REVIEW ARTICLE

Chest Pain, Coronary Artery Disease and Risk Factors: A Global Snapshot

Mehwish Hussain[1], Nazeer Khan[2], Mudassir Uddin[3] and Mansour M Al Nozha[4]

ABSTRACT

Coronary artery disease is a persistent public health problem worldwide. Chest pain is one of the perceptible symptoms of the same disease. This study reviewed global insight on epidemiology of coronary artery disease and cardiac chest pain. We first highlighted worldwide prevalence and mortality ratio of coronary artery disease. Then, we discussed epidemiology of risk factors reported for different regions. Statistics on hazards pertaining to chest pain are reported in the aftermost section. This narrative review revealed that despite reduction on the prevalence of coronary artery disease in developed countries, developing regions are at high risk to endure the disease. Urbanization is considered to be the superseded risk factor for the same. Strategies should be made worldwide to ameliorate treatment of CAD from first onset of its symptom.

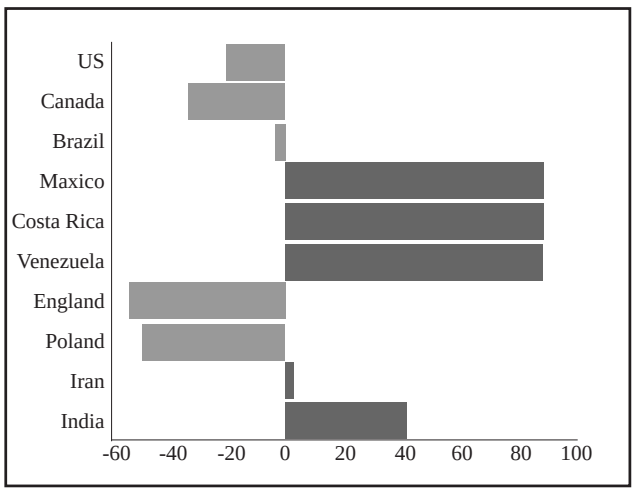
Key words: Chest Pain, coronary artery disease, risk factors, epidemiology, geographical review.

How to cite this article: Hussain M, Khan N, Uddin M, Al Nozha MM. Chest pain, coronary artery disease and risk factors: a global snapshot. J Dow Uni Health Sci 2014; 8(2): 80-86.

INTRODUCTION

The third global burdened disease ranked by WHO[1] and leading fatal disease till 2020[2] coronary artery disease (CAD) has killed millions of patients worldwide.[3] Numerous researches have been done to evaluate the epidemiology of CAD.[4] Several risk factors have been identified.[5] Nevertheless, the frequency and hazards of CAD have not declined significantly especially in low and middle income countries.[3] Developed countries, on the other hand, showed dramatic decrease in mortality trend than developing countries (Fig. 1).[6] A study showed that CAD was responsible for each 3 out of 4 deaths in low and middle income countries. Changing life style factors and moving towards urbanization are the major risk factors in this regard.[3] This article presented global snapshot on epidemiology of chest pain, coronary artery disease and related risk factors reported in the literature so far.

Fig. 1: CAD Mortality trend among developed and developing regions



Risk Prevalence:

A study from United States (US) indicted CAD for 33.3% of all deaths.[7] However, in last decade of 2000 century, 13.3% decline in CAD incidence has been reported in the same region.[8] Center of Diseases Control and Prevention reckoned 20% decrease in incidence

1 Department of Statistics, University of Karachi, Karachi, Pakistan, Senior Lecturer of Biostatistics, Department of Research, Dow University of Health Sciences, Karachi, Pakistan.

2 Department of Research, Jinnah Sindh Medical University, Karachi, Pakistan.

3 Department of Statistics, University of Karachi, Karachi, Pakistan.

4 Department of Medicine & Consultant Cardiologist, President, Taibah University, Madinah Munawwarah, Kingdom of Saudi Arabia.

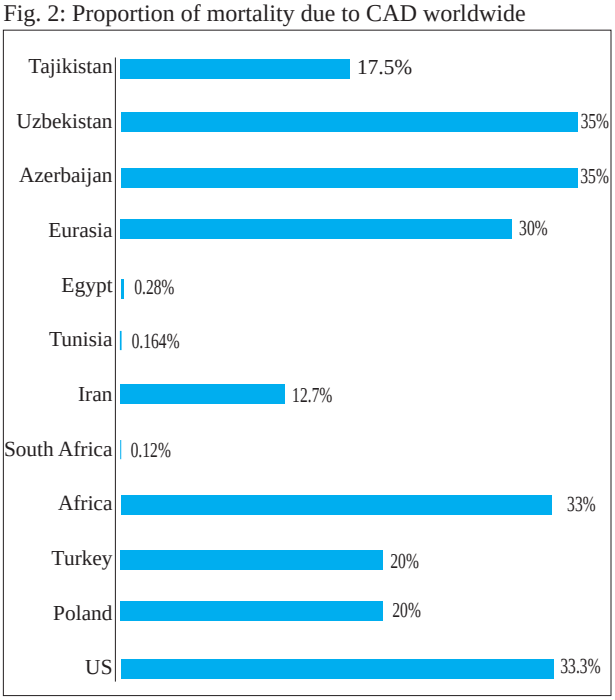
Correspondence: Mehwish Hussain, Department of Research, Dow University of Health Sciences, Karachi, Pakistan.

Email: mehvish.hussain28@gmail.com

of CAD mortality by 2020.[9] Luepker et al. stated that increase in literacy level in US may be one of the factor for the decline in CAD.[10] Statistics from Canada revealed 35% decrease in CAD mortality in the region[11] while in Brazil the same decline was observed up to 3.6%.[12] Despite the delighting statistics of decline of deaths in America, there are still different regions where hazards of CAD have not been reduced yet. Mexico, Costa Rica and Venezuela were the regions where considerable (90%) rise of prevalence of CAD was reported in both gender.[13]

The decline in CAD mortality and prevalence has also reported for some regions in Europe too. Unal et al. performed a meta-analysis on decline of deaths due to coronary artery disease from 1981 to 2000 in England. A 54% decline in CAD mortality was estimated in the region.[14] In Poland, 20% of all deaths accounted due to CAD.[3] While, after modeling for socioeconomic transformation, the CAD mortality declined up to 50%.[15] Despite the decline, CAD had significant contribution among the causes of deaths in Europe. In Turkey, 20% of deaths reported were due to CAD (Fig. 2). The same statistic was 43% in Georgia and 45% in Ukraine.[3]

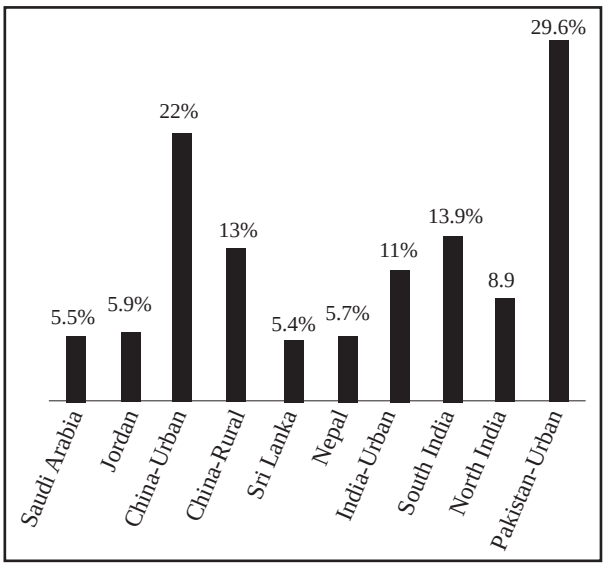
Fig. 2: Proportion of mortality due to CAD worldwide



Statistics about prevalence and mortality rates of coronary artery disease have not been reported for Australian general populations so far. However, the prevalence and complications rates of coronary heart failure and other cardiovascular diseases were reported to be higher in older adults who are more than 55 years of age. The same statistics were remarkably drowning among young adults male and females.[16-19]

There is paucity of literature related to epidemiology of CAD in Africa. Among the few researches conducted in this region reported that in earlier era prevalence of CAD was negligible.[20] Though, changes in life style factors and increasing modernization tended this prevalence to grow.[21] In 2001, CAD was responsible for 33% of all cardiac diseases intuitively.[3] In Middle-East and African regions, the prevalence of CAD is significant (Fig. 3). As per WHO report for South Africa, the mortality rate due to CAD was 120 per 100,000 populations.[22]

Fig. 3: Prevalence of CAD in Middle-East and Asian Population



In Iran, the prevalence of CAD rose up to 2.4% from 1999[23] to 2009.[24] Prevalence of CAD in Iran is reported to be highest (12.7%)[25] amongst other Middle East countries. In Saudi Arabia, a population based study indicated that 5.5% of Saudi inhabitants suffered with CAD.[26] Jordan had 5.9% of the population encountered with CAD.[27] In Tunisia and in Egypt the mortality rates due to CAD was measured to be 163.8[28] and 280[22] per 100,000 population respectively.

Each 3 out of 10 individuals in Europe and Central Asia died due to coronary artery diseases.[3] Japan had the lowest rate of CAD than rest of the western countries.[29] The life style and population of China is apparently same to Japan. However, the prevalence of CAD is reported to be quite high. In urban areas, CAD accounted 22% of all deaths and in rural areas CAD was responsible for 13% of all deaths.[30]

The CAD mortality amongst population of Azerbaijan and Uzbekistan is remarkably high. The proportion of this fatal disease in both regions was 35%. In Tajikistan, 17.5% of all deaths were due to CAD.[3] In Sri Lanka and Nepal, the prevalence of CAD is comparatively low. About 5.4% of Sri Lankan population[31] and 5.7% of Nepalese[32] suffered CAD.

In urban areas of India, CAD is prevalent in 11% of the population.[33] Deaths due to CAD in India was raised from 1.17 million in 1990 to 1.59 million in 2000.[34] Comparative analysis on South and North Indians revealed that former were more prone to suffer with CAD (13.9% vs. 8.6%).[35]

In Pakistan, there is scarcity of research on prevalence of CAD. A single study was found which was conducted by a private sector tertiary care hospital in metropolitan city, Karachi. According to the study 29.6% were affected by CAD among 320 selected adult population.[36] Another study indicated that prevalence of CAD among Pakistani population was 3.6% based on physician's diagnosis.[37]

Risk Factors:

Causes of decline in prevalence and mortality in developed countries were discussed extensively. Better provision of medical treatment and advancement in surgical methods in Canada had great influence for the same.[11] In Australia, young adults, less smoker, low cholesterol, blood pressure and glucose level assisted in the decline of CAD in their region.[16]

Being female makes higher chances for the risk of CAD worldwide.[5,26,29,38-40] On the contrary, Chinese males had higher prevalence of CAD than females.[41] Similarly, Russian male encountered more deaths due to CAD than females.[29] In Pakistan the prevalence of CAD for both gender was equal.[36] Conflicts in gender-based risk of CAD have also been reported in other studies too.[4]

Increased BMI and high waist circumstances are the leading risk factors for the development of CAD.[42] Torpy et al., reckoned that decreasing 10% weight of body would significantly reduce heart rate.[43] The reports of Framingham heart study revealed that high blood pressure, smoking, dyslipidemia, diabetes and obesity were positively associated with the risk of CAD.[44,45] A study on Polish female also classified these five risk factors as highly prevalent among CAD patients.[46] American College of Cardiology reported that other than these five factors aging is the leading risk for the mortality of CAD.[47] In Australia, native[17] and elderly more than 55 years[16] were in higher risk.

Smoking, saturated fat intake, cholesterol level, diabetes, hypertension, glucose intolerance and other risk factors were found more in South Indians as compare to North Indian which led to high prevalence of CAD among the former ones.[35]

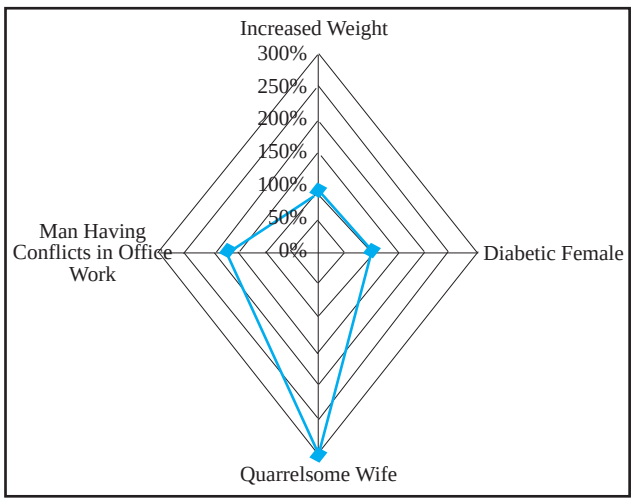
Gender and Diabetes play a significantly higher role in the development of CAD worldwide. Men from South Asia had higher death ratio due to CAD than European men. Diabetes was found leading risk factors for the same.[39] Diabetic female had 2 times higher chances to die due to CAD as compare to diabetic men.[48]

Dietary habits and patterns also vary the hazards of CAD. Intake of trans-fatty acids and food with high glycemic index are hazardous risk factors for the same. Seafoods, folate, whole grains, vitamin intake lessen the risk of CAD.[49] The cause for low mortality and CAD prevalence in Japan was reported that they take low cholesterol in their diet.[29]

Excessive dietary habits enhanced risk of CAD among Middle East natives.[50] In Iran, low literacy rate, unstable socio-economic condition and residents of flats amplify the chances for the development of CAD.[23,51] Urban population was also classified as more prone to have CAD in India[38] and Africa.[22] Changes in life style factor while moving towards urbanization has also reported to be riskiest factor in Mexico, Costa Rica, Venezuela,[13] Africa[21] and in Arab Middle East.[50]

Psychosocial factors have also indicated to increase risk of CAD. According to Framingham Heart study depression, conflicts, disagreements etc. are the most common factors in this regard.[52] A study from Sweden diagnosed depression as major co-morbid for CAD.[53] Conflicts management by married partner has profound effect on reduction of CAD. Females who fight back with husband had four fold higher chances of development of CAD as compare to those females who kept silence during fight with their male partner (Fig. 3). For men, conflict in office work caused 2.7 fold higher chances of developing CAD.[54]

Fig. 4: Quantified Risk Factors Elevating Chances of CAD



Chest Pain:

Among many other symptoms indicated coronary artery disease, chest pain is one of the discernible symptom.[55] The examination of patients with chest pain is critical. This examination declared whether the chest pain is cardiac or non-cardiac. If the chest pain is diagnosed to be non-cardiac, the patient can be referred to general physician.[56] Nevertheless, in case of cardiac chest pain, also called as angina, physicians first strive to eradicate CAD and other hazardous conditions for patient's life.[57] Intuitively, it can be confessed that not all patients with chest pain necessarily encounter coronary artery disease.[7] A follow up study from Verdon et al confirmed the statement while reporting 2.7% prevalence of chest pain among the cohort of 24,620 Swiss populations. Among them, only 12% of patients diagnosed with coronary artery disease.[58]

Predicting mortality for CAD patients have been studied widely in literature.[59,60] One study from Philippines measured length of hospital stay for CAD patients.[61] Though, as far as author's knowledge is concerned, literature on modeling chest pain to CAD is limited. Ledwich and Mondragon reported that longer duration of acute chest pain led larger infarct size.[62] Another study from US by Squist et al shared an interesting outcome reporting risk of CAD found low in those patient who suffered chest pain.[63] A study from Canada showed that many risk factors of CAD were also correlated with onset of chest pain (Fig. 5).[64]

Fig. 5: Comparison showing Factors Elevating Risk of CAD among Patients with Acute and Chronic Chest Pain

CAD Risk Factors	Acute Chest Pain to CAD Risk Factors	Chronic Chest Pain to CAD Hazardous Factors
Urbanization	Chest Pain Duration	Male Gender
Advancing Age	History	Old Age
Excessive Smoking	Physical exercise	Low High Density Lipoprotein
High Cholesterol	Age	High Body Mass Index
High Blood Pressure	Gender	No Exercise
High Glucose Level	Lipid Profiles	High Triglyceride Nitrate
Gender		
Increased BMI		
High Waist Circumstances		
Low High Density Lipoprotein		
Saturated Fat Intake		
Modernization		
Excessive Diet		
Physical Inactivity		
Low Literacy Rate		
Low Income Class		
Depression		
Conflicts		
Disagreement		

Gencer et al derived risk scores for ruling out CAD in primary care patients of Switzerland based on their history and physical examination.[55] The score was consisted of eight predictors ascribed to reduction of CAD. Duration of acute chest pain is among one of the eight predictors. Bosner et al, on the other hand, reckoned age/sex with exercise is the prominent risk factors for CAD with patients having acute chest pain in Germany.[65] Hussain et al attempted to estimate duration from chronic chest pain to past among Saudi adults.[66] Female had significantly longer duration then male. The average duration from chest pain to coronary artery disease was found to be 5 years .[67] Young age, increased high density lipoprotein, low body mass index, exercise and triglyceride nitrate were the significant predictors increasing duration from chest pain to CAD.

CONCLUSION

This narrative review revealed that despite drastic decrease among developed regions, prevalence and mortality ratio of coronary artery disease are still cause of concern for developing regions. Urbanization, unhealthy diets and sedentary life style are the leading factors in this regard. Strategies should be made worldwide to ameliorate treatment of CAD from first onset of its symptom.

REFERENCES

1. Murray CJL, Lopez AD. The global burden of disease. Geneva: WHO 1996; 270.
2. Murray CJ, Lopez AD. Alternative projections of mortality and disability by cause 1990–2020: Global Burden of Disease Study. The Lancet. 1997; 349: 1498-504.
3. Gaziano TA, Bitton A, Anand S, Abrahams-Gessel S, Murphy A. Growing epidemic of coronary heart disease in low-and middle-income countries. Current problems in cardiology 2010; 35:72-115.
4. Genders TS, Hunink MG. Epidemiology of Coronary Artery Disease. Clinical Applications of Cardiac CT 2012:3-6.
5. AHA. Risk Factors and Coronary Artery Disease. Am Heart Assoc 2010.
6. Yusuf S, Reddy S, Ôunpuu S, Anand S. Global burden of cardiovascular diseases part I: general considerations, the epidemiologic transition, risk factors, and impact of urbanization. Circulation 2001; 104:2746-53.
7. Valderrama AL, Loustalot F, Gillespie C, George MG, Schooley M. Million Hearts: Strategies to Reduce the Prevalence of Leading Cardiovascular Disease Risk Factors- United States, 2011. Morbidity and Mortality Weekly Report 2011; 60:1248.

8. Ergin A, Muntner P, Sherwin R, He J. Secular trends in cardiovascular disease mortality, incidence, and case fatality rates in adults in the United States. Am J Med 2004; 117:219-27.

9. Fang J. Prevalence of Coronary Heart Disease-United States, 2006-2010. U.S. Department of Health and Human Services, Atlanta, Georgia: Centers for Disease Control and Prevention (CDC), Services USDoHaH; 2011 October 14, 2011. Report No.: Contract No.: 40.

10. Luepker RV, Rosamond WD, Murphy R, Sprafka JM, Folsom AR, McGovern PG, et al. Socioeconomic status and coronary heart disease risk factor trends. The Minnesota Heart Survey. Circulation 1993; 88:2172-9.

11. Wijeysundera HC, Machado M, Farahati F, Wang X, Witteman W, van der Velde G, et al. Association of temporal trends in risk factors and treatment uptake with coronary heart disease mortality, 1994-2005. J Am Med Assoc 2010; 303:1841-7.

12. Curioni C, Cunha CB, Veras RP, André C. The decline in mortality from circulatory diseases in Brazil. Rev Panam Salud Publica 2009; 25:9-15.

13. Rodriguez T, Malvezzi M, Chatenoud L, Bosetti C, Levi F, Negri E, et al. Trends in mortality from coronary heart and cerebrovascular diseases in the Americas: 1970–2000. Heart 2006; 92:453-60.

14. Unal B, Critchley JA, Capewell S. Modelling the decline in coronary heart disease deaths in England and Wales, 1981-2000: comparing contributions from primary prevention and secondary prevention. Br Med J 2005; 331:614.

15. Bandosz P, O'Flaherty M, Drygas W, Rutkowski M, Koziarek J, Wyrzykowski B, et al. Decline in mortality from coronary heart disease in Poland after socioeconomic transformation: modelling study. Br Med J 2012;344.

16. Backholer K, Stevenson C, Nusselder WJ, Boyko EJ, Moon L, Tonkin A, et al. Age-specific trends in cardiovascular mortality rates in Australia between 1980 and 2005. Aus epidemiol 2011; 18:33.

17. Clark RA, Driscoll A, Nottage J, McLennan S, Coombe DM, Bamford EJ, et al. Inequitable provision of optimal services for patients with chronic heart failure: a national geo-mapping study. Med J Aus 2007;186(4):169.

18. Mathers CD, Vos ET, Stevenson CE, Begg SJ. The burden of disease and injury in Australia. Bulletin-world Health Org 2001; 79:1076-84.

19. O'Flaherty M, Allender S, Taylor R, Stevenson C, Peeters A, Capewell S. The decline in coronary heart disease mortality is slowing in young adults (Australia 1976–2006): a time trend analysis. Int J Cardiol 2012; 158:193-8.

20. Walker A, Sareli P. Coronary heart disease: outlook for Africa. J Royal Society Med 1997;90:23.

21. Keil JE, Sutherland SE, Knapp RG, Lackland DT, Gazes PC, Tyroler HA. Mortality rates and risk factors for coronary disease in black as compared with white men and women. New Eng J Med 1993; 329:73-8.

22. Almahmeed W, Arnaout MS, Chettaoui R, Ibrahim M, Kurdi MI, Taher MA, et al. Coronary artery disease in Africa and the Middle East. Therapeutics and clinical risk management 2012; 8:65.

23. Sarraf-Zadegan N, Sayed-Tabatabaei F, Bashardoost N, Maleki A, Totonchi M, Habibi H, et al. The prevalence of coronary artery disease in an urban population in Isfahan, Iran. Acta cardiologica 1999; 54:257.

24. Hadaegh F, Harati H, Ghanbarian A, Azizi F. Prevalence of coronary heart disease among Tehran adults: Tehran Lipid and Glucose Study. East Mediter Health J 2009; 15:157.

25. Nabipour I, Amiri M, Imami SR, Jahfari SM, Shafeiae E, Nosrati A, et al. The metabolic syndrome and nonfatal ischemic heart disease; a population-based study. Int J Cardiol 2007; 118:48-53.

26. Al Nouzha MM, Arafah MR, Al-Mazrou YY, Al-Maatouq MA, Khan NB, Khalil MZ, et al. Coronary artery disease in Saudi Arabia 2004; 25.

27. Nsour M, Mahfoud Z, Kanaan M, Balbeissi A. Prevalence and predictors of nonfatal myocardial infarction in Jordan. Eastern Mediterranean health journal= La revue de santé de la Méditerranée orientale= al-Majallah al-sihhiyah li-sharq al-mutawassit 2008; 14:818.

28. Ben RH, Bougatef S, Skhiri H, Gharbi D, Kafsi M, Belhani A, et al. The first Tunisian cardiovascular diseases register: processes and results]. Revue d'épidémiologie et de santé publique 2004; 52:558.

29. Yusuf S, Reddy S, Ôunpuu S, Anand S. Global burden of cardiovascular diseases Part II: Variations in cardiovascular disease by specific ethnic groups and geographic regions and prevention strategies. Circulation. 2001; 104:2855-64.

30. Zhang X, Lu Z, Liu L. Coronary heart disease in China. Heart 2008; 94:1126-31.

31. Mendis S, Ekanayake E. Prevalence of coronary heart disease and cardiovascular risk factors in middle aged males in a defined population in central Sri Lanka. Int J Cardiol 1994; 46:135-42.

32. Vaidya A, Pokharel P, Nagesh S, Karki P, Kumar S, Majhi S. Prevalence of coronary heart disease in the urban adult males of eastern Nepal: a population-based analytical cross-sectional study. Ind Heart J 2009; 61:341-7.

33. Mohan V, Venkatraman JV, Pradeepa R. Epidemiology of cardiovascular disease in type 2 diabetes: the Indian scenario. J Diabet Sci Tech 2010; 4:158.

34. Ghaffar A, Reddy KS, Singhi M. Burden of non-communicable diseases in South Asia. Br Med J 2004; 328:807.

35. Begom R, Singh R. Prevalence of coronary arterydisease and its risk factors in the urban population of South and North India. Acta Cardiologica 1995; 50:227-40.

36. Jafar TH, Jafary FH, Jessani S, Chaturvedi N. Heart disease epidemic in Pakistan: women and men at equal risk. Am Heart J 2005; 150:221-6.

37. Jafar TH, Qadri Z, Chaturvedi N. Coronary artery disease epidemic in Pakistan: more electrocardiographic evidence of ischaemia in women than in men. Heart 2008; 94:408-13.

38. Ahmad N, Bhopal R. Is coronary heart disease rising in India? A systematic review based on ECG defined coronary heart disease. Heart 2005; 91:719-25.

39. Forouhi N, Sattar N, Tillin T, McKeigue M, Chaturvedi N. Do known Risk Factors explain the higher coronary heart disease mortality in South Asian compared to European Men? Prospective Follow-up of the Southall and Brent studies, UK. Diabetologia 2006; 49:2580-88.

40. Jousilahti P, Vartiainen E, Toumilehto J, Puska P. Sex, Age, Cardiovascular Risk Factors, and Coronary Heart Disease:. Circulation 1999; 99:1165-72.

41. Yang ZJ, Liu J, Ge JP, Chen L, Zhao ZG, Yang WY. Prevalence of cardiovascular disease risk factor in the Chinese population: the 2007–2008 China National Diabetes and Metabolic Disorders Study. Eu Heart J 2012; 33:213-20.

42. Balkau B, Deanfield J, Després J, Bassand J, Fox K, Smith S, et al. International Day for the Evaluation of Abdominal Obesity (IDEA): A Study of Waist Circumference, Cardiovascular Disease, and Diabetes Mellitus in 168 000 Primary Care Patients in 63 Countries. Circulation 2007; 116:1942-51.

43. Torpy JM, Burke AE, Class RM. Coronary Heart Disease Risk Factors. J Am Med Ass 2009; 302:2388.

44. D'Agostino RB, Vasan RS, Pencina MJ, Wolf PA, Cobain M, Massaro JM, et al. General cardiovascular risk profile for use in primary care the Framingham Heart Study. Circulation 2008; 117:743-53.

45. Marti B, Tuomilehto J, Salonen J, Puska P, Nissinen A. Relationship between Leisure-time Physical Activity and Risk Factors for Coronary Heart Disease in Middle-aged Finnish Women. Acta Medica Scandinavica 2009; 220:223-30.

46. Lubiszewska B, Skóra E, Kruk M, Broda G, Ksiezycka E, Kurjata P, et al. Prevalence of classical risk factors in Polish women with premature coronary artery disease. Kardiologia polska 2010; 68:1032.

47. Laslett LJ, Alagona Jr P, Clark III BA, Drozda Jr JP, Saldivar F, Wilson SR, et al. The Worldwide Environment of Cardiovascular Disease: Prevalence, Diagnosis, Therapy, and Policy Issues: A Report From the American College of Cardiology. J Am Coll Cardiol 2012; 60:S1-S49.

48. Huxley R, Barzi F, Woodward M. Excess Risk of Fatal Coronary Heart Disease associated with diabetes in Men and Women: Meta Analysis of 37 Prospective Cohort Studies. Br Med J 2006; 332:73-8.

49. Mente A, Koning L, Shannon H, Anand S. A Systematic Review of the Evidence Supporting a Causal Link Between Dietary Factors and Coronary Heart Disease. Arch Intern Med 2009; 169:659-69.

50. Musaiger AO. Diet and prevention of coronary heart disease in the Arab Middle East countries. Medical Principles and Practice 2002; 11:9-16.

51. Janati A, Matlabi H, Allahverdipour H, Gholizadeh M, Abdollahi L. Socioeconomic Status and Coronary Heart Disease. Health Promotion 2011; 1:105-10.

52. Haynes SG, Feinleib M, Levine S, Scotch N, Kannel WB. The relationship of psychosocial factors to coronary heart disease in the Framingham study II. Prevalence of coronary heart disease. Am J Epidemiol 1978; 107:384-402.

53. Kendler KS, Gardner CO, Fiske A, Gatz M. Major depression and coronary artery disease in the Swedish twin registry: phenotypic, genetic and environmental sources of comorbidity. Arch Gen Psy 2009; 66:857.

54. Eaker ED, Sullivan LM, Kelly-Hayes M, D'Agostino RB, Benjamin EJ. Marital status, marital strain and risk of coronary heart disease or total mortality: the Framingham Offspring Study. Psy Med 2007; 69:509-13.

55. Gencer B, Vaucher P, Herzig L, Verdon F, Ruffieux C, Bösner S, et al. Ruling out coronary heart disease in primary care patients with chest pain: a clinical prediction score. BMC medicine 2010; 8:9.

56. Venkatesan S. What do we mean by Atypical Chest Pain? [Internet]. Wordpress; 2008. Available from: http://drsvenkatesan.wordpress.com/2008/09/14/what-do-we-mean-by-atypical-chest-pain/.

57. MedIndia. Chest Pain – Initial Approach to the Patient with Chest Pain. Medical Education 2009.

58. Verdon F, Herzig L, Burnand B, Bischoff T, Pecoud A, Junod M, et al. Chest pain in daily practice: occurrence, causes and management. Swiss Medical Weekly. 2008; 138:340.

59. Reid C, Billah B, Dinh D, Smith J, Skillington P, Yii M, et al. An Australian risk prediction model for 30-day mortality after isolated coronary artery bypass: the Aus score. J Thoracic and Cardiovascular Surg 2009; 138:904-10.

60. Billah B, Reid CM, Shardey GC, Smith JA. A preoperative risk prediction model for 30-day mortality following cardiac surgery in an Australian cohort. Eu J Cardio-Thoracic Surg 2010; 37:1086-92.

61. Mingala MCV, Estolano MP, editors. Parametric and Nonparametric Survival Analysis of Myocardial Infarction Patients Admitted in Dr. Paulino J. Garcia Memorial Research and Medical Center in Cabanatuan City. 10th National Convention on Statistics 2007; EDSA - Shangrila Hotel.

62. Ledwich JR, Mondragon GA. Chest pain duration in myocardial infarction. JAMA: J Am Med Asso 1980; 244:2172-4.

63. Sequist TD, Morong SM, Marston A, Keohane CA, Cook EF, Orav EJ, et al. Electronic Risk Alerts to Improve Primary Care Management of Chest Pain: A Randomized, Controlled Trial. J Gen Int Med 2011; 27:1-7.

64. Stevens RJ, Lasserson D. In primary care, when is chest pain due to coronary artery disease? Can Med Asso J 2010; 182:1281-2.

65. Bösner S, Haasenritter J, Becker A, Karatolios K, Vaucher P, Gencer B, et al. Ruling out coronary artery disease in primary care: development and validation of a simple prediction rule. Can Med Asso J 2010; 182:1295-300.

66. Hussain M, Khan N. A retrospective approach in Survival Analysis for estimating duration from chest pain to Coronary Artery Disease. Recent Advances in Statistics 2011:19.

67. Hussain M, Khan N, Uddin M. Non-parametric and Parametric Duration Analysis of Coronary Artery Disease with Chest Pain in Past. Islamic Countries Society of Statistical Sciences 83.