ORIGINAL ARTICLE

Prevalence of coronary artery disease and its risk factors among outpatients in northern Afghanistan: A cross-sectional study in Andkhoy City

MOHAMMAD HASHEM HAMRAH[1], MOHAMMAD SHOAIB HAMRAH[2], MOHAMMAD HASSAN HAMRAH[1,3], MOHAMMAD HUSSAIN HAMRAH[1,4], AHMAD ELIAS HAMRAH[1], TOBA DAHI[5],ANOSHAHAMRAH[1], LEUSAHAMRAH[6], SHUKRIA HAMRAH[1], MOHAMMAD NAIM MUSAMMEM[7,]AHMAD EDRIS HAMRAH[1]

[1]*Dr.Mohammad Hashem Hamah's Curative Clinic*
[2]*Center for Rural Health, School of Health Sciences, University of Tasmania*
[3]*Departmentof Pediatric Dentistry, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran*
[4]*Arya University Faculty of Medicine, Mazar-i-Sharif, Afghanistan*
[5]*Faculty of Dentistry, AbantIzzet Baysal University, Bolu, Turkey*
[6]*Faculty of Medicine, Bursa Uludag University Faculty of Medicine Nilüfer/Bursa, Turkey*
[7]*Faryab Public Health Department, Faryab, Afghanistan*
Correspondenceto Mohammad Shoaib Hamrah, MD, MSc, PhD, ***E-mail -*** *mshoaibhamrah@gmail.com, mohammadshoaib.hamrah@utas.edu.au,*

ABSTRACT

Background: Coronary artery disease is the most common form of cardiovascular disease a group of diseases that are a leading cause of mortality worldwide.
Aim: To assess the prevalence of coronary artery disease and among patients attending an outpatient clinic in Afghanistan.
Methods: We conducted a cross-sectional survey of 2005 patients from April 2018 to December 2018. Information on socio-demographics, smoking, physical inactivity, history of hypertension, diabetes and coronary artery disease were collected using a face-to-face interview. Anthropometric measurements, blood pressure, electrocardiogram and biomedical measurements were performed. Data were analysed using descriptive statistics.
Results: The prevalence of coronary artery disease among patients was 17.4%, with females having significantly higher prevalence than males (20.1% versus 14.9%, P=0.02). Hypertension and physical inactivity were more prevalent among females than males (47.9% versus 34.6%, P<0.001), and (66.0% versus 51.4%, P<0.001), respectively. The prevalence of overweight and obesity was greater in females than males (59.8% versus 54.6%, P= 0.019) and a higher proportion of females had dyslipidaemia and diabetes mellitus compared to males (81.8% versus 63.3%, P<0.001, and 30.7% versus 23.0%, P<0.001), respectively. However, smoking was more prevalent among males than females (46.5% versus 4.1%, P<0.001).
Conclusions: The high prevalence of coronary artery disease and its risk factors among outpatients, especially women, attending one outpatient clinic in Afghanistan, highlights an urgentneedto prevent and control the disease in this area.
Keywords: Coronary artery disease, risk factor, hypertension,

INTRODUCTION

Coronary artery disease (CAD) is the most common form of cardiovascular disease (CVD)a group of diseases that are a leading cause of mortality worldwide[1,2]. The World Health Organization estimates CVD is responsible for 17.9 million deaths (31%of all deaths)in 2015[3]. Of these deaths, 7.4 million were due to CAD and 6.7 million to stroke[4]. The number of global CVD deaths is projected to increase to 23 million by 2030[5], and approximately three quarters of thesedeaths are likely to occur in low- and middle-income countries[6].

In 2016, there were 9.5 million people with CAD, a 19% increase over the prior decade[1]. The increasing prevalence of CAD in low-and middle-income countries is attributed to socio-economic changes, ageing, a growing population, and acquisition of lifestyle related CAD risk factors[7]. CAD, particularly among young adults, incurs a major economic burden on health care systems (e.g. hospitalizations, rehabilitation services, physician visits, drugs) and adversely affects personal and economic productivity (e.g. Losses of productivity due to premature mortality and short- or long-term disability)[8].

The conventional risk factors for CAD can be divided into non-modifiable, including age, male gender, family history of CAD, and race, and modifiable risk factors, including diabetes mellitus (DM), smoking, dyslipidaemia, hypertension, lack of physical activity, and obesity[9]. The importance of modifiable risk factors for CAD was reportedin the INTERHEART study which is a largemulti-centre, case-control study conducted in 52 countries from 262 centres in Asia, Europe, the Middle East, Africa, Australia, North America, and South America[10]. In some developed countries the prevalence of CAD risk factors has decreased whereas it has increased in developing countries[11]. South Asians had a greater risk of CAD than Western populations[12].

Previous studies have indicated a high prevalence of CAD risk factors among Afghan adults including hypertension 32.3%[13], smoking 35.4%[14], dyslipidaemia 52.8%, overweight and obesity 57.4%[15], DM22.4%[16], and physical inactivity 59.2%[17]. However, these studies were

conducted in urban areas of Afghanistan. At the time of this study, no-onehadevaluated the prevalence of CAD and its risk factors among Afghan adults in regional areas of Afghanistan. It is worthy to note that access to health services is known to be particularly poor in regional areas of Afghanistan[18]. The aim of this study was to determine the prevalence of CAD and its risk factors among patients visiting an outpatient clinic in Andkhoy, Afghanistan.

METHODOLOGY

Study design and population: This cross-sectional study was conducted in the curative clinic in Andkhoy, Afghanistan, from April 2018 and December 2018. The subjects were patients aged 18 years and above.A total of 2005 consecutive patients were included in this study. The study was approved by the Faryab Public Health Directorate. The curative clinic is an outpatient service for people who need to see a specialist, which provides patients with care, ongoing management and referrals to other services, if needed. The curative clinic is also a referral centre in Faryab province in norther part of Afghanistan. Informed consent was obtained from all participants. Patients with physical and neurocognitive disorders were excluded from the study.Data were collected face to face using the WHO STEP wise questionnaire. The questionnaire was translated into the Dari language and tested to check the effectiveness of the research process (the results of the pilot study were not included in the analysis).

Measurements: The STEP wise questionnaire recorded information on socio-demographic characteristics, including age, sex, educational level (illiterate, primary/private education, secondary education, university/other higher education), marital status (single, married, other),and occupation (employed, unemployed, housewife, farmer). Information on other riskfactors were also recorded, including smoking, physical inactivity, CAD, DM, history of hypertension, and family history of CAD.Anthropometry measurements,blood pressure, electrocardiogram(ECG), and biomedical measurements were performed.

Body mass index (BMI) was calculated as weight in kg divided by the square of the height in meters (kg/m^2). Height was measured using a wall-mounted stadiometer to the nearest centimeter. Before measuring weight, we asked patients to remove heavy items from their pockets and remove heavy items of clothing or apparel (i.e. big jackets, shoes). Their weight was measured with a portable electronic weighing scale which was placed on a firm horizontal surface and zeroed.Then, the patientwas askedto stand upright without shoes, with their back against the wall, heels together and eyes directed forward. We used an electronic scale with accuracy to the nearest 100 g. For this study, overweight was defined by a BMI of 25 to <30 kg/m^2 and obese by a BMI ≥30 kg/m^2(19). Physical inactivity was defined as not doing moderate-intensity aerobic physical activity for a minimum of 30 minutes on five days in a week or vigorous-intensity aerobic physical activity for a minimum of 20 minutes on three days in a week[20].

Hypertension was diagnosed when patients were taking antihypertensive medication at the time of participating in the study,the past medical history/record documented raised blood pressure (BP) on multiple occasions, or the BP was recorded higher than average (>140/90 mmHg) on multiple separate occasions[21]. Family history of CAD was defined as CAD occurring before age 55 years among first degree relativesof patients (parent, sibling, child)[22]. The presence of CAD was examined by ECG. Patients were classified as having CAD if they had one of the following: 1) a history of hospital admission for acute myocardial infarction (AMI) or an episode of angina, 2) a 12-lead ECG positive for prior AMI or angina by the Minnesota Coding System (criteria I, 1–3; IV, 1–3; V, 1–2; and VII, 1), and 3) a history of coronary artery bypass graft or percutaneous transluminal coronary angioplasty[23]. Resting ECG was also taken as part of the study.

Diabetes Mellitus was diagnosed when patients had a fasting blood glucose level of ≥ 126 mg/dL, a random blood glucose level of ≥ 200 mg/dL, or self-reported use of antidiabetic medications[24]. Current smokers were defined as patients who have smoked at least 100 cigarettes in their lifetime and currently smoke cigarettes. Past smokers were defined as patients who had smoked at least 100 cigarettes in their lifetime but did not smoke at the time of the study. Nonsmokers were defined as patients who have never smoked a cigarette or had smoked fewer than 100 cigarettes in their lifetimes (and had stopped smoking at the time of the interview)[25].

Dyslipidaemia was defined by having: a total cholesterol (TC) ≥ 200 mg/dLor Triglyceride (TG) ≥ 150 mg/dL, high density lipoprotein cholesterol (HDL-c)< 40 mg/dL in males or 50 mg/dL in females; low density lipoprotein cholesterol (LDL-c) ≥ 130 mg/dL); or the patient was under treatment for dyslipidaemia[26].

Statistical analysis: All analyses were performed with the SPSS version 20software package (IBM Corp., Armonk, N.Y., USA). The data areshown asmeans standard deviations (SDs) and percentages. Descriptive statistics related to patient characteristics are reported using frequencies and 95% CI (confidence interval). The mean of study variables was compared by t-test and qualitative variables were compared by Chi- square.Two-tailed *p*-values <0.05 were considered significant.

RESULTS

The study sample included 2005 participants, of whom 52.7% (n = 1057) were males. Patients' mean age was 49.6 (±15.6 SD) years. The majority of these participants (62.7%) were illiterate. Females had significantly higher systolic and diastolic blood pressures than males (*p*=0.01).The mean levels of TC, TG and HDL-c, LDL-c, and BMIwere also significantly higher among females than males (*p*≤ Females had significantly higher mean blood glucose levels compared to males (*p*=0.01).

The prevalence of CAD was 17.4%(95% CI: 15.7-19.1%), more common among females than males (20.1%, 95% CI: 17.6-22.8% versus 14.9%,95% CI: 12.8-17.1%,*p*=0.02). Hypertension, and physical inactivity were more prevalent among females than males (47.9%, 95% CI: 44.7-51.1% versus34.6%, 95% CI: 31.8-37.6%,*p*<0.001), and (66.0%, 95% CI: 62.9-69.0% versus51.4%, 95% CI: 48.3-54.4%, *p*<0.001), respectively. The prevalence of overweight and obesity was greater in

females than males (59.8%, 95% CI: 56.6-62.9%versus 54.6%, 95% CI: 51.5-57.6%, *p*= 0.02). A higher proportion of females had dyslipidaemia and DM in comparison with males (81.8%, 95% CI: 79.1-84.2% versus 63.3%,95% CI: 60.3-66.2%, *p*<0.001), and (30.7%, 95% CI: 27.8-33.7%, versus 23.0%,95% CI: 20.5-25.6%, *p*<0.001), respectively. The proportion of females with elevated blood glucose was higher than males (10.5%, 95% CI: 8.7-12.7% versus 4.6%,95% CI: 3.4-6.1*p*<0.001).However, smoking was more prevalent among males than females (46.5%, 95% CI: 43.5-49.6% versus 4.1%, 95% CI: 2.9-5.6%, *p*<0.001) (table 2).

Table 1: Sociodemographic and clinical characteristics of study participants

	Total (n-2005)	Male (n-1057)	Female (n-948)	*P-value*
Age, mean, years, mean ±SD	49.6±15.1	50.6±15.3	48.5±14.7	0.001
Marital status				0.270
Married	1656 (82.6%)	867 (82.0%)	789 (83.2%)	
Single	225 (11.2%)	116 (11.0%)	109 (11.5%)	
Others	124 (6.2%)	74 (7.0%)	50 (5.3%)	
Level of education				<0.001
Illiterate	1257 (62.7%)	588 (55.6%)	669 (70.6%)	
Primary/private education	306 (15.3%)	159 (15.0%)	147 (15.5%)	
Secondary	250 (12.5%)	133 (12.6%)	117 (12.3%)	
High school/higher	192 (9.6%)	177 (16.4%)	15 (1.6%)	
Occupation				<0.001
Employed	419 (20.9%)	385 (36.4%)	34 (3.6%)	
Unemployed	347 (17.3%)	322 (30.5%)	25 (2.6%)	
Housewife	709 (35.4%)	0 (0)	709 (74.8%)	
Farmer	341 (17.0%)	341 (32.3%)	0 (0)	
Others	189 (9.4%)	9 (0.85%)	180 (19.0%)	
Systolic BP, mm Hg, mean ±SD	124.9±26.1	121.4±24.1	128.9±27.7	<0.001
Diastolic BP, mm Hg, mean ±SD	82.8±14.4	81.3±13.8	84.5±14.8	<0.001
BMI, mean ±SD	25.6±4.2	25.2±4.2	26.0±4.6	<0.001
Blood glucose, mg/dL, mean ±SD	105.7±28.4	103.7± 27.3	107.9±29.4	0.001
TC, mg/dL**,** mean ±SD	192.2±35.6	189.0±34.3	195.8±36.6	<0.001
TG, mg/dL**,** mean ±SD	164.6±38.3	160.6±35.0	169.1±41.2	<0.001
HDL, mg/dL**,** mean ±SD	47.4±16.3	46.2±13.3	48.7±19.1	<0.001
LDL, mg/dL**,** mean ±SD	101.7±28.0	100.1±27.7	103.4±28.2	0.010
CAD, no (%)	348 (17.4%)	157 (14.9%)	191 (20.1%)	0.02

BP, blood pressure; BMI, body mass index.TG, triglyceride; TC, Total cholesterol; HDL-c, high density lipoprotein; LDL-c, low density lipoprotein cholesterol; coronary artery disease (CAD)

Table 2: Prevalence of CAD risk factors in study participants

	Total (n-2005)	Male (n-1057)	Female (n-948)	*P-value*
Hypertension, no (%)	820 (40.9%)	366 (34.6%)	454 (47.9%)	<0.001
Physical inactivity, no (%)	1169 (58.3%)	543 (51.4%)	626 (66.0%)	<0.001
Overweight or obesity, no (%)	1144 (57.1%)	577 (54.6%)	567 (59.8%)	0.019
Dyslipidaemia, no (%)	1444 (72.0%)	669 (63.3%)	775 (81.8%)	<0.001
Diabetes mellitus, no (%)	534 (26.6%)	243 (23.0%)	291 (30.7%)	<0.001
Smoking, no (%)	531 (26.5%)	492 (46.5%)	39 (4.1%)	<0.001
Elevated blood glucose, no (%)	149 (7.4%)	49 (4.6%)	100 (10.5%)	<0.001
TC≥200mg/Dl	845 (42.1%)	411 (38.9%)	434 (45.8%)	0.002
TG≥150 mg/dL	1118 (55.8%)	557 (50.9%)	561 (59.2%)	0.004
LDL-c ≥ 130 mg/dL	432 (21.5%)	208 (19.7%)	224 (23.6%)	0.034
HDL-c <40 mg/dL (M); <50 mg/dL (F)	903 (45.0%)	346 (32.7%)	557 (58.7%)	<0.001
Family history of CAD, no (%)	109 (5.4%)	49 (4.6%)	60 (6.3%)	0.114

TC, Total cholesterol; TG, triglyceride; HDL-c, high density lipoprotein; LDL-c, low density lipoprotein cholesterol, CAD.

DISCUSSION

To our knowledge, this is the first study to report on the prevalence of CAD andits risk factors in Afghanistan.The findings of our study revealed that the prevalence of CAD was high among outpatients in Andkhoy, with females having a significantly higher prevalence than males. The study indicated a high prevalence of CAD risk factors, including hypertension, dyslipidaemia, DM, overweight/ obesity and physical inactivity and smoking in this population. These findings suggest that CAD and its risk factors may be especiallychallenging among Afghan peopleliving in regional areas of Afghanistan given the combination of high prevalence of CAD and its risk factors and barriers to accessing healthservices in regional areas[18].

The prevalence of CAD among adult patients who visited an outpatient clinic in Andkhoy, Afghanistan was 17.3%. A similar prevalence of CAD (18.5%) has been reported among patients attending the cardiac centre in Arar, Saudi Arabia[27]. The prevalence observed in the current study was higher than the 3.5% found in a cross-sectional study among 1,275,174 adults from an English primary care sentinel network[28]. It was also higher than the 12.5% reported in a population-based study among adults in Kerala, India[29]. The stark contrast between these results seen to be consistent with the idea that the prevalence of CAD is decreasing in developed countries and rising in low-middle income countries[30]. A possible reason for the high prevalence of CAD in this study may be due to the country's economic development[31], which has led to major changes in lifestyle, diet and physical activity. Afghanistan is experiencing epidemiologictransition[32], and one of the effects of this transition is a shift in the disease spectrum from communicable to non-communicable diseases, particularly CAD and diabetes[33]. A key finding was the higher prevalence ofCADamong females than males in our study.This difference may be explained by higher rates of obesity and overweight, diabetes, dyslipidaemia, hypertension, and physical inactivityamong females than males in this study.

Our study indicated that 40.9% of the outpatients studied had hypertension. A similar rate of hypertension (41.7%)has been reported in a previous study conducted with adult patients of an outpatient department of a rural health training centrein India[34]. The prevalence of hypertension inother community based cross-sectional studies conducted in Afghanistan have ranged from 19.1% to 46.2%[13,35,36,37]. These differences in prevalence may be explained bythe variability in sample size, study design, cultural and socioeconomic characteristics of the participants and methods of study. Our results shed further light on the prevalence of CAD and its risk factors and the need to study the topic more extensively and implement early intervention strategies.

The present study indicated that there was a high prevalence of DM (26.6%) among adult patients.This finding is also comparable to thecommunity prevalence of DM (22.4%) which was found in a study conducted among adultsin Kandahar, Afghanistan[16]. However, the prevalence of DM among patients in the current study was considerably higher than previous research conducted among ambulatorypatientsat the Aga Khan University Hospital in Karachi, Pakistan(15%)[38]. The high prevalence of DM in patients in this study could be explained by the association between inpatient and community prevalence of diabetes[39]. Another possible reason for the high rate of DM in our study could bedue to the current epidemic of non-communicable diseasesamong Afghan people.

In the current study, about three-fifths of adult outpatients were physically inactive (58.3%). The result was similar to findings reported in a study conducted among adult patients attending health centres in Nagpur, India(59.2%)[40], but higher than a study ofpatients visiting a community psychiatry service in Northern India(36.5%)[41]. Similar to India, Afghanistan's economic improvement has resulted in an increase in the use of motorized vehicles along with a decrease in walking and cycling – and may account for the high prevalence of physical inactivity in our study population. This suggestshelping people to increase participation in physical activitymay be an important component in efforts to reverse the increasing trend of CAD and its risk factors. Therefore, investing in efforts to increase participation of Afghan people in physical activity may result in a decrease in the burden of CAD and its risk factors in regional areas of Afghanistan.

In the present study, the prevalence of obesity and overweightamong adult patients was 57.1%. A similar finding has been reported in a study of in-patients attending a community psychiatry service in North India (58.4%)[41]. The high prevalence of obesity and overweight in the current studycould be attributable to the high prevalence of illiteracy and physical inactivity among the study population.It is believed that physical inactivity and obesity constitute a vicious circle[42]. Other studies have also found an association between BMI and educational status and it may be that those who are illiterate are less aware of the consequences of obesity and overweight[43,44]. In addition, culturally, overweight and obesity are still seen as a sign of well-being among Afghan people[15].

Our study revealed a high prevalence of dyslipidaemia among adult outpatients (71.5%), a finding similar to that ofa study onducted among outpatients attending urban and rural general practice clinics in the UAE where the prevalence was 74%[45].The prevalence of dyslipidaemiain our study was,however, higher than that reportedfor ambulatory patients at the Aga Khan University Hospital in Karachi, Pakistan 3(31%)[38].A possible reason behind the high prevalence of dyslipidaemia in this study may be due to theintake of high-calorie-density foods such as Quabili Palaw, which is one of the most popular dishes in Afghanistan; especially the northern part of the country, andis frequently served by people in Andkhoy city. It consists of rice mixed with raisins, carrots, oil, and lamb. The use of solid oil in daily cooking is common among Afghan people with one study reporting approximately three-fifths of participants consumed solid oils in cooking in Jalalabad, Afghanistan[15]. It is well established that there is an association between solid oil and dyslipidaemia[46]. The current findings support the need to target health awareness about diet, including unhealthy diet and provide an early intervention program designed to improve health literacy. Improving health literacy and knowledge is known to assist people to take an active role in bringing about changes in their lifestyle and environment that shape their health and well-being[47].Arguably, the approach could be applied to reverse the prevalence and risk of CAD forpeople in regional areas of Afghanistan.

The prevalence of smoking among adult patients in this study was 26.5%, which is comparable to another recent study of adult patients in Andkhoy, Afghanistan (26.3%)[48]. Our finding is considerably higher than the figure of 15% from a study of adults attending selected urban healthcare facilities in South Africa[49]. However, the prevalence of smoking in this study is lower than the 35% found in a study of patients visiting a Dental College and Hospital in India[50].The inconsistencies in the prevalence between different studies in other countries could be due to a multitude of confounding variables such as diverse geographical, cultural and socioeconomic characteristics of

the patients studied, andpublic health policy, thesedifferences in the prevalence alsocould be explained by the variations in diagnostic criteria or survey measures used to assess smoking status.These similarities between our findings and those reported in other developing countries, across a range of indicators, support the notion that the prevalence of CAD and its risk factors are among risky individuals common[45,50,51].

The current study has several limitations. First, our study was conducted at a single centre and was limited to outpatients, thus, the results cannot be considered generalizable to all Afghan peoplein Afghanistan orto all outpatient. Finally, the sample was non-random which affects its overall power. One of the strengths of this study is that it provides valuable insight into the prevalence of CAD and CAD risk factors among outpatients in Andkhoy, Afghanistan and therefore provides a solid evidence base to inform strategic health initiatives to reverse the increasing prevalence of CAD in the region. It also contributes a sizeable body of data from 2005 patients, that could be built on by replicating the study elsewhere and accumulating further data on the topic.

CONCLUSION

This study revealed a high prevalence of CAD and CAD risk factors among the patients visiting an outpatient clinic in Andkhoy, Afghanistan; specifically, hypertension, physical inactivity, overweight and obesity, dyslipidaemia and DM were more prevalent among womenwhereas, smoking was more prevalent among men.Thus, there is an immediate need to adopt evidence-based early intervention strategiesto promote health literacy related to CAD risk reduction and CAD prevention to help reverse the increasing prevalence of CAD.It is worthwhile to launch a campaign to increase the awareness about the risk factors and measures to decrease them; especially among Afghan people living in regional areas of Afghanistan. The findings also highlight a need for a larger scale study to investigate the prevalence of CAD in other areas of Afghanistan and need for similar strategies elsewhere.

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REFERENCES

1. Naghavi M, Abajobir AA, Abbafati C, Abbas KM, Abd-Allah F, Abera SF, et al. Global, regional, and national age-sex specific mortality for 264 causes of death, 1980–2016: a systematic analysis for the Global Burden of Disease Study 2016. The Lancet. 2017;390(10100):1151-210.
2. Assareh AR, Cheraghi M, Nourizadeh M, Daeenejad F, Haybar H, Kiarsi MR. Distributions of ischemic heart disease risk factors in patients who were admitted for angioplasty in Iran. 2013.
3. World Health Organization. Cardiovascular diseases 2017 [Available from: https://www.who.int/en/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds).
4. Shahwan AJ, Abed Y, Desormais I, Magne J, Preux PM, Aboyans V, et al. Epidemiology of coronary artery disease and stroke and associated risk factors in Gaza community–Palestine. PLoS One. 2019;14(1).
5. Mozaffarian D, Benjamin E, Go A, Arnett D, Blaha M, Cushman M, et al. Heart disease and stroke statistics-2016 update: a report from the American Heart Association. Circulation. 2016;133(4):e38.
6. Abubakar I, Tillmann T, Banerjee A. Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet. 2015;385(9963):117-71.
7. Gaziano TA, Bitton A, Anand S, Abrahams-Gessel S, Murphy A. Growing epidemic of coronary heart disease in low-and middle-income countries. Curr Probl Cardiol. 2010;35(2):72-115.
8. American Heart Association. Cardiovascular disease: A costly burden for America. Projections through. 2017;2035.
9. Hajar R. Risk factors for coronary artery disease: historical perspectives. Heart views: the official journal of the Gulf Heart Association. 2017;18(3):109.
10. Yusuf S, Hawken S, Ôunpuu S, Dans T, Avezum A, Lanas F, et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. The lancet. 2004;364(9438):937-52.
11. .Xu S, Jiayong Z, Li B, Zhu H, Chang H, Shi W, et al. Prevalence and clustering of cardiovascular disease risk factors among Tibetan adults in China: a population-based study. PLoS One. 2015;10(6).
12. Rabanal KS, Meyer HE, Tell GS, Igland J, Pylypchuk R, Mehta S, et al. Can traditional risk factors explain the higher risk of cardiovascular disease in South Asians compared to Europeans in Norway and New Zealand? Two cohort studies. BMJ open. 2017;7(12):e016819.
13. Saeed KMI. Burden of hypertension in the capital of Afghanistan: a cross-sectional study in Kabul City, 2015. Int J Hypertens. 2017;2017.
14. Hamrah MS, Hamrah MH, Ishii H, Suzuki S, Hamrah MH, Hamrah AE, et al. Anxiety and depression among hypertensive outpatients in Afghanistan: a cross-sectional study in Andkhoy city. Int J Hypertens. 2018;2018.
15. Saeed K, Rasooly M, Alkozai A. Prevalence of risk factors for noncommunicable diseases in Jalalabad city, Afghanistan, evaluated using the WHO STEPwise approach. East Mediterr Health J. 2016;21(11):783-90.
16. Saeed KMI. Prevalence of Diabetes and its Risk Factors in Urban Setting of Kandahar City, Afghanistan-2015. IOSR Journal of Pharmacy. 2016;6(11):53-60.
17. Kahan D. Adult physical inactivity prevalence in the Muslim world: Analysis of 38 countries. Preventive medicine reports. 2015;2:71-5.
18. Kim C, Saeed KMA, Salehi AS, Zeng W. An equity analysis of utilization of health services in Afghanistan using a national household survey. BMC Public Health. 2016;16(1):1226.
19. Musaiger AO. Overweight and obesity in eastern mediterranean region: prevalence and possible causes. J Obes. 2011;2011.
20. Haskell WL, Lee I-M, Pate RR, Powell KE, Blair SN, Franklin BA, et al. Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. Med Sci Sports Exerc. 2007;39(8):1423-34.
21. Carretero OA, Oparil S. Essential hypertension: part I: definition and etiology. Circulation. 2000;101(3):329-35.
22. Avogaro A, Giorda C, Maggini M, Mannucci E, Raschetti R, Lombardo F, et al. Incidence of coronary heart disease in type 2 diabetic men and women: impact of microvascular complications, treatment, and geographic location. Diabetes Care. 2007;30(5):1241-7.

23. DAI Study Group. The prevalence of coronary heart disease in type 2 diabetic patients in Italy: the DAI study. Diabetic Medicine. 2004;21(7):738-45.
24. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care. 2014;37(Supplement 1):S81-S90.
25. Hodge F, Nandy K. Factors associated with American Indian cigarette smoking in rural settings. Int J Environ Res Public Health. 2011;8(4):944-54.
26. Grundy SM, Cleeman JI, Daniels SR, Donato KA, Eckel RH, Franklin BA, et al. Diagnosis and management of the metabolic syndrome: an American Heart Association/National Heart, Lung, and Blood Institute scientific statement. Circulation. 2005;112(17):2735-52.
27. Altaleb FF, Alshammari OM, Alanazi HM, Aljaber DA, Alanazi AB, El-Fetoh NMA, et al. Pattern and factors associated with cardiovascular diseases among patients attending the cardiac center in Arar City, Northern Saudi Arabia. Electronic physician. 2017;9(10):5459.
28. Hinton W, McGovern A, Coyle R, Han TS, Sharma P, Correa A, et al. Incidence and prevalence of cardiovascular disease in English primary care: a cross-sectional and follow-up study of the Royal College of General Practitioners (RCGP) Research and Surveillance Centre (RSC). BMJ open. 2018;8(8):e020282.
29. Krishnan M, Zachariah G, Venugopal K, Mohanan P, Harikrishnan S, Sanjay G, et al. Prevalence of coronary artery disease and its risk factors in Kerala, South India: a community-based cross-sectional study. BMC Cardiovasc Disord. 2016;16(1):12.
30. Reid C, Owen A, Freedman B. Coronary artery disease epidemics: not all the same. Medicographia. 2014;36(1):11-8.
31. Bjelica J, Rutting T. The State of Aid and Poverty in 2018. A New Look at Aid Effectiveness in Afghanistan. Afghanistan Analyst Network. 2018;17.
32. Saeed KMI. Prevalence and associated risk factors for obesity in Jalalabad city–Afghanistan. Alexandria Journal of Medicine. 2015;51(4):347–52.
33. Mohan V, Deepa R, Rani SS, Premalatha G. Prevalence of coronary artery disease and its relationship to lipids in a selected population in South India: The Chennai Urban Population Study (CUPS No. 5). J Am Coll Cardiol. 2001;38(3):682-7.
34. Bartwal J, Awasthi S, Rawat CMS, Singh RK. Prevalence of hypertension and its risk factors among individuals attending outpatient department of rural health training centre, Haldwani. Indian Journal of Community Health. 2014;26(1):76-81.
35. Saeed KMI. Prevalence of risk factors for non-communicable diseases in the adult population of urban areas in Kabul City, Afghanistan. Central Asian Journal of Global Health. 2013;2(2).
36. Saeed KMI, Rasooly MH, Brown NJ. Prevalence and predictors of adult hypertension in Kabul, Afghanistan. BMC Public Health. 2014;14(1):386.
37. Saeed KMI. Prevalence of hypertension and associated factors in Jalalabad City, Nangarhar Province, Afghanistan. Central Asian journal of global health. 2015;4(1).
38. Iqbal S, Dodani S, Qureshi R. Risk factors and behaviours for coronary artery disease (CAD) among ambulatory Pakistanis. Journal of Pakistan medical association. 2004;54(5):261.
39. Bach LA, Ekinci EI, Engler D, Gilfillan C, Hamblin PS, MacIsaac RJ, et al. The high burden of inpatient diabetes mellitus: the Melbourne Public Hospitals Diabetes Inpatient Audit. Med J Aust. 2014;201(6):334-8.
40. Patil C, Dhoble M, Kaware A. A study of physical activity levels and its correlates among adults: a cross-sectional study. International Journal of Community Medicine and Public Health. 2017;4(4):1154-8.
41. Singh SM, Surendran I, Jain S, Sharma A, Dua D, Shouan A, et al. The prevalence of non-communicable disease risk factors in community-living patients with psychiatric disorders: A study from North India. Asian J Psychiatr. 2019;41:23-7.
42. Carr D, Jaffe KJ, Friedman MA. Perceived interpersonal mistreatment among obese Americans: Do race, class, and gender matter? Obesity. 2008;16(S2):S60-S8.
43. Palo SK, Swain S, Priyadarshini S, Behera B, Pati S. Epidemiology of obesity and its related morbidities among rural population attending a primary health centre of Odisha, India. Journal of family medicine and primary care. 2019;8(1):203.
44. Pradeepa R, Anjana RM, Joshi SR, Bhansali A, Deepa M, Joshi PP, et al. Prevalence of generalized & abdominal obesity in urban & rural India-the ICMR-INDIAB Study (Phase-I)[ICMR-INDIAB-3]. The Indian journal of medical research. 2015;142(2):139.
45. Radaideh G, Tzemos N, Ali TM, Eldershaby Y, Joury J, Abreu P, editors. Cardiovascular Risk Factor Burden in the United Arab Emirates (UAE): The Africa Middle East (AfME) Cardiovascular Epidemiological (ACE) Study Sub-analysis. International Cardiovascular Forum Journal; 2017.
46. Briggs MA, Petersen KS, Kris-Etherton PM, editors. Saturated fatty acids and cardiovascular disease: replacements for saturated fat to reduce cardiovascular risk. Healthcare; 2017: Multidisciplinary Digital Publishing Institute.
47. Nutbeam D, Kickbusch I. Advancing health literacy: a global challenge for the 21st century. Oxford University Press; 2000.
48. Hamrah MS, Hamrah MH, Ishii H, Suzuki S, Hamrah MH, Hamrah MH, et al. Associations between proteinuria and cardiovascular risk factors among hypertensive patients in Andkhoy, Afghanistan. Nagoya J Med Sci. 2016;78(4):377.
49. Owolabi E, Goon D, Adeniyi O, Seekoe E, Adedokun A. Prevalence and factors associated with tobacco use among adults attending selected healthcare facilities in Buffalo City Metropolitan Municipality, South Africa. South African Family Practice. 2017;59(6):201-7.
50. Hussain J, Ram S. Prevalence of tobacco habits and attitude towards its cessation among outpatients of Mahatma Gandhi Missions Dental College and Hospital, Navi Mumbai, Maharashtra. J Contemp Dent. 2013;3(2):57-60.
51. Nelson F, Nyarko K, Binka F. Prevalence of risk factors for non-communicable diseases for new patients reporting to Korle-Bu teaching hospital. Ghana Med J. 2015;49(1):12-8