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Risk factors of cardiovascular disease and its recommendations in Pakistani context.

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Abstract

Cardiovascular diseases possess a major cause for fatality and disability the world over. Since last several decades, the rates of cardiovascular diseases-related deaths have decreased in a number of high-income countries but increased in low- and middle-income countries with around 80% of the burden. Despite the seriousness of cardiovascular diseases in low- and middle-income countries, minimal attention is given to the prevention of cardiovascular diseases risk factors in South Asia, particularly in Pakistan. In addition, economic and political instability is accelerating the rates of cardiovascular diseases in the country. Practical efforts are required to enhance the understanding of cardiovascular diseases risk factors such as diet, physical activity, and tobacco-control policies to support prevention and control at the population level. This paper reviews the major modifiable risk factors in Pakistan, highlights available preventive services, and presents the most likely ways to promote risk-factor reduction.

Keywords: CVD, Factors, Pakistan, Recommendations.

Introduction

The latest evidence has revealed that globally, cardiovascular disease (CVD) is the leading cause of death, and around 80% to 86% of these deaths occur in low- and middle-income countries (LMICs).[1-4] From around16 million deaths that occur due to non-communicable diseases (NCDs), 82% are in LMICs and 37% of these deaths are related to CVD.[2-4]

However, there is a substantial variation in the mortality rates, according to sex, age, ethnicity, socio-economic status (SES), and geographical location. The worldwide CVD-related death rates for men (age less than 70 years) is three times higher than for women and double in low socio-economical areas than in affluent areas.[3]

Most South Asian countries, including Pakistan, Sri Lanka,

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Bangladesh, India, and Nepal, comprise more than a quarter of the LMICs and are identified to have a higher risk of coronary heart diseases (CHD) as compared to other part of the globe.[3] A large population-based cohort study identified that the prevalence of CVD in South Asian patients was high as compared to Chinese and Canadian patients.[5] There are several behaviours, including social, biological, and psychological risk factors, that raises the CVD burden in LMICs. The INTERHEART case-control study, conducted in 52 countries all over Europe, Asia, the Middle East, Australia, Africa, and North and South America, found 9 modifiable contributors for acute myocardial infarction (AMI) that leads to CVD. These modifiable risk factors include hypertension, diabetes, smoking, abdominal obesity, psychological index, lack of exercise, lack of fruits and vegetables, Apolipoprotein B/Apolipoprotein A1 (ApoB/ApoA1) ratio, and the use of alcohol.[2,6]

Numerous studies regarding the risk factors of CVD have been done, however, there is scarcity of literature in Pakistani setting. The Pakistan health research council in 2016 concluded that in Pakistan, the risk factors for NCDs is increasing.[3] Therefore, this paper presents the epidemiologic transition of CVD in Pakistan; it examines the major contributors in Pakistan; and emphasises on the present anticipatory services available in the country. The final part of the paper highlights the best possible ways of promoting the modifications of risk-factors in the Pakistani population.

Methodology

Literature was searched from PubMed, Medline and Google Scholar. Only English language articles from the 2006-2017 period were considered. We included only published articles with adequate sample size, sampling technique and relevance to CVD-related risk factors. Various keywords were used to extract the required information from the databases, like cardiovascular disease, cardiac disease, causes, risk factors, and recommendations. Overall, 200 abstracts were read and 35 references were included in the final review as these were directly related to CVD risk factors.

CVD in Pakistan: An Epidemiologic Transition

Pakistan is facing a dual burden of both communicable and non-communicable diseases. The 2013 global burden of disease report predicted that the 30% of the worldwide deaths are related to CVD.[7] This particular shift in disease-related paradigm will have additional implications for health care service delivery capacities and resource allocation.

A few of the estimates about the common illness among Pakistani adult population includes 41% hypertension, 21% tobacco use, 17.3% high cholesterol, 21% obesity,[8] 10% diabetes mellitus (DM), and dyslipidaemia (males, 34%; females, 49%),[16] and 2.8% stroke.[1] These estimates are rising in the country, and the rate of NCDs and communicable diseases is almost equal. This epidemiologic transition has an influence on the distribution of the modifiable risk factors of CVD in Pakistan, including increased stress levels, unhealthy eating habits, sedentary lifestyle and increase in smoking rates.

Lack of Population Data for Risk Factors for CVD in Pakistan

In Pakistan, population data for heart disease is limited; two population studies were conducted in 1965 and 1973 that showed that the prevalence of heart disease is between 0%and 3.7% in rural and urban areas.[9] Data from the1994 National Health Survey of Pakistan (NHSP) on health problems shows a high incidence of risk factors for CVD in both rural and urban populations.[6,10] Other small-scale studies also showed high prevalence of CVD risk factors in Pakistan, however, these studies have limitations in sample size and the self-reported data-collection methods. A cross-sectional study conducted at a hospital of Karachi identified the CVD-related risk factors, including family history of ischaemic heart disease (IHD), age, body mass index (BMI), smoking, sedentary lifestyle, total cholesterol, DM, low-density lipoprotein (LDL),high-density lipoprotein (HDL), and triglycerides. It revealed that high cholesterol [odds ratio (OR) = 1.6 (1.04, 2.24)]; > 40 years age [OR=4.4 (2.32, 8.5)]; BMI > 29.9 kg/m^2 [OR = 1.7 (1.01,2.71)]; diabetes [OR = 2.03 (1.24, 3.3)]; and a positive family history of IHD are separately associated with coronary artery disease(CAD).[7] Since the studies incorporated cross-sectional design with convenient sampling, their results might not be generalised to the population residing in rural areas of Pakistan.

Economic Status and Low Literacy: The Major Challenge of Poverty

Pakistan faces critical challenges in reducing poverty and closing the social and economic gaps between the rich and poor. According to multidimensional poverty index, Pakistan's poverty rate declined from 55% to 39% during 2004 to 2015.[11] The literacy rate of Pakistan varied from 97% (in Islamabad) to 20% (in District Kohlu).[12] The majority of the people of Pakistan live in rural areas (60%-65%); however, people are migrating to the large cities. According to a report on the national vision, more people will move to cities than to rural areas, and by 2030 Pakistan will become predominantly urban.[12] This will have major implications for the availability and sustainability of the resources required for the people of Pakistan to survive; they face a lack of safe drinking water, food insecurity, and a lack of quality and affordable primary health care services.[12,13] This results in a poorly developed social protection net; an infrastructure shortfall, mainly in transport, energy, and irrigation; and inadequate delivery of social services.[14,15] Besides these challenges, the continuous structural changes and dictated policies in Pakistani health systems have led to social inequalities and worsened health statistics in the world.

Burden of Risk factors in Pakistan

Examination of the risk factors to reduce the CVD burden and mortality is important to prioritise the CVD prevention and reduction efforts in countries like Pakistan, where the CVD burden is increasing. Data shows that excessive alcohol use, poor diet, physical inactivity, tobacco use, and psychosocial issues are the main determinants for CVD.[1,2] The next section briefly discusses the burden of the major risk factors for CVD in the Pakistani context.

A. Smoking: A Major Risk

The relationship between smoking and CVD is unequivocal; it is the major health risk in today's world.[16] According to the 2015World Health Organisation (WHO) report, 22.2% of men and 2.1% of women smoke in Pakistan.[17] In the 20th century,100 million people died the world over due to diseases caused by the use of excess tobacco, and it is projected that by 2030, one of every six individuals will die due to the deadly effects of smoking. Of these deaths, 50% are expected among the middle-age group (35-69years).[18] The INTERHEART and other studies conducted in Pakistan have shown a linear relationship between the number of cigarettes smoked and CVD. Individuals who smoke 40 or more cigarettes per day have a nine times higher risk of heart problems than those who have never smoked.[1]

B. Socio-economic status and education

It is generally noted that an individual's SES and illiteracy

are directly associated with risk behaviours and an unhealthy lifestyle. For example, Teo et al.[18] reported that of an estimated 1.3 billion smokers globally, 82% are in LIMCs. Thus, resource constraint led people to use money on alcohol and smoking rather than on education and healthy food, which cause unfavourable effects on cardiovascular system.[19,20] For example, a study conducted in Rawalpindi, Pakistan, showed that there is a significant relationship of literacy and tobacco use and that the wide proportion of tobacco consumption is steadily widening between those with "no formal education" and those with a "graduation level of education".[21]

C. Other forms of tobacco use in Pakistan

The various forms of tobacco use in Pakistan, including cigarettes, beedis, chewing tobacco (paan) and hookah/shisha (water pipe smoking), are on the rise.[22,23] The use of smokeless tobacco is considered part of the Pakistani and Indian culture. The prevalence of tobacco use varies among various districts of Pakistan, and different studies conducted in various places in Pakistan have reported that 33% of Pakistani men and 4.7% of females are reported to be tobacco users.[21] Tobacco consumption is broadly considered as a substitute to smoking even though the studies show the harmful effects of tobacco use.[18] A study in Karachi's squatter settlements identified 40% prevalence rate of smokeless tobacco use.[24]

The awareness about the risks of various forms of tobacco use is lacking; for instance, AMI patients do not consider the use of a water pipe type of tobacco as harmful for AMI recurrence. A cross-sectional study measured the water pipe smoking practice in students and reported that 60% students considered it as less harmful compared to cigarette smoking.[23,24] The source of government income of Pakistan has been dependable on the tobacco industry contributing Rs27.5 billion per year.[24] More than 65.40 billion cigarettes were produced in 2010-2011,and the government of Pakistan generated over Rs55 billion from the tobacco industry in the same financial year.[25] The use of tobacco is not decreasing; there was a 17% rise in tobacco sales from January to September 2008 compared to 2007. Of this increase, 9.3% is from increased sales, and the rest from increases in the price of cigarettes.[25] In 2003 Pakistan passed an antismoking law, but its implementation was poor. Countrywide awareness programmes about the hazards of tobacco, a ban on cigarette advertisement, and the dissuasion of tobacco cultivation became major strategic interventions. However, because of many political barriers, these government-supported strategies have not been fully implemented.

D. Pakistani Dietary Patterns and Challenges

Generally, the Pakistani cooking style is curry-based with the use of a large quantity of saturated fat. The main diet of people who live below the poverty line consists of carbohydrates and foods that contain more saturated fats. A cross-sectional descriptive study conducted in Pakistan revealed that the carbohydrate consumption among urban population of Pakistan is 51.5% and fat is 36.3%.[26] This group eats unhealthy food for many reasons: the rising costs of fresh fruits and vegetables, the lack of agricultural opportunities, and the availability of highly saturated commercial products (oils and ghee), that are cheap and readily available.[26-28]

This has consequently led to an increased risk for CVD. Encouraging people to change from the less expensive, commercially produced oils to healthier oils is a major challenge for the health care system in Pakistan and requires a drastic agricultural and food policy change in the country. This drastic change in the overall systems in Pakistan should be implemented only after careful study of the impact on people who live below the poverty line.

E. High Blood Pressure

The strong, relationship between CVD and high blood pressure (BP) has long been established.[2] Approximately 7.6 million people per year die globally, and 13.5% of the total deaths are associated with high blood pressure. Over time the trend towards hypertension reported in the South Asian population has increased.[1] Though the exact sources for primary hypertension have not been fully understood, however, obesity, high sodium intake and lack of health access for treatment are considered as the major risk factors for causing high blood pressure.[2] One of the studies identified that the elevated blood pressure is considered as a classical risk factor of other CVD-related diseases in South Asians, Caucasians, Chinese and African populations.[29] In Pakistan, the prevalence of hypertension is also increasing. A 1994 health survey in Pakistan[10] found that 22% of adults (age 15 years or more), and 33% of adults (age 45 years of age and more) were hypertensive (blood pressure >140 and diastolic >90 mm of Hg, whereas -in 2003 the age-standardised prevalence was 17.3%-25.3% for men and 9.9%-41.4% for women with the different ethnic backgrounds.[28]

F. Lack of Awareness Regarding BP Control in Pakistan

The studies suggest that Pakistani's general practitioners (GPs) fail to detect hypertension correctly as per recommended guidelines of the Pakistan Hypertension

League. One of the studies in Pakistan has shown that 28.5% of the GPs have lack of understanding about disease and 76.47% do not follow recommended guidelines to manage hypertensive patients.[30] A study conducted in Australia also found that 61.5% GPs did not start treatment for hypertension due to the fact that they possess knowledge gap, lack of familiarity with recommended guidelines, and lack of awareness about the drug therapy.[31] The significant reasons for the lack of control of blood pressure is the inadequate knowledge of healthcare professionals, and lack of treatment compliance of patients. This concern is indeed meticulous for aging population, which is ultimately increasing the burden of illnesses related to hypertension.

G. Blood Glucose Level (Diabetes) and Its Challenges

The burden of diabetes is rapidly increasing due to the increasing prevalence of unhealthy diet, sedentary lifestyle, population aging, and smoking. According to a recent survey, 5.1% of Pakistanis have been newly diagnosed with DM: 5.1% men and 6.8% women in urban areas and 5.0% men and 4.8% women in rural areas.[32] In 2000, 5.2 million patients were diabetic, and by 2020, it is estimated to increase to 13.9 million and 14.5 million by 2025.[32] The NHSP identified 25% (age 45 years or above) people suffer from DM. Moreover, the DM prevalence among the population with age 15 years or more was 5.4% (95% confidence interval (CI); 4.9-5.9), with considerable ethnic variations.[10]

The poor diagnosis and poor control of blood glucose levels further raises the prevalence of diabetes. It is estimated by NHSP that 2.7 million people suffer from diabetes; of them, only 0.8 million have been diagnosed and are conscious about their condition. Of the diagnosed, just 3% control their sugar levels. The condition is worse in rural areas and for women. This shows that it is essential to have age-specific regional and national data on blood sugar levels so that the programmes for preventive measures can be initiated.[10]

Similarly, physical activity is declining in LMICs as a result of urbanisation and lifestyle modifications. This change is due to societal shift of population from rural to urban settings, which ultimately changes their dietary habits, and often runs parallel to an increased sedentary lifestyle.[33] For example, in Swaziland, Namibia and South Africa, 40% of women are physically inactive.[34] Further, it was also identified that during the urbanisation period, the adults physical activity in China declined by 32%, and sedentary lifestyle like prolonged watching of television increased drastically.[34] Similar situation exists in Pakistan. In Pakistan,

a study conducted on the prevalence of obesity in people over the age of 15 years found that 25% were overweight or obese (95% CI 21.8%-28.2%).[35] These estimations are distressing for Pakistan's health system, since a considerable number of the people are still underweight, specifically during their school-age years. Similarly, there has been a drastic increase in the proportion of obese and overweight school-aged children in Pakistani urban areas.

In summary, the proportion of the risk factors mentioned above is increasing in Pakistan; on the other hand, there are limited data available on the prevalence of CAD and none on the incidence of CAD. The subsequent section will discuss some of the active health structures and the available services at primary and secondary preventive levels in Pakistan.

Health Infrastructure and System in Pakistan

Pakistan has a complex healthcare infrastructure with private and public facilities. According to the National Institute of Population Studies (2006-2007), the private sector serves more than 70% of the population and is primarily based on fee for service.[15] The health care system in Pakistan is not proficient enough to afford sufficient services for the growing population and it is not still set to face the disease-related epidemiological transitions.[15] The role of private-sector health care is also significant in terms of providing health care services, which include armed forces, non-governmental organisations (NGOs), and social security institutions that facilitate their own providers and allocate and raise their own funds. However, no mechanism exists in the government or private and semi-private healthcare sectors to monitor their clinical practice and the quality of service.[18] Because of these problems in the health system, Pakistan continues to have poor health indicators.

High-Technology Approach to the Management of CVD

Little importance has been attached to CVD prevention in Pakistan. Most of its health resources are utilised to deal with infectious/communicable and reproductive issues; therefore, the health system is unable to meet the increasing demands of chronic diseases. This has led to the development of high-technology tertiary care facilities for CVD.[18] Patients usually seek medical help only after a cardiovascular event has already occurred.

Regardless of highlighting the need of tertiary health care for CVD management, human resources and technological services are at a bare minimum in Pakistan. The majority of the rural population is not accessible to

these services due to transportation barriers and financial burdens. Very few private institutions have developed CVD preventive initiatives for the Pakistani population.

Current Prevention Strategies/Programmes in Pakistan

Some of the private organisations focus on CVD prevention and health promotion in collaboration with international organisations. Because modifiable contributing factors are accountable for the most non-communicable disease, the CVD prevention can be reported under NCD prevention. It is crucial to have sufficient health care systems in the country that integrate both primary and secondary levels of prevention programmes as well as coordinated public and private health care facilities. Due to the economic and political crises, the prevention and control of CVDs in Pakistan are notably unaddressed in health care forums. This spells out the need for a multifaceted population and high-risk approach. Without involving multiple stakeholders such as the health and finance ministry, the department of education, and agricultural and other regulatory bodies, efforts in isolation will not be sufficient to prevent and control CVD in the country. Fuster and Kelly's framework could serve as the basis for future actions that involve multiple sectors so that contextually based interventions can be used in the country; moreover, it takes account of a full range of complex determinants of CVD.[1] The framework also supports the integration of public and private organisations in Pakistan that focus on CVD risk-reduction programmes.[18] In this context, the following recommendations are made to address the emergent needs with regard to CVD in Pakistan.

Recommendations
Recognising Chronic Diseases as a National Health Priority

It is important that the Pakistani health system adds chronic illness to its health care agenda. Integrating existing programmes for the prevention of communicable diseases with programmes for the prevention of chronic diseases is a major health goal for many LMICs. Pakistan can also apply this model to address the common risk factors, such as smoking, unhealthy diet, lack of physical activity, high blood pressure, and obesity.[35] The plan focuses on identifying risk behaviours and their modification, which requires change in legislation and policy; for example, changes in agricultural policies to increase access to and demand for healthy food, the development of strategies to utilise open spaces for physical activity, and the involvement of religious and community leaders to endorse the participation.

Improving Population Data for Risk Factors for CVD in Pakistan

The recent surveillance of Pakistan surveillance is outdated and fragmented. A national system gather records from private and public segment that is not fully programmed; in addition, the health information management system is also outdated and may be unreliable in the present context.[15] At the local and population level a quality surveillance system is needed in order to determine the effects of these risk factors on CVD; it is recommended that the attention on causes of mortality and morbidity should be provided, primary determinants of CVD should be identified in the local context, money should be properly allocated for long-run, sustainable system of chronic disease-related surveillance.[4] In low- and middle-income countries, the surveillance system could be initiated with the presence of contextual factors.

Contextual Understanding of the Risk Factors

To integrate the prevention of CVD in national health plan, a contextual approach is required. A large number of patients who attend secondary prevention programmes do not achieve lifestyle changes such as smoking cessation, improved eating habits, and more physical activity. Culturally relevant and context-specific policies are needed while taking into account the infrastructure capacity and financial actuality.[18] Moreover, it is also crucial to include a system that comprises of satisfactory communication, proper planning, flexible decision-making, and committed people.[4,18]

Awareness Regarding BP Control

Public-communication interventions concerning health-related messages are cost-effective and useful in changing behaviours at the population level.[10] For instance, the messages associated with the hazards of smoking, high level of fat and salt consumption can be communicated via newspapers and pamphlets and replicated in other settings where people have access to newspapers and are literate. However, 70% of Pakistanis are not able to read newspapers or lack of access to newspapers, television programmes or radios that can be broadcasted regularly. The educational programmes for health should also be included in health policies.

Community-Based Programmes

Offering small community-based programmes and using population-based approaches are ideal ways to alert society to the need for changes in the risk factors.[4] Many health-related community programmes are currently being implemented in urban settings in many LMICs.

These integrated and targeted community programmes that address multiple risk factors can be integrated into health systems and offer access to individuals in multiple settings in communities where they already gather, such as schools, worksites, mosques, and other community organisations.[4] This approach is feasible and economical in Pakistani settings. However, it is essential to be very practical whilst executing community-based programmes and to be dubious about spending on those programmes that whose chief objective is not to lessen the CVD burden. It is also important to consider the matter of local context, no matter what interventional approach is used to prevent or control CVD, the local context matters enormously.

Implementation of Prevention Programmes

The evidences have suggested that the acquirement and increment of cardiovascular risks commenced early in life.[4] Unhealthy practices in childhood and adolescent increase the risk which includes tobacco use, high fat and high-calorie intake, and lack of physical activity; as a result, establishment of cardiovascular health promotion programmes during pregnancy and the early days of life is of immense worth. The efforts for its prevention should be sustained throughout the course of life. The explanation of the epidemiological transition emphasises the varying disease trends, from communicable to NCDs, with the massive burden of CVD risk in Pakistan. It is a major challenge to reduce these risks in Pakistani population. The present spread and fragmented programme requires proper planning and monitoring. The potential cost-effective methods of modifying these high-risk behaviours have been recommended, including health promotion programmes, better surveillance and exchange programmes in the local setting. Reviewing the dynamics of health systems and health behaviours helps to gain useful insight. Understanding the social and economical challenges and adjusting in the culture, the specific setting-related capacities and resources will be needed for population-based interventions for achieving the goal of CVD risk reduction in Pakistan.

Improving Economic Status

Income-generating schemes for the poor, such as microfinance or microcredit, require meaningful and transparent institutional support for economic development programmes which are aimed towards the poor vulnerable group.[19] Moreover, the major transformation is needed in terms of fund allocation, its appropriate utilisation and precision of those allocated amounts.

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References

1. Turin TC, Shahana N, Wangchuk LZ, Specogna AV, Al Mamun M, Khan MA, et al. The Burden of Cardiovascular and Cerebrovascular Diseases and the Conventional Risk Factors in the South Asian Population. Glob Heart. 2013; 8:121-30.
2. Filion KB, Luepker RV. Cigarette Smoking and Cardiovascular Disease: Lessons from Framingham.Glob Heart. 2013; 8:35-41.
3. WHO. Global status report on non-communicable diseases 2014. Media Centre 2017.[Online][cited 2016 May 1]. Available from: URL: http://www.who.int/nmh/publications/ncd-status-report-2014/en/.
4. Yusuf S, Rangarajan S, Teo K, Islam S, Li W, Liu L, et al. Cardiovascular Risk and Events in 17 Low-, Middle-, and High-Income Countries. N Engl J Med. 2014; 371:818-27.
5. Quan H, Chen G, Walker R, Wielgosz A, Dai S, Tu K, et al. Incidence, cardiovascular complications and mortality of hypertension by sex and ethnicity. Heart. 2013; 99:715-21.
6. Government of Pakistan. Population Census Organisation 2012.Retrieved from http://www.census.gov.pk.Link is not working
7. Bhatnagar P, Wickramasinghe K, Williams J, Rayner M, Townsend N. The epidemiology of cardiovascular disease in the UK 2014. Heart. 2015; 101:1182-9.
8. Amin F, Fatima S, Islam N, Gilani A. Prevalence of obesity and overweight, its clinical markers and associated factors in a high risk South Asian population. BMC Obesity. 2015; 2:16.
9. World Health Organization. Non-communicable Diseases (NCD) Country Profiles. [Online] 2014 [Cited 2016 July 13]. Available from URL: http://www.who.int/nmh/countries/pak_en.pdf.
10. Pakistan Medical Research Council. National Health Survey of Pakistan 1990 -1994. 1998 [Cited 2016 July 13]. Available from URL: http://www.statpak.gov.pk/depts/pco/.
11. United Nations Development Programme. Pakistan's new poverty index reveals that 4 out of 10 Pakistanis live in multidimensional poverty 2016. [Online] [Cited 2016 July 13]. Available from URL: http://www.pk.undp.org/content/pakistan/en/home/presscenter/pressreleases/2016/06/20/pakistan-s-new-poverty-index-reveals-that-4-out-of-10-pakistanis-live-in-multidimensional-poverty.html
12. Nishtar S, Khalid F, Ikram A, Kazi A, Mirza YA, Khattak H, et al. Protecting the poor against health impoverishment in Pakistan: proof of concept of the potential within innovative web and mobile phone technologies. WorldHealth Report. World Health Organization, 2010.
13. Krishnadath IS, Jaddoe VW, Nahar-van Venrooij LM, Toelsie JR. Ethnic differences in prevalence and risk factors for hypertension in the Suriname Health Study: a cross sectional population study. PopulHealthMetr. 2016; 14:33.
14. World Health Organization. Equity, social determinants and public health programmes 2010. [Online] [cited 2016 Aug 5]. Available from URL: https://www.mah.se/upload/FAKULTETER/OD/Avdelningar/who/doc/Equity%20socia%20determinants%20public%20health%20_eng.pdf.
15. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study. Lancet. 2012; 380:2224-60.
16. Nishtar S, Bile KM, Ahmed A, Amjad S,Iqbal A. Integrated population-based surveillance of non-communicable diseases: the Pakistan model. Am J Prev Med. 2005;29:102-6.

17. World Health Organization. Report on the Global Tobacco Control Report: Country Profile, Pakistan 2015: 1-7. [Online] [Cited 2016 May 11]. Available from URL: http://who.int/tobacco/economics/country_profile/pak.pdf.

18. Nishtar S. Vision 2030 of the Planning Commission of Pakistan - strategic health imperatives. Heart File.2006;5:1-11.

19. Samb B, Desai N, Nishtar S, Mendis S, Bekedam H, Wright A, etal. Prevention and management of chronic disease: a litmus test for health-systems strengthening in low-income and middle-income countries. Lancet. 2010; 376:1785-97.

20. Psaltopoulou T, Hatzis G, Papageorgiou N, Androulakis E, Briasoulis A, Tousoulis D. Socioeconomic status and risk factors for cardiovascular disease: impact of dietary mediators. Hellenic J Cardiol. 2017; 58:32-42.

21. Alam AY, Iqbal A, Mohammad KB, Laporte RE, Ahmed A, Nishtar S. Investigatingsocieconomic-demographic determinants of tobacco use in Rawalpindi, Pakistan. BMC Public Health. 2008; 8:50.

22. Safdar N, Bertone-Johnson E, Cordeiro L, Jafar T, Cohen, M. Dietary patterns and their association with hypertension among Pakistani urban adults. Asia Pac J ClinNutr. 2015;24:710-9.

23. Jawaid A, Zafar AM, Rehman TU, Nazir MR, Ghafoor ZA, Afzal O, et al. Knowledge, attitudes and practice of university students regarding waterpipe smoking in Pakistan. Int J Tuberc Lung Dis. 2008; 12:1077-84.

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

25. Abbas S, Riaz A, Abbas KS. Disease Burden of Ischemic Heart Disease in Pakistan and Its Risk Factors. Ann Pak Inst Med Sci. 2009; 5:145-50.

26. Zaman R, Iqbal Z, Ali U. Dietary Intakes of Urban Adolescents of Sialkot, Pakistan Do Not Meet the Standards of Adequacy. Pak J Nutr. 2013; 12:460-7.

27. Aziz K, Faruqui A. Awareness of cardiovascular disease including life styles in a lower middle class urban community in an Asian country.Pak Heart. 2012;41:1-10.

28. Bastien M, Poirier P, Lemieux I, Despres J.Overview of Epidemiology andContribution of Obesity to Cardiovascular Disease. ProgCardiovasc Dis.2014; 56:369-81.

29. Hussain S, Oldenburg B, Wang Y, Zoungas S, Tonkin A. Assessment of Cardiovascular Disease Risk in South Asian Populations. Int J Vasc Med. 2013; 2013:786801.

30. George C, Ramadas D, Norman G, Mukherjee D, Rao T. Barriers to cardiovascular disease risk reduction: Does physicians' perspective matter? Indian Heart J. 2016; 68:278-85.

31. Fürthauer J, Flamm M, Sönnichsen A. Patient and physician related factors ofadherence to evidence based guidelines in diabetes mellitus type 2, cardiovascular disease andprevention: a cross sectional study. BMC FamPract. 2013; 14:47.

32. Narula J, Prabhakaran D. Tobacco and CVD. Global Heart 2012;7:195-6.

33. Chomistek AK, Manson JE, Stefanick ML, Lu B, Sands-Lincoln M, Going SB, et al.Relationship of Sedentary Behavior and PhysicalActivity to Incident Cardiovascular Disease. J Am Coll Cardiol. 2013; 61:2346-54.

34. Teo KK, Ounpuu S, Hawken S, Pandey MR, Valentin V, Hunt D,et al. Tobacco use and risk of myocardial infarction in 52 countries in the INTERHEART study: a case-control study. Lancet. 2006; 368:647-58.

35. Jafar TH, Chaturvedi N, Pappas G. Prevalence of overweight and obesity and their association with hypertension and diabetes mellitus in an Indo Asian Population. CMAJ. 2006; 175: 1071-77.