”	Haryana	1994	1400	35-64	0.50	-	-
“Wander GS”	Punjab	1994	1100	30-70+	1.18	1.64	3.09
“Gupta R”	Rajasthan	1994	3148	20-70+	1.11	2.10	3.53
“Gupta AK”	Himachal	2002	1160	20-70+	-	-	5.00
“Kumar R”	Punjab	2006	2559	35+	-	-	1.65
“Kamili M”	Kashmir	2007	1552	40+	1.03	-	6.70
“Chow CK”	Andhra	2007	345	20-70+	-	-	3.60
“Bhardwaj R”	Himachal	2009	812	20-70+	-	4.06	4.06
“Joshi R”	Andhra	2009	4535	30-70+	-	-	4.80
Multisite studies							
“Rao”	Multisite, Rural & Urban	2005	390913	25-60	-	6.00	-
“Kinra”	Multisite Rural & Urban	2010	1983	20-65	1.45	-	-
“Gupta”	Multisite rural & Urban	2012	6198	20-70+	2.55	-	-
“Gupta”	Multisite rural & Urban	2014	33423	35-70	2.04	-	-
“Menon J”	Multisite Kerala	2014	84456	20+	1.35	-	-
“Krishnan MN”	Multisite, Kerala	2016	5167	20-70	3.50	-	12.5

“Source: Gupta et al. (2016). *Annals of Global Health*, VOL. 82, NO. 2, 2016 CHD in India March–April, 2016: 307–315”

It is argued that various biological mechanisms, social factors, and their interactions are the reasons for the escalated levels of CAD fatality, and the high rate of premature deaths CVD mortality had a sharp decline for both genders in countries with an SDI > 0.75 (Rothetal., 2017). As per a report of the Registrar General of India, 2013, CHD has caused 17% of total deaths and 26% of adult deaths in 2010-2013. The study Global burden of disease, 2013 has reported that an estimate of age standardized CVD death rate of 272 per 100000 populations in India is higher than the global average of 235 per 100000 populations.

The World Health Organization and Global Burden of Disease study have assessed the escalating trend in years of life lost (YLLS) and disability adjusted life years (DALYS) from CHD in India. Over the past six decades, CHD prevalence has risen from 1% to 9-10% in urban India and <1% to 4-6% in rural India Gupta et al., 2016. It is observed that there is an alarming increase in the incidence of disease in the younger age groups due to improper lifestyle, impaired physical activity levels and culture influences etc. Technically speaking, the disease is seeping in the India’s productive population leading to an economic setback.

Table 2: “Age and dwelling-wise distribution and number of cases (males and females) of CHD in India”

Year/ Area	20-29yrs	30-39yrs	40-49yrs	50-59yrs	60-69yrs	Total
2000						
Urban	2,711,501	2,635,019	2,776,974	2,288,412	1,888,199	12,300,104
Rural	1,799,691	2,854,247	3,342,472	3,590,855	3,153,512	14,704,808
Total	4,511,192	5,489,266	6,119,446	5,879,296	5,041,711	27,040,912
2005						
Urban	4,138,045	3,869,904	4,116,830	3,171,320	2,582,790	17,878,889
Rural	2,012,363	3,383,816	4,217,201	4,544,974	3,849,544	18,007,899
Total	6,150,408	7,253,720	8,334,032	7,716,294	6,432,334	35,886,789
2010						
Urban	5,992,412	5,154,766	5,606,731	4,223,273	3,710,938	24,688,119
Rural	2,324,772	3,940,722	5,367,797	5,817,363	4,829,922	22,280,577
Total	8,317,184	9,095,489	10,974,527	10,040,636	8,540,860	46,968,695
2015						
Urban	8,167,924	7,927,846	8,493,463	6,156,089	5,346,975	36,092,297
Rural	2,324,087	4,523,697	5,816,588	6,852,050	5,913,624	25,430,046
Total	10,492,011	12,451,542	14,310,051	13,008,140	11,260,599	61,522,343

“Source: Indrayan A. *Forecasting Vascular Disease Cases and Associated Mortality in India. Background papers. Burden of disease in India. National Commission on Macroeconomics and Health, Ministry of Health and Family Welfare, Government of India, New Delhi, India. 2005”*

Table 3: “Total years of life lost due to CVD in 2000 and projected figures for 2030.”

Country	2000		2030	
	Total years of life lost	Rate per 100,000	Total years of life lost	Rate per 100,000
India	9,221,165	3572	17937070	3070

"Source: Leeder S, Raymond S, Greenberg H. *A Race against Time: The challenge of Cardiovascular Disease in Developing Economies*. 2004. Columbia University, New York City New York"

Conclusion:

CVDs are the lead killers and major cause of health loss for all regions of the world. The global burden of CVD falls, principally, on the lower and middle-income countries, accounting for over 80% of CVD deaths. Different populations face differing health challenges, and each specific population has unique health burdens, however, CVD continues to remain one of the greatest health challenges worldwide. Over the six decades, CHD prevalence has increased from 1% to 9-10% in urban India and <1% to 4-6% in rural India. The prevalence of CVD's in India is higher than other countries of the same region and the disease is getting a stronger grip in the country affecting whole society, from educated to less educated, and affluent to less affluent.

Recommendations

1. CVD prevention is a major challenge for the people, policy makers, and health care workers.
2. A co-ordinated set of programmes, at public and individual level, can help in eradicating or minimizing the impact of CVDs and the associated disability.
3. Modification in lifestyle, Diet and Nutrition can help in the prevention and management of the disease.
4. Healthcare literacy can help to a greater extent in controlling this disease.

References

- [1] Alkhawam, H., Nguyen, J., Sayanlar, J., Sogomonian, R., Desai, R., Jolly, J.P., Vyas, N., Syed, U., Homsy, M., Rubinstein, D. (2016). Coronary artery disease in patients with body mass index 30 kg/m² : a retrospective chart analysis. *Journal of Community Hospital Internal Medicine Perspectives*, 6: 31483, retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4942517/pdf/JCHIMP-6-31483>.
- [2] Badimon, L., Gonzalez, G., Ldorentecortes, V. (2006). Cell biology and lipoproteins in atherosclerosis. *Current Molecular Medicine*, 6(5):439-456, retrieved from <https://www.ingentaconnect.com/content/ben/cmm>
- [3] Bhardwaj R, Kandoria A, Marwah R, Vaidya P, Dhiman P, Singh B. (2009). Coronary heart disease in rural population of Himachal: a population based study. *Journal of Association of Physicians of India*, 57:505e7.
- [4] Bittencourt, Márcio Sommer (2018). Family History of Cardiovascular Disease: How Detailed Should It Be? *Mayo Clinic Proceedings*, 93: 9, 1167 – 1168. [https://www.mayoclinicproceedings.org/article/S0025-6196\(18\)30576-7/abstract](https://www.mayoclinicproceedings.org/article/S0025-6196(18)30576-7/abstract)
- [5] Chadha, S.L., Gopinath, N., Radhakrishnan, S., Ramachandran, K., Kaul, U., Tandon, R. (1989). Prevalence of coronary heart disease and its risk factors in a rural community in Haryana. *Indian Journal of Community Medicine*, 14:141e7.
- [6] Chadha, S.L., Radhakrishnan, S., Ramachandran, K., Kaul, U., Gopinath, N. (1990). Epidemiological study of coronary heart disease in urban population of Delhi. *Indian Journal of Medical Res*; 92:424e30.
- [7] Chauhan, S., Aeri, B.T. (2013). Prevalence of cardiovascular disease in India and its economic impact: A review. *International journal of scientific and research publications*, 3(10): 2250-3153, retrieved from <http://www.ijsrp.org/research-paper-1013/ijsrp-p2234.pdf>.
- [8] Chow, C.K., Cardona, M., Raju, P.K., et al. (2007). Cardiovascular disease and risk factors among 345 adults in rural India: the Andhra Pradesh Rural Health Initiative. *International Journal of Cardiology*, 116:180e5.
- [9] Dewan, B.D., Malhotra, K.C., Gupta, S.P. (1974). Epidemiological study of coronary heart disease in rural community in Haryana. *Indian Heart Journal*, 26:68e78.
- [10] Global atlas on CVD prevention and control, 2011.
- [11] Gupta, A.K., Bhardwaj, A., Ashotra, S., Gupta, B.P. (2002). Feasibility and training of multipurpose workers in detection prevention and control of coronary artery disease in the apple-belt of Shimla hills. *South Asian Journal of Preventive Cardiology*, 6:17e22.
- [12] Gupta, R., Deedwania, P.C., Sharma, K.K., et al. (2012). Association of education, occupation and socioeconomic status with cardiovascular risk factors in Asian Indians: a cross-sectional study. *Public Library of Science, One*, 7:e044098.
- [13] Gupta, R., Gupta, V.P., Ahluwalia, N.S. (1994). Educational status, coronary heart disease and coronary risk factor prevalence in a rural population of India. *British Medical Journal*, 309:1332e6.
- [14] Gupta, R., Gupta, V.P., Sarna, M., et al. (2002). Prevalence of coronary heart disease and risk factors in an urban Indian population: Jaipur Heart Watch-2. *Indian Heart Journal*, 54:59e66.
- [15] Gupta, R., Mohan, I., Narula, J. (2016). Trends in Coronary Heart Disease Epidemiology in India. *Annals of global health*, 82(2): 2214 – 9996, <https://www.sciencedirect.com/science/article/pii/S2214999616300297>.
- [16] Gupta, R., Mony, P., Shankar, K., et al. (2015). Socioeconomic status and cardiovascular secondary prevention therapies in South Asia: PURE Study. *European Journal of Preventive Cardiology*, 22:1261e71.

- [17] Gupta, R., Prakash, H., Majumdar, S., Sharma, S.C., Gupta, V.P. (1995). Prevalence of coronary heart disease and coronary risk factors in an urban population of Rajasthan. *Indian Heart Journal*, 47: 331e8.
- [18] Gupta, S.P., Malhotra, K.C. (1975). Urban-rural trends in the epidemiology of coronary heart disease. *Journal of Association of Physicians of India*, 23:885e92.
- [19] Hajar, R. (2017). Diabetes as “Coronary Artery Disease Risk Equivalent”: A Historical Perspective, *Heart Views*, 18(1): 34–37, retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5448252/>
- [20] Harikrishnan, S., Leeder, S., Huffman, M., Jeemon, P., Prabhakaran, D. (2014). A Race against Time: The Challenge of Cardiovascular Disease in Developing Economies. 2nd Ed. New Delhi, India: New Delhi Centre for Chronic Disease Control, retrieved from
- [21] Hassan, Alkhwam., James, Nguyen., Jason Sayanlar., Robert Sogomonian., Ronak Desai., Josh Paul, Jolly., Neil, Vyas., Umer, Syed., Maher, Homsy., David, Rubinstein. (2016). Coronary artery disease in patients with body mass index ≥ 30 kg/m²: a retrospective chart analysis. *Journal of community hospital internal medicine perspective*, (6) 3: 10.3402/jchimp.v6.31483., retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4942517/>.
- [22] Hassan, Z., Farooq, S., Nazir, N., Iqbal, K. (2014). Coronary artery disease in young: A study of risk factors and angiographic characterization in the valley of Kashmir. *International journal of scientific and research publications*, 4(7): 20-28,
- [23] Hassan, Z., Farooq, S., Nazir, N., Iqbal, K. (2014). Coronary artery disease in young: A study of risk factors and angiographic characterization in the valley of Kashmir. *International journal of scientific and research publications*, 4(7): 20-28.
- [24] Indrayan .A. (2005). Forecasting Vascular Disease cases and associated mortality in India. Background papers .Burden of disease in India .National commission on macroeconomics and health and family welfare, Government of India, New Delhi, India, retrieved from http://origin.searo.who.int/india/topics/cardiovascular_diseases/Commission_on_Macroeconomic_and_Health_Bg_P2_Forecasting_vascular_disease_cases_and_associated_mortality_in_India.
- [25] Jajoo, U.N., Kalantri, S.P., Gupta OP, Jain AP, Gupta K. (1988). The prevalence of coronary heart disease in the rural population from central India. *Journal of Association of Physicians of India*, 36:689e93., R., Chow, C.K., Raju, P.K., et al. (2009). Fatal and nonfatal cardiovascular disease and the use of therapies for secondary prevention in a rural region of India. *Circulation*, 119:1950e5. *Journal*, 58:126e30.
- [26] Joshi, R., Chow, C. K., Cardona, M., Raju, P.K., et al. (2009). Fatal and nonfatal cardiovascular disease and the use of therapies for secondary prevention in a rural region of India. *Circulation*, 119:1950-5.
- [27] Kamili, M., Dar, I., Ali, G., Wazir, H., Hussain, S. (2007). Prevalence of coronary heart disease in Kashmiris, *Indian Heart Journal*, 59:44e9.
- [28] Keto, J., Ventola, H., Jokelainen, J., Linden, K., Sirkka Kiukaanniemi, K., Timonen, M., Ylisaukko-oja, ---. (2016). Cardiovascular disease risk factors in relation to smoking behaviour and history: a population-based cohort study. *Open Heart* 3: e 000358, retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/27493759>.
- [29] Kinra, S., Bowen, L.J., Lyngdoh, T., et al. (2010). Sociodemographic patterning of non-communicable disease risk factors in rural India: a cross sectional study. *British Medical Journal*, 341:c4974.
- [30] Krishnan, M.N., Zachariah, G., Venugopal, K., et al. (2016) Prevalence of coronary artery disease and its risk factors in Kerala, South India: a community based cross-sectional study, *BMC Cardiovascular Disorders*, 16:12.
- [31] Kumar R, Singh MC, Ahlawat SK, et al. (2006). Urbanization and coronary heart disease: a study of urban rural differences in northern India. *Indian Heart Journal*, 58: 126-30
- [32] Kumar, R., Sharan, K.H., (2016). A comparative study on awareness of cardiovascular risk determinants among rural and urban women population of Davangere district, Karnataka, India. *International Journal of Community Medicine and Public Health*, 3(12):3336-3339, retrieved from <http://www.ijcmph.com>.
- [33] Kutty, V.R., Balakrishnan, K.G., Jayasree, A.K., Thomas, J. (1993). Prevalence of coronary heart disease in the rural population of Thiruvananthapuram district, Kerala, India. *International Journal of Cardiology*, 39:59e70.
- [34] Latheef, S.A., Subramanyam, G. (2007). Prevalence of coronary artery disease and Coronary risk factors in an urban population of Tirupati. *Indian Heart Journal*, 59:157e64.
- [35] Leeder, S., Raymond, S., Greenberg, H. (2004). A Race against Time: The challenge of Cardiovascular Disease in Developing Economies. 2004. Columbia University, New York City, retrieved from <http://www.ccdindia.org/wp-content/uploads/2015/12/A-RACE-AGAINST-TIME.pdf>.
- [36] Mahan, K.L. (2017). Food & Nutrition Care Process. Riverport lane, St. Louis Missouri, Canada. Elsevier.
- [37] Mc Aloon, C.J., Anderson, B.M.W., Panting, J., et al. (2016). Long term follow up of isolated epicardial left ventricular lead implant using a minithoracic approach for cardiac resynchronisation therapy. *Journal of world society of arrhythmia*. 39 : (10), retrieved from <http://online.library.wiley.com>.
- [38] Menon, J., Joseph, J., Thachil, A., Attacheril, T.V., Banerjee, A. (2014). Surveillance of non-communicable diseases by community health workers in Kerala. The epidemiology of non-communicable diseases in rural areas (ENDIRA) study. *Global Heart journal*, 9(4):9-17
- [39] Menon, J., Joseph, J., Thachil, A., Attacheril, T.V., Banerjee, A. (2014). Surveillance of non-communicable diseases by community health workers in Kerala. The epidemiology of non-communicable diseases in rural areas (ENDIRA) study. *Global Heart journal*, 9:409e17.

- [40] Milane, A., Abdallah, J., Kanbar, R., Khazen, G., Ghassibe-Sabbagh, M., Salloum, A. K., Youhanna, (2014). Association of hypertension with coronary artery disease onset in the Lebanese population. *SpringerPlus*, 3:533, retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4176843/>.
- [41] Mohan, V., Deepa, R., Rani, S.S., Premalatha, G. (2001). Prevalence of coronary artery disease and its relationship to lipids in a selected population in South India. *Journal of American College of Cardiology*, 38:682e7.
- [42] Murthy, P.D., Prasad, K.T., Gopal, P.V., Rao, K.V., Rao, R.M. (2012). A survey for prevalence of coronary artery disease and its risk factors in an urban population in Andhra Pradesh, *Journal of Association of Physicians of India*, 60:17e20.
- [43] Nag, T., Arnab, Ghosh, A. (2013). Cardiovascular disease risk factors in Asian Indian population: A systematic review. *Journal of Cardiovascular Disease Research*, 222:e228, retrieved from
- [44] Naghavi, M., Roth, G.A., Johnson, C., Abajobir, A., Abd-Allah, F., Abera, S.F., Abyu, G., ---, , Vos, T., Murray, C. (2006). Global, Regional, and National Burden of Cardiovascular Diseases for 10 Causes. *Journal of the American College of Cardiology* 70 (1): 1-25, retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/28527533>
- [45] Peters, S.A., Singhathe, Y., Mackay, D., Huxley, R.R., Woodward, M. (2016). Total cholesterol as a risk factor for coronary heart disease and stroke in women compared with men: A systematic review and meta-analysis. *Atherosclerosis*, 248:123-31, retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/27016614>.
- [46] Piepoli, M.F., Hoes, A.W., Agewall, S., Albus, C., Brotons, C., Catapano, A.L., Cooney, M.T., Corrà, U., Cosyns, B., Deaton, C., Graham, I., Hall, M.S., Hobbs, F.D.R., Løchen, M.L., Löllgen, H., Marques-Vidal, P., Perk, J., Prescott, E., Redon, J., Richter, D.J., Sattar, N., Smulders, Y., Tiberi, M., van der Worp, H.B., van Dis, I., Verschuren, W.M, M, , Binno, S., ESC Scientific Document Group. (2016). European Guidelines on cardiovascular disease prevention in clinical practice: The Sixth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of 10 societies and by invited experts) Developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EACPR). *European Heart Journal*, 37: 2315–2381. retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/27222591>.
- [47] Pinto, V.G., Motghare, D.D., Ferreira, A.M.A., Kulkarni, M.S. (2004). Prevalence of coronary heart disease in an urban community of Goa. *South Asian Journal of Preventive Cardiology*, 8:211-5.
- [48] Prabhakaran, D., Jeemon, P., Roy, Ambuj. (2016). cardiovascular disease in India: Current epidemiology and future directions, *circulation*. 133:1605-1620, retrieved from American heart association, retrieved from <http://ahajournals.org/content/133/16/1605>.
- [49] Rao K.D., Bhatnagar, A., Murphy, A. (2011). Socioeconomic inequalities in the financing of cardiovascular and diabetes inpatient treatment in India, *Indian Journal of Medical Research*, 133:57e63.
- [50] Reddy, K.S. (1993). Cardiovascular diseases in India. WHO Stat Q 1993; 46:101e7.
- [51] Sarvotham, S.G., Berry, J.N. (1968). Prevalence of coronary heart disease in an urban population in northern India. *Circulation*, 37:939e53.
- [52] SIGN (Scottish Intercollegiate Guidelines Network). Risk Estimation and the Prevention of Cardiovascular Disease. A National Clinical Guideline. 2007. Report No. 97. <http://www.sign.ac.uk/pdf/sign97.pdf>.
- [53] Sinha, P.R., Gaur, S.D., Somani, P.N. (1990). Prevalence of coronary heart disease in an urban community of Varanasi. *Indian Journal of Community Medicine*, 15:82e5.
- [54] Wander, G.S., Khurana, S.B., Gulati, R., et al. (1994). Epidemiology of coronary heart disease in a rural Punjab population: prevalence and correlation with various risk factors. *Indian Heart Journal*, 46:319e23.
- [55] WHO (World Health Organization) (2013). Cardiovascular diseases (CVDs), retrieved from [https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-\(cvds\)](https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)).
- [56] WHO (World Health Organization), (2017). Cardiovascular diseases (CVDS), Key facts, retrieved from [https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-\(cvds\)](https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds))
- [57] Xavier, D., Pais, P., Devereaux, P.J., Xie, C., Prabhakaran, D., Reddy, K.S., Gupta, R., Joshi P., Kerkar, (2008). Treatment and outcomes of acute coronary syndromes in India (CREATE): a prospective analysis of registry data. *Lancet*, 371:1435–1442, retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/18440425>.