CHAPTER II

REVIEW OF LITERATURE

The purpose of this review of literature is to identify those studies that relate to the knowledge, attitude and Practice regarding Cardiovascular Disease related risk factors, signs and symptoms, lifestyle habits etc. among early adulthood. This will put the present study into context, establishing the aims and proposed hypotheses of the study. The pertinent review of literature on the subject is given below under the following heads according to the phases:

Phase I- Preliminary Phase

2.1 Personal Attributes
   2.1.1 Defining CVD
   2.1.2 Signs and Symptoms of CVD
   2.1.3 Types of CVD
   2.1.4 Prevalence of CVD
   2.1.5 Health Aspects related to CVD among Early Adulthood

2.2 Risk Factors of Cardiovascular Disease
   2.2.1 Cardiovascular Disease Risk factors
   2.2.2 Prevalence of Risk Factors of CVD
   2.2.3 Scales related to Measure CVD
   2.2.4 Perception of Risks

2.3 Knowledge, Attitude and Practices related to CVD
   2.3.1 Knowledge related to CVD
   2.3.2 Attitude related to CVD
   2.3.3 Practices related to CVD

Phase II- Interventional studies Related to KAP among CVD

Phase III- Post- Intervention
   2.5 Personal Attributes Vs. CVD
   2.6 Risks of CVD
   2.7 Knowledge, attitude and Practices
   2.8 Web Based Interventional Modules
2.1 PERSONAL ATTRIBUTES

In Today’s era where everything has turned its direction towards technology, it gets a little tough to follow the daily routine of a healthy lifestyle, the rapid economic growth is trailed by not only change in lifestyle but also various cultural changes have taken place. Lifestyle of an individual including nutrition plays an imperative role in the aetiology of various diseases that takes a toll on the man’s health among which one of them is the Cardiovascular Diseases, which has increased the pervasiveness of non-communicable diseases in India that has ultimately outgrown through gender, age, locations etc. CVD has been designated as the leading cause of mortality and morbidity in India, representing a total of 31% of all global deaths (WHO Fact sheet, 2015). With the growing incidences and presence of CVD in both urban and rural area among male and females, it gets necessary to look into the depth and quote the causes for the growing condition. Further this section has been divided into as follows:

2.1.1 DEFINITIONS: This section deals with various definitions related with cardiovascular diseases and early adulthood age group for introducing the present study.

2.1.1.1 Cardiovascular Diseases:

In India where CVD has been estimated to be the cause of death of 1.5 million people annually (Gaziano T., et.al, 2006), it might soon become the country with the highest mortality and morbidity because of CVD (World Health Report, 2002). Cardiovascular Diseases have been defined as a “group of heart and blood vessels disorders that include mainly hypertensive heart disease, ischemic heart disease, rheumatic heart disease and cerebrovascular disease or strokes” (WHO Fact sheet, 2015a).

Cardiovascular Disease is a term collectively used for the “diseases related to heart and circulatory system which also includes ischemic heart disease, cardiomyopathy, valvular disease, heart failure, arrhythmias, peripheral artery disease, and stroke” (British Association of Cardiovascular Prevention and Rehabilitation [BACPR], 2006). Many times the occurrence of CVD is related to the presence of other serious conditions such as diabetes or myocarditis (Fagan and Suntharesswaran 2002).

In other terms it has been defined “as the most avertable cause of death because of the fact that this disease can be prevented by controlling the risk factors related to it such
as obesity, stress, dyslipidaemia, hypertension, smoking, diabetes, alcohol consumption, dietary practices etc. can be easily controlled with change in lifestyle” (Awad and Nafisi, 2014)

It is also been defined as “Heart and Blood vessel diseases” that included various other problems of which atherosclerosis is one of the most important (fat deposition in form of plaque) (American Heart Association, 2014).

An intense exposure to various risk factors contribute in developing the cardiovascular diseases, in few cases a lot of people are predisposed to the condition of Heart Disease but in most of the cases it is because of the leniency towards a healthy lifestyle, the more we expose our body to such factors, higher the chances we have of developing CVD (World Heart Federation, 2012).

In other terms CVD is defined as an “illness that involves the blood vessels (veins, arteries and capillaries) or the heart, or both - diseases that affect the cardiovascular system” (Nordqvist C., 2016). Heart disease often used in case of CVD refers to condition involving narrowed or blocked vessels that cause symptoms like chest pain, numbness, vertigo etc. leading to heart attack or stroke (Mayo clinic, 2014) which is quite often used interchangeably with heart disease (Mayo Clini, 2011) whereas CVD is any disease of the heart or blood vessels but it cannot be used synonymously with heart disease as cardiac disease can be used (Medicine net, 2016).

Fatty deposits within the arteries increasing the risk of clots and affecting the heart or blood vessels is defined as CVD which is associated with the damage of other organs such as kidney, brain etc. (NHS Choices, 2016). It has also been defined “as a disease that includes all the diseases of the heart and circulation including coronary heart disease, angina, heart attack, congenital heart disease and stroke” (British Heart Foundation, 2015)

“Cardiovascular Disease is described as a condition in which a waxy substance like plaque builds up within the arteries which supply oxygen rich blood to our heart muscles and when blockage occurs angina, heart attack or stroke may happen” (National Heart, Lung and Blood Institute, 2016). An unusual functioning of the heart or blood Vessels which enhances the risk of death, heart attack, stroke, heart failure etc. which results in to a decreased life expectancy and declined quality of life (Cardiovascular Disease Foundation (CDF), 2011a)
2.1.1.2 Early Adulthood:

Early Adulthood or Young Adulthood often defined as a stage from the age of 20-40 years where transition takes place from exploration to experimentation, a phase of life which involves personal and economic independence, a time where an individual gets involved in exploring themselves to the fullest, they become more self-focused. According to Erikson (1975) in the wake of the adolescent emphasis upon identity formation, 'the young adult, emerging from the search for and insistence on identity, is eager and willing to fuse their identity with that of others. He [or she] is ready for intimacy, that is, the capacity to commit… to concrete affiliations and partnership. 

Erikson (1950) states that young adults try to explore relationships which leads to longer term relationships with someone other than family members. He also defines that once this stage is completed successfully, further than individual can lead to a better sense of commitment, safety and care within a relationship.

Occurring in young adulthood (ages 18 to 40 yrs), they begin to share ourselves more intimately with others. They explore relationships leading toward longer term commitments with someone other than a family member.

Successful completion of this stage can lead to comfortable relationships and a sense of commitment, safety, and care within a relationship. Avoiding intimacy, fearing commitment and relationships can lead to isolation, loneliness, and sometimes depression. Success in this stage will lead to the virtue of love.

In a self definition through story Mc Adams, (1989) defines that one there is a transformation from adolescence to early adulthood, a person is reluctant to seeks the self through story in historical and biographical terms. The past of the child is reviewed as a simple series of factual events; a curiosity is evoked within a young adult to explore the meaning and validity of those facts. A person for the first time does not search for oneself in others instead he confronts the others as a separate person with whom one longs to connect.

2.1.2 SIGNS AND SYMPTOMS OF CVD

Most of the Heart diseases require different kind of treatment but mostly the sign and symptoms associated with it are same, getting a correct diagnosis and prompt treatment requires an individual to understand their signs and symptoms.
World Health Organisation (2016) illustrates the symptoms of Heart Attack as pain or discomfort in the centre of the chest, pain or discomfort in the arms, the left shoulder, elbows, jaw, or back. The symptoms of stroke includes numbness of the face, arm, or leg, especially on one side of the body, confusion, difficulty speaking or understanding speech, difficulty seeing with one or both eyes, difficulty walking, dizziness, loss of balance or coordination, severe headache with no known cause and fainting or unconsciousness. Rheumatic heart disease symptoms are very much related to heart attack symptoms such as Symptoms of rheumatic heart disease include: shortness of breath, fatigue, irregular heartbeats, chest pain and fainting. Symptoms of rheumatic fever include: fever, pain and swelling of the joints, nausea, stomach cramps and vomiting.

World Heart Federation (2011) in its factsheet on CVD it’s signs and symptoms illustrated the symptoms of Heart Attack as Chest discomfort – most attacks have discomfort in the centre of the chest that lasts more than a few minutes, or that goes away and comes back. An uncomfortable pressure, squeezing, fullness or pain, Pain or discomfort in other areas of the body – that can include one or both arms, the back, neck, jaw or stomach, Shortness of breath, Other signs include breaking out in a cold sweat, nausea or light-headedness whereas warning signs of a stroke include: Sudden weakness of the face, arm, or leg, most often on one side of the body, Sudden confusion, trouble speaking or understanding, Sudden trouble walking, dizziness, loss of balance or coordination, Sudden, severe headache with no known cause respectively.

According to (National Heart Lung and Blood Institute, 2014) the most common symptom of Coronary Heart Disease is Angina, men feel the angina as squeezing or pressure in chest whereas women’s feel pain in the neck, jaw, throat, abdomen, or back and the pain in chest as sharp and burning chest pain. Symptoms associated with Heart disease includes Chest pain or discomfort among men and women complain of back or neck pain, indigestion, heartburn, nausea (feeling sick to the stomach), vomiting, extreme fatigue (tiredness), or problems breathing. Other symptoms include light headedness, dizziness among women and cold sweat and pain in arm among men. Associated symptoms with heart include swelling in the feet, ankles, legs, abdomen, and veins in the neck.
The Centre for disease control and prevention, (2015) described the five major symptoms of heart attack as Pain or discomfort in the jaw, neck, or back, Feeling weak, light-headed, or faint, Chest pain or discomfort, Pain or discomfort in arms or shoulder, Shortness of breath whereas other symptoms might also include unusual or unexplained tiredness, nausea or vomiting.

American Heart Association (2016) defines the heart failure symptoms as not alone one symptom can be the cause for alarm instead, if a person may have more than any of these symptoms like shortness of breath (dyspnea) wheezing or consistent coughing, oedema, fatigue, lack of appetite, confusion, trouble thinking, nausea, increased heart rate then a person must report to the clinic and evaluate their heart.

The National Health service Choice (2014) elaborates the symptoms of Angina as heart palpitations, unusual breathlessness, mild, uncomfortable feeling similar to indigestion, painful feeling of heaviness or tightness, usually in the centre of the chest, which may spread to the arms, neck, jaw, back or stomach.

Mayo Clinic (2014) distinguishes the symptoms on the basis of different Heart Diseases such as:

<table>
<thead>
<tr>
<th>Atherosclerotic disease</th>
<th>Heart arrhythmias</th>
<th>Congenital Heart Disease</th>
<th>Heart infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest pain (angina)</td>
<td>Fluttering in chest</td>
<td>Pale gray or blue skin colour (cyanosis)</td>
<td>Fever</td>
</tr>
<tr>
<td>Shortness of breath</td>
<td>Racing heartbeat (tachycardia)</td>
<td>Swelling in the legs, abdomen or areas around the eyes</td>
<td>Shortness of breath</td>
</tr>
<tr>
<td>Pain, numbness, weakness or coldness in your legs or arms if the blood vessels in those parts of your body are narrowed</td>
<td>Slow heartbeat (bradycardia)</td>
<td>In an infant, shortness of breath during feedings, leading to poor weight gain</td>
<td>Weakness or fatigue</td>
</tr>
<tr>
<td>Chest pain or discomfort</td>
<td>Chest pain or discomfort</td>
<td></td>
<td>Swelling in your legs or abdomen</td>
</tr>
<tr>
<td>Shortness of breath</td>
<td>Light-headedness</td>
<td></td>
<td>Changes in heart rhythm</td>
</tr>
<tr>
<td>Dizziness</td>
<td>Fainting (syncope) or near fainting</td>
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<td>Dry or persistent cough</td>
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<td></td>
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<td>Skin rashes or unusual spots</td>
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</table>
2.1.3 TYPES OF CVD

CVD has been defined as the group of disorder of heart and blood vessels which include the following (WHO CVD Fact sheet, 2010-2011 a)

a) **Coronary Heart Disease** defined as the disease of blood vessels, when the arteries which are responsible for providing blood and oxygen to the heart muscle get narrowed by deposition of fat (plaque) causing a blockage in the inner walls of blood vessels.

b) **Cerebrovascular disease** is a group of condition that affects the circulation of blood in the brain, causing low blood flow or none at all in the affected area.

c) **Peripheral Artery Disease** is a condition where the blood supply through the vessels to the arms and legs gets disrupted due to narrowed arteries causing gangrene.

d) **Rheumatic Heart Disease** caused by untreated streptococcal (strep) infection leading to rheumatic fever and subsequently affecting the heart and other organs.

e) **Congenital Heart Disease** defined as a birth defect affecting the normal functioning of the heart.

f) **Deep Vein Thrombosis and Pulmonary Embolism**, a blood clot usually in the leg, travelling to the lungs and causing a blockage in blood vessels leading to low oxygen levels in blood.

CVD includes the aforesaid conditions but is not particularly limited to it (WHO, 2011 b)

2.1.3.1 **Coronary Heart Disease**

Coronary Heart Disease often the most common form of Heart disease, it is a condition where arteries in the heart are blocked because of continuous fat deposition which in return leads to further complication mostly including:

a) **Angina**- when the heart does not have enough oxygen.

b) **Heart Attack**- when the heart does not have oxygen at all and few muscles of the heart might even die because of lack of oxygen.

Over the years, this plaque (fat) keeps on depositing in the form of clot made from cholesterol, calcium and other waste product of cell. Further, it clogs the arteries, narrowing it and slowing down the flow of blood, a condition called as atherosclerosis, usually occurring anywhere in the body. This condition is usually tagged along with symptoms as dizziness, fatigue, pain etc. (Heart and Stroke
Foundation, 2009). Coronary Heart Disease is often interchangeably used with coronary artery disease, as there is no such difference between both of them (American Heart Association, 2015) but the cause of Coronary Heart disease is actually a result of coronary artery disease, mostly the plaque starts building up from our childhood, hence it becomes quite evident by teenage years that this clot deposit with stay for life with an individual (Fisher, 2015).

2.1.3.2 Cerebrovascular disease:

The (American Association of Neurological Surgeons, 2005) define Cerebrovascular disease that includes all disorders in which an “area of the brain is temporarily or permanently affected by ischemia or bleeding and one or more of the cerebral blood vessels are involved in the pathological process. Cerebrovascular disease includes stroke, carotid stenosis, vertebral stenosis and intracranial stenosis, aneurysms, and vascular malformations”

| Stroke | An abrupt interruption of blood flow to the brain causing loss to neurological functions usually because of a blockage or bleeding in the brain. It is of two types:

**Ischemic stroke**: Usually thrombotic or embolic. When a blood clot called thrombus blocks the artery causing no flow of blood to the brain whereas when a thrombus travels downstream from its original site, this moved particle is called embolus, the brain damage depends on how far downstream in the artery the blockage occurs.

**Hemorrhagic Stroke**: usually caused by hypertension, rupture of aneurysm (localised swelling) or vascular malformation. When a bleeding occurs directly into the brain tissue, forming a clot within the brain.

| Transient Ischemic Attack | Before any serious damage occurs. |

National Health Service Choices (2014) describe the Cerebrovascular Disease as conditions caused by problems that affect the supply of blood to the brain. The most common conditions have been defined as:

- **Stroke** – A condition where one part of the brain is damaged usually by a lack of blood supply or bleeding within the brain from a ruptured blood vessel.
• **Transient ischemic attack (TIA)** – a temporary condition causing a fall in blood supply leading to stroke like symptoms.

• **Subarachnoid haemorrhage** – blood leaks out from the vessels within the brain surface.

• **Vascular dementia** – a mental impairment caused due to stoke or other condition due to blood circulation to the brain.

(Walker, 1990) explains that cerebrovascular disease is subdivided into ischemic events and cerebral haemorrhages. The Ischemic events are divided whether symptoms occur in carotid or vertebrobasilar distribution along with the duration of symptoms whereas TIA will last more than a few minutes and never more than 24 hours. The neurologic deficit in the ischemic stroke could be stable, progressive or resolving.

2.1.3.2 Peripheral Artery disease:

National Heat Lung and Blood Institute (2016) defines P.A.D as a disease when plaque builds up in the arteries that carry blood to the head, organs and limbs. In this condition mostly the arteries in the legs are affected causing pain and numbness, and if the condition gets worst due to infection in leg, the patient may get gangrene leading to leg amputation. The risk of CHD, Heart Attack, Stroke, TIA is highly related with P.A.D in increasing the risk, though serious this condition is treatable.

Ouriel (2001) delineates that the lower extremity peripheral arterial disease (PAD) occurs most commonly with pain during ambulation, which is known as “intermittent claudication”. On the whole the symptoms are comforted with exercise, pharmacotherapy, and cessation of smoking. The main concern should be focused on generalised atherosclerotic process like lowering blood lipid, sugar and BP. The risk of limb loss is only significant if there is gangrene, pain at rest or ischemic ulceration.

American Heart Association (2016) demarcates PAD as the narrowing of the peripheral arteries to the legs, stomach, arms, and head - most commonly in the arteries of the legs. It has been quite associated with Coronary Artery Disease (CAD) as the reason for both is atherosclerosis. People who suffer from PAD have double the chances Heart Attack or stroke as it often goes unidentified by Health professionals or ignored by the sufferer due to normal leg cramping, tiredness in leg or hip muscles while walking which usually goes away after resting.
2.1.3.3 Rheumatic Heart Disease:

Marijon et al. (2012) define the Rheumatic Heart Disease (RHD) occurring from an abnormal autoimmune response to a group A streptococcal infection in a genetically susceptible host. Acute Rheumatic fever (ARF) the precursor to RHD affects different organs and leads to irretrievable valve damage and heart failure.

WHO (2011b) states the Acute Rheumatic fever as a hypersensitivity reaction that is classically directed to antibodies against group A streptococcal molecules that also are cross-reactive with host antigens. Here the antibodies against M protein of few streptococcal strains unite to proteins in the myocardium and cardiac valves and cause injury through the activation of complement and FC receptor-bearing cells (including macrophages). He CD4+ T cells that identify streptococcal peptides also can cross-react with host antigens & bring forth cytokine-mediated inflammatory responses.

Harris et al. (2015) illustrates Rheumatic Fever as a condition that is characterized by widespread inflammation affecting a number of organs in the body, including heart due to occurrence of a throat infection caused by streptococcal A bacteria. The immune system of the body responses both the bacteria and some of the body’s own tissues containing the same bacteria as that in the molecule including the heart, skin,
joints and nervous system. This disease is generally a result of occurring episodes of rheumatic fever. The main parts affected are the valve of the heart, particularly mitral and aortic valves. The inflammation causes the valves to narrow which results in decreased blood flow through heart or flow of blood in wrong direction due to valve leakage. This condition ultimately to arrhythmia, for instance atrial fibrillation, or heart failure, where the heart is unable to pump enough blood to meet the body’s needs.

Steger (2015) defines Rheumatic fever as a complication of Acute Rheumatic Fever caused by group A β-haemolytic Streptococcus and develops in due course. It mostly includes mitral and aortic valves stenosis or insufficiency, pancarditis, arrhythmias and heart failure, often characterized by fibrosis and scarring of the leaflets, commisures and cusps.

2.1.3.4 Congenital Heart Disease:

American Heart Association (2015) defines the term congenital meaning “existing at birth”. The ailment of the heart is best describes as a defect and not a disease. This defect generally occurs when the heart or blood vessels near the heart don’t develop before birth.

Heart and stroke Foundation (2012) states CHD occurring at birth, usually present in 1% of live births and is the most frequent malformation in newborns. Most of the times there is no known cause but other times, the reason may be viral infections such as rubella (measles), certain inherited conditions such as Down syndrome, or drug or alcohol abuse during pregnancy.

Table 2.2: Various types of CHD

<table>
<thead>
<tr>
<th>Obstruction of blood flow (stenosis): narrowing or obstruction of heart valves, arteries or veins that partly or completely blocks the flow of blood.</th>
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</thead>
<tbody>
<tr>
<td><strong>Pulmonary stenosis</strong></td>
</tr>
<tr>
<td><strong>Pulmonary atresia</strong></td>
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</table>
### Tricuspid atresia
The tricuspid valve manages the blood flow between the right atrium and the right ventricle is not formed accurately, with no opening in between the blood is not able to flow from the right atrium into the right ventricle then onto the lungs, where it goes to get oxygenated. If left untreated, this condition is fatal.

### Aortic stenosis
The aortic valve (controls flow of blood between the left ventricle (the main pumping chamber of the heart) and the aorta, the large artery) becomes narrowed making it difficult for the heart to pump blood to the body.

### Coarctation of the aorta
The aorta is pinched or stiff, which hinder the flow of blood to the lower part of the body and augments blood pressure above the constriction.

### Septal defects (holes in the heart)
There is an opening in the wall (septum) which differentiates the right and left sides of the heart, the flow of blood takes place between the two chambers instead flowing normally leading to an enlarged heart. Commonly termed as “hole in the heart”

#### Atrial septal defect
Hole in the septum, or muscular wall, that separates the heart’s two upper chambers (atria).

#### Ventricular septal defect
Hole in the wall (septum) that separates the heart’s two lower chambers (ventricles).

### Patent ductus arteriosus
An abnormal connection between the aorta and the pulmonary artery in the heart. The pulmonary artery carries blood from the heart’s right lower chamber (ventricle) to the lungs, where it is loaded up with oxygen. From the lungs, the blood returns to the heart’s left ventricle and is pumped out through the aorta to the body.

### Cyanotic defects
Blood pumped to the body contains less-than-normal amounts of oxygen, causing cyanosis, a blue discoloration of the skin.

### Tetralogy of Fallot
This condition involves four defects that make the level of oxygen in the blood too low:
- A large hole in the wall between the two ventricles that allows oxygen-poor blood to mix with oxygen-rich blood (ventricular septal defect).
- A narrowing at, or just beneath or above, the pulmonary valve, which can block the flow of blood from the right side of the heart to the lungs; this narrowing typically occurs across all three areas.
- A more muscular than normal right ventricle.
- An aorta that lies directly over the right ventricle, allowing oxygen-poor blood to flow into the aorta.

#### 2.1.3.5 Deep Vein Thrombosis and Pulmonary Embolism:
Hirsh and Hoak (1996) define the venous thrombi as intravascular deposits made up of fibrin and red cells with platelets and leukocyte component. They are usually formed in the area of slow or troubles large venous sinuses and in the valve cusps in the deep veins of the calf or venous segments which have been exposed to direct pain.
Centre for disease control and prevention (2013) explains Deep vein thrombosis as a condition when a clot develops deep within the large veins and when that clot breaks off and travels to the lungs causing it to be fatal is referred to as pulmonary embolism.

Rathbun (2009) refers DVT as a condition where one or more blood clots in the body’s large veins usually limbs are formed causing partial or complete blockage of circulation in the vein leading to swelling, tenderness, pain etc. whereas a more serious complication arising from DVT is PE when a clot breaks loose travels in the bloodstream to heart and then lungs, partially or completely blocking one of the pulmonary artery or its branches. DVT and PE are commonly grouped together and sometimes referred to as “venous thromboembolism” (VTE).

2.1.4 PREVALENCE OF CVD

Over the past years where India has seen such a rapid growth in its economy, the burden of diseases has also subsequently. The load of diseases including communicable and Non-communicable is expected to rise far more that its present percentage by 2020. Where India faces a total of 53% deaths due to non-communicable disease in India CVD shares its percentage of 24%, with this growing rate India is about to face an epidemic of cardiovascular disease in the coming years (NCD Profile WHO,2011c). Where the total burden of CVD in the world is constituted to be about 17.3 million deaths per year, heart attacks were responsible for 7.3 million deaths and strokes were responsible for 6.2 million deaths, it is even estimated that 80% of all death occurs due to Heart Attack and stroke (WHO,2008) in which India shared its percentage of 2.94 million deaths in 2015 (Ministry of Health and Family Welfare, 2005). In a study conducted by Soman et al. (2011) to find out the incidences of mortality related to CVD in a five year follow up on 161942 rural community dwelling adult it was found that diseases of the circulatory system contributed 40%. Coronary heart disease was the leading cause of death in men (31.1%) and women (17.6%). Age-standardized cardiovascular disease (CVD) death rates were 490 for men and 231 for women per 100 000 person years. Thus, proving the burden of CVD is at a very high rate. The reported prevalence of coronary heart disease (CHD) in adult surveys has risen 4-fold over the last 40 years (to a present level of around 10%), and even in rural areas the prevalence has doubled over the past 30 years (to a present level of around 4%).
In a study conducted by (Chow et al. 2007) it was reported that in 45 villages of a southern state in India, in the year 2004, 32% of all deaths were due to CVD, in contrast to infectious disease which were responsible for 13%. The (WHO, 2003) estimated that over the next 10 years, India will lose 237 billion USD due to heart disease, stroke, and diabetes.

According to the data by Greenberg et al. (2005) it has been found that the deaths due to CVD in the age group of 35 to 64 years, resulted in 9.2 millions productive years of life being lost in 2000 and it is expected to rise to 17.9 million years in 2030 (more than the assumed figure for U.S)

In the region of South East Asia the contribution of deaths due to CHD is an estimated 3.7 million of deaths or a quarter of all deaths in that region which include 2.0 million among male population and 1.7 million among female population (WHO Fact Sheet, 2015). A total of 2.25 million deaths were estimated in 2010 in India and it was assumed to reach 2.94 million in 2015 (Ministry of Health and Family Welfare, 2005).

Hoffman and Kaplan (2002) estimate the incidence of specific major forms of CHD. The incidence of CHD in various studies varies from about 4/1,000 to 50/1,000 live births. The total incidence of CHD was related to the relative frequency of ventricular septal defects (VSDs), the most common type of CHD. There are about 6/1000 live births incidences of moderate and severe form of CHD.

Wanni et al. (2014) conducted a study on 767,921 patients for a period of 3 years and 10 months to establish the prevalence and spectrum of CHD. It was found that 877 out of 767,921 patients were found having CHD, concluding the prevalence of 1.12/1000. About 777 (88.5%) were the acyanotics (shunting (flowing) of blood occurs from the left side of the heart to the right side of the heart due to a structural defect (hole) in the interventricular septum) and 100 (11.5%) were cyanotic (oxygenated or a mixture of oxygenated and deoxygenated blood bypasses the lungs and enters the systemic circulation) heart patients.

Shah et al. (2010) found the prevalence of CHD to be 1.3/1000 children, on examining 118,212 children, the most common lesions found were ventricular and atrial septal defects, aortic stenosis with or without regurgitation, and pulmonary stenosis. Similar results were found in the study conducted by Bhardwaj et al.,
where the prevalence was found to be 19.14/1000 on examining 34517 individuals, here also the common defects found were ventricular septal defect (33%), followed by atrial septal defect (19%) and tetralogy of Fallot (16%). Majority of cases were between 0 to 5 years of age, the prevalence among adults was found to be 2.4/1000 individuals with atrial septal defect (44.5%) being the most frequent defect.

### 2.1.5 Health Aspects related to CVD among Early Adulthood

Early adulthood usually defined as the healthiest time of life. Knechtle, et al., (2012) defines young adults as generally in good health, who neither are subjected to any sort of disease nor problems of senescence, at this period of time the physical performance and strength reach a peak from 20-35 years of age. Roy (2014) comments that irrespective of the age depending upon an individual’s daily routine and exercise pattern a 40 years old may even defeat a 20 year old and can show better signs of healthy lifestyle. Mirbolouk et al. (2016) in a follow up of 9.2 year among Iranian early adults aged 20-40 years for predicting early adulthood incidence of pre-diabetes and Type 2 Diabetes among a population of 2563 subjects found that during follow-up 208 cases of pre-diabetes/T2D occurred, resulting in an incidence rate of 9.61 per 1000 person-years. Multivariate-adjusted hazard ratios (HRs) for incident pre-diabetes/T2D showed significant risk for 1 standard deviation increase in FPG and body mass index with corresponding HR of 1.89 (1.6–2.23) and 1.435 (1.080–1.905), respectively. Among parental potential risk factors, the paternal history of T2D was independently associated with increased risk for pre-diabetes/T2D in the adolescence (HR=1.63(1.02–2.60)).

The high rate of unemployment among emerging adults is associated with risk of depression was analyzed by (McGee and Thompson, 2015) from the data obtained from Behavioural Risk Factor Surveillance System (BRFSS), it was concluded that 12% of emerging adults were depressed (PHQ-8 ≥10) and about 23% were unemployed. Significantly more unemployed than employed emerging adults were classified with depression. In the final model, the odds of depression were about 3 times higher for unemployed than employed emerging adults.
Shaw et al. (2010) estimated the prevalence of diabetes for 2010 and 2030 by the studies conducted in 91 countries for calculating age- and sex-specific diabetes prevalence’s, which were further applied on all 216 countries to for 2010 and 2030, it was revealed that the world prevalence of diabetes among adults (aged 20–79 years) will be 6.4%, affecting 285 million adults, in 2010, and will increase to 7.7%, and 439 million adults by 2030. Between 2010 and 2030, there will be a 69% increase in numbers of adults with diabetes in developing countries and a 20% increase in developed countries.

Gajalakshmi et al. (2003) conducted a case control study on of the smoking habits of 27,000 urban and 16,000 rural men who had died in the state of Tamil Nadu, southern India, from medical causes (ie, any cause other than accident, homicide, or suicide), and of 20,000 urban and 15,000 rural male controls aged 25-69 years. The chief mortality among smokers was primarily tuberculosis (4.5 [4.0–5.0], smoking-attributed fraction 61%), a third involved vascular disease (1.8 [1.7–1.9], smoking-attributed fraction 24%), 11% involved cancer (2.1 [1.9–2.4], smoking-attributed fraction 32%), chiefly of the respiratory or upper digestive tracts, and 14% involved alcoholism or cirrhosis (3.3 [2.9–3.8], not attributed to smoking).

2.2 Risk Factors for Cardiovascular Disease

2.2.1 Cardiovascular Disease Risk factors

The American Heart association, (2015) defines the risk factors of CVD into three categories: Major risk factors (that considerably amplify the risk of CVD), Modifiable risk factors (that can be treated, controlled or modified) and contributing risk factors (associated with increase in CVD risk, but their pervasiveness and implication have not been precisely determined). Major risk factors that cannot be changed are Race/ethnicity, age, Sex. The chances of developing CVD is highly depended on the existence of these risk factors says American Heart Association.

1. Major Non-modifiable risk factors

a) Race and ethnicity

The major non-modifiable risk factors that we do not have control are Race/ethnicity. South Asians are at increased risk of heart diseases suggested by (Chaturvedi, 2003) because of increased levels of insulin resistance and associated factors such as inflammation and endothelial dysfunction. According to American Heart Association
fact sheet on CVD health disparities American Indians die from Heart disease much earlier than expected 36% compared to 17% of U.S population overall along with a higher prevalence of diabetes among them.

b) Age and Gender

Age and Gender are one of the risk factors that can’t be controlled. As a person goes through aging there is an increased vulnerability to endothelial injury and decreased endothelial repair says (Huether and McCance, 2010). Although CVD can happen at any age, the risk of CVD increases with age. As people age, heart also lessens its functions. The wall of the heart thickens and arteries may get rigid making hard for pumping the blood. All of these changes in the heart make people exposed for developing CVD when they age. AHA advocates everyone to undertake cardiac risk assessment at the age of 40 and every five years thereafter. The risk of developing CHD is high among women after menopause (Agrninier et al., 2010; Matthews et al., 2009; Tan et al., 2009). Different studies on heart disease confirmed that most of the risk factors for heart disease starts to develop at young age (Berenson, 2009; Pencina et al., 2009;). Studies completed among university students showed that college students have enough risk factors for developing CVD (Hlaing et al., 2007; Spencer, 2002).

c) Heredity and Family history

CVD is dominant among people who have a family history of CVD, than those who do not have such family member (CDC, 2011b), often combined with factors such as unhealthy lifestyle, smoking, poor diet etc. the presence of any such family history among patients requires the physicians to recommend their patients to adapt an extra attentive attitude towards their health heart (Zlot, Valdez, Han, Silvey, & Leman, 2010). (Murabito et al. 2005) reported a double risk of MI, even after adjusting the conventional risk factors among the patients who had a family history of CVD, genetic factors are critically involved in the pathogenesis of CVD and can be utilised for further risk prediction of CVD says (Thanassoulis and Vasan, 2010).

2. Major Modifiable Risk Factors:

The factors that reduce the probability of occurrence of disease by altering its course through intervention say (Porta, 2008). The risk factors that can be treated or modified include cigarette smoking, physical inactivity, unhealthy diet, harmful use of alcohol, obesity, HTN, dyslipidemia, diabetes, and stress (AHA, 2011a; Mendis et al., 2011; Mosca et al., 2000). The prevalence of 80% stroke and CHD cases
worldwide is highly attributed to smoking, physical inactivity, unhealthy diet (WHO, 2011). Physical Inactivity and unhealthy diet is often the reason behind the occurrence of Hypertension, dyslipidemia, diabetes or elevated blood sugars, and obesity (Mendis et al., 2011)

a) High Blood Cholesterol

High blood cholesterol one of the major risk factors for developing heart disease (NHLBI, 2009; AHA, 2014). Through time as the cholesterol level increases, the chances of heart disease and stroke parallel to it also increases. When too much fat like substance starts building up in the arteries in the form of plaque. A block in the blood flow occurs which results in heart attack or stroke. Usually there are no symptoms when a person has high levels of blood cholesterol; it is tested through fasting blood test. The recommended levels for blood cholesterol by AHA are.

- Total cholesterol - less than 200 mg/dL.
- Low-density lipoprotein (LDL, or “bad”) cholesterol – <100 mg/dL is considered optimal. (Increased LDL levels pose greater chances of getting heart disease)
- High-density lipoprotein (HDL, or “good”) cholesterol- which helps keeps cholesterol from building up in the arteries. ≥ 60 mg/dL is considered good as it helps in protecting against heart disease.
- Triglycerides- another form of fat in blood stored in our body that can be later used later for energy purpose. (<150 mg/dL (optimal), 150-199 mg/dL (borderline to high), 200-499 mg/dL (high), >500 mg/dL (very high)). (NHLBI, 2009).
- VLDL- Considered as Bad cholesterol, Very-low-density lipoprotein (VLDL) cholesterol is produced in the liver and released into the bloodstream to supply body tissues with a type of fat (triglycerides). An elevated VLDL cholesterol level is more than 30 milligrams per decilitre

Eating low fat diet, being physically active, maintaining healthy body weight, can result in reducing the cholesterol levels (CDC, 2011). In a family history of people with high cholesterol there are more chances of carrying it through genes as one grows older. A check-up of cholesterol level in every 5 years is highly recommended by health professionals as various studies have shown increased cholesterol level among college going students aged 18-26 years (Spencer, 2002).
b) **High Blood Pressure**

High blood pressure also called as hypertension or HTN is defined when the force of blood pushing against the walls of arteries is too high. It is measured as systolic (blood pressure when the heart beats while pumping blood) and diastolic pressure (blood pressure when the heart is at rest between beats), the normal range for BP is 120/80 mmHg and when this number exceeds a person is said to have HTN. It is defined as a major risk factor for CVD including MI and stroke. With ever 20 mmHg systolic or 10 mmHg diastolic augment in resting blood pressure there is a two-fold elevation in risk of death from ischemic heart disease or stroke. *(Maraj et al., 2013)* elucidate that HTN is associated with decrease in vascular fulfilment and endothelial injury. *(Kumar, 2014)* in a study conducted on 345 elderly hypertensive South Asian patients aged 56-64 years have shown that dietary vitamin intake was higher in hypertensive patients compared to normotensive controls. A significant difference was observed in anthropometric variables. A significant increase in cholesterol, low density lipoproteins-cholesterol (LDL-c), TG in hypertensive patients (P<0.001) was observed. A similar study setting on 86 elderly hypertensive patients aged 56-64 years for estimating ischemia modified albumin as prognostic marker of to avoid future coronary complications, showed extensively elevated ischemia modified albumin levels in hypertensive patients as contrast to normotensive controls (P<0.001) *(Kumar, 2014)*.

**Table 2.3: Normal Range values for Blood Pressure**

<table>
<thead>
<tr>
<th>Blood Pressure Category</th>
<th>Systolic</th>
<th>Diastolic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Normal</strong></td>
<td>less than 120</td>
<td>and less than 80</td>
</tr>
<tr>
<td><strong>Prehypertension</strong></td>
<td>120 – 139</td>
<td>or 80 – 89</td>
</tr>
<tr>
<td><strong>High Blood Pressure</strong> (Hypertension) Stage 1</td>
<td>140 – 159</td>
<td>or 90 – 99</td>
</tr>
<tr>
<td><strong>High Blood Pressure</strong> (Hypertension) Stage 2</td>
<td>160 or higher</td>
<td>or 100 or higher</td>
</tr>
<tr>
<td><strong>Hypertensive Crisis</strong> (Emergency care needed)</td>
<td>Higher than 180</td>
<td>or Higher than 110</td>
</tr>
</tbody>
</table>

*Source: National Heart, Lung and Blood Institute 2015*
c) **Physical inactivity**

People who lead a sedentary lifestyle are nearly twice as likely to develop a heart disease as compared to those who do. According to the (WHO, 2010) global recommended guidelines for physical activity a person must involve himself into 30 minutes of moderate activity on all days of the week as Physical inactivity is now identified as the fourth leading risk factor for global mortality. Physical inactivity levels are raising in many countries with major implications for the prevalence of non-communicable diseases (NCDs) and the general health of the population worldwide. (Yusuf *et al.*, 2010) in his INTERHEART study on 52 countries revealed that almost 12% of the global burden of MI is due to physical inactivity.

d) **Obesity and overweight**

Pertaining to the fact that how excess body fat especially at the waist is related to increased Heart disease risk and associated with high blood pressure, high cholesterol, or high blood sugar can make the condition shoddier. Gupta *et al.*, 2002 in its study on 1123 subjects in an urban population of Jaipur found that prevalence of obesity was 63%, a worrisome number also in a cohort study done in phases (1-6) by (Huffman *et al.*, 2011) in Delhi region among 1100 participants, In the latest phase (6th phase) it was found that incidence of obesity annually was 2.0% (95% confidence interval [CI]: 1.6% to 2.4%) for men and 2.2% (95% CI: 1.7% to 2.8%) for women. There was a significant increase in Mean BMI (25 to 27 kg/m²), waist circumference, hip circumference, and WHR (90 to 96 cm in men and from 80 to 87 cm in women) and the prevalence of overweight, obesity (9% to 21% in men and from 13% to 25% in women), and central obesity (2% to 71% in men and from 48% to 70% in women) through 5th and 6th phase. The measurement of obesity is done on the basis of BMI and WHR. WHO, 2016 defines Body Mass Index (BMI) as a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in metres (kg/m²).
Table 2.4: Body Mass Index Values

<table>
<thead>
<tr>
<th>Classification</th>
<th>BMI(kg/m²)</th>
<th>Principal cut-off points</th>
<th>Additional cut-off points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt;18.50</td>
<td>&lt;18.50</td>
<td></td>
</tr>
<tr>
<td>Severe thinness</td>
<td>&lt;16.00</td>
<td>&lt;16.00</td>
<td></td>
</tr>
<tr>
<td>Moderate thinness</td>
<td>16.00 - 16.99</td>
<td>16.00 - 16.99</td>
<td></td>
</tr>
<tr>
<td>Mild thinness</td>
<td>17.00 - 18.49</td>
<td>17.00 - 18.49</td>
<td></td>
</tr>
<tr>
<td>Overweight</td>
<td>≥25.00</td>
<td>≥25.00</td>
<td></td>
</tr>
<tr>
<td>Pre-obese</td>
<td>25.00 - 29.99</td>
<td>25.00 - 27.49</td>
<td>27.50 - 29.99</td>
</tr>
<tr>
<td>Obese</td>
<td>≥30.00</td>
<td>≥30.00</td>
<td></td>
</tr>
<tr>
<td>Obese class I</td>
<td>30.00 - 34.99</td>
<td>30.00 - 32.49</td>
<td>32.50 - 34.99</td>
</tr>
<tr>
<td>Obese class II</td>
<td>35.00 - 39.99</td>
<td>35.00 - 37.49</td>
<td>37.50 - 39.99</td>
</tr>
<tr>
<td>Obese class III</td>
<td>≥40.00</td>
<td>≥40.00</td>
<td></td>
</tr>
</tbody>
</table>


Table 2.5 Waist to Hip Ratio Values

<table>
<thead>
<tr>
<th>Gender</th>
<th>Low</th>
<th>High</th>
<th>Very High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Man</td>
<td>&lt;94 cm</td>
<td>94-102 cm</td>
<td>&gt;102 cm</td>
</tr>
<tr>
<td>Woman</td>
<td>&lt;80 cm</td>
<td>80-88 cm</td>
<td>&gt;88 cm</td>
</tr>
</tbody>
</table>

Source: Adapted from WHO, 2010

e) Tobacco/smoking:

Krishnan, 2012 states that in a country like India where tobacco companies have aggressively exploited the growth potential of tobacco sales in developing countries, these companies have denied the adverse effects of tobacco especially via passive smoking and referring tobacco as the only consumer product that ultimately kills half of its users. Also the production and prevalence of tobacco has increased considerably.
in contrast to the fact that almost 182 million smokers live in India which was very well supported in a study conducted by (Gupta et al., 2002) where the use of tobacco among 1123 subjects was found to be 23.9% and 42% in a sample of 7449 from rural urban and slum background double than the United States (Thankappan et al., 2013). It’s an alarming situation that how both of them are deteriorating the state of health of Individuals irrespective of the fact that Cigarette smoking is itself a powerful independent risk factor for sudden cardiac death in patients with coronary heart disease. Cigarette smoking along with other RFs elevates the risk of CVD. Exposure to other people's smoke increases the risk of heart disease even for non-smokers.

f) **Diabetes:**

*International diabetes federation, 2015* defines diabetes as a chronic disease that occurs when the pancreas is no longer able to make insulin, or when the body cannot make good use of the insulin it produces. Currently there is 1 adult out of every 11 suffering from diabetes, with 78.3 million cases of diabetes in South East Asia expected to rise to 140.2 million by 2040. There are three main types:

- **Type 1 diabetes:** produce very little or no insulin
- **Type 2 diabetes:** insulin resistance and relative insulin deficiency (body make insulin, but their cells don't use it as well as they should).
- **Gestational diabetes:** high blood glucose levels during pregnancy

**Table 2.6: Values for Blood Sugar Range**

<table>
<thead>
<tr>
<th>Blood sugar classification</th>
<th>Fasting</th>
<th>2 hours after eating</th>
<th>HbA1c Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Blood sugar</td>
<td>70-100 mg/dL</td>
<td>Less than 140 mg/dL</td>
<td>About 5</td>
</tr>
<tr>
<td>Pre Diabetes</td>
<td>100-125 mg/dL</td>
<td>140 to 200 mg/dL</td>
<td>5.7 to 6.4</td>
</tr>
<tr>
<td>Established Diabetes</td>
<td>Over 125 mg/dL</td>
<td>More than 200 mg/dL</td>
<td>6.5 or above</td>
</tr>
</tbody>
</table>

*Source: International Diabetes Federation, 2015*

Texas Heart Institute (2016) affirms that the chance of developing CVD is more among people suffering with adult-onset or Type 2 diabetes (also known as non-insulin-dependent diabetes). (Abate and Chandalia, 2007) states that the Excessive insulin resistance in migrant Asian Indians have contributed to the mechanism for the increasing prevalence of Type 2 diabetes in this population, along with the ongoing westernization and acculturation, both have an equal share in elevating the number of
diabetes patients in Asian Indians. (Kumar, 2014) defines DM as one of the main risk factors which has a quite distinct association with CHD, particularly its predominant form, type 2 diabetes mellitus. A higher risk of CHD has been documented among people with diabetes than non-diabetic, of which CVD accounts to 65-75% deaths in people with diabetes. The frequency of diabetes for all age-groups worldwide is approximated to be 2.8% in 2000 and 4.4% in 2030. The overall number of people with diabetes is anticipated to augment from 171 million in 2000 to 366 million in 2030. The commonness of diabetes is elevated in men than women, but there are more women with diabetes than men. The urban population in developing countries is projected to double between 2000 and 2030 (Wild et al., 2004)

3. Contributing Risk Factors:

The major contributing risk factors comprise of stress, alcohol consumption and diet & Nutrition (AHA, 2010). Various studies have reported significant relationship between stress and CVD in a person’s life which in return contribute to other RFs such as overreacting, alcohol consumption smoking etc. A prolonged and direct activation of the autonomic system affects CHD (Chandola et al., 2008). (Johansson et al., 2006) states that elevated hormones level like adrenaline hasten the development of atherosclerosis, also suggested by (Johnasson et al., 2006) that the pattern of blood clotting is changed due to exposure to stress hormones, making it more susceptible to MI, also stress is said to increase blood pressure another Risk factor for heart diseases which is often neglected by majority of people. Consuming Alcohol has been associated with the risk of atherosclerosis development involving inflammation and cholesterol oxidation (Pletcher et al., 2005). With the implication of all RFs such as obesity and overweight, high blood cholesterol and diabetes mellitus (AHA, 2010); Alcohol has shown to increase stress and chaotic flow of blood (Pletcher et al., 2005). Smoking may be less relevant in South Asian groups particularly among women’s, but ghee consumption is strikingly high which is undoubtedly atherogenic, need for encouraging saturated fat is appreciably needed to reduce the RFs of CVD (Chaturvedi, 2003)
2.2.2 Prevalence of Risk Factors of CVD

An optimal management of risk factors is must, thus it is very important that an individual must be able to identify their risk factors. Estimating the prevalence of risk factor is very important as CVD is a multi-factorial disease, with a wide variety of factors affecting the health of an individual and subsequently leading to CVD. Various Risk factors including modifiable and non-modifiable have shown to affect the condition of people through time. In a study done by (Ismail et al., 2015), it was found that smoking, the use of ghee in cooking, raised blood glucose and cholesterol, parental consanguinity, low level of income, and lack of education (p<.001 for each) and paternal history of cardiovascular disease, (p=.03) were all independent risk factors for acute myocardial infarction in young South Asian adults who were ≥45 years.

Prabhakaran et al. 2005 in a selected relatively young male population in an industrial setting from north India also revealed that there was a high prevalence of coronary risk factors. In a cross-sectional survey conducted on the employees in the age group of 20–59 years' age group in an organized sector industry, a total of 2935 employees (344 women and 2591 men) were signed up in the survey. Almost One-third of the participants had hypertension and 15% were suffering from diabetes; 36% were smokers. Even in the youngest between 20 and 29 years of age, only a handful had normal blood pressure, half had normal glucose tolerance, more than half had dyslipidemia and one-fifth had at least two coronary risk factors.

Yusuf et al. (2004) through the large multinational INTERHEART (study of risk factors for first myocardial infarction in 52 countries and over 27,000 subjects) case-control study concluded relating to 5 South Asian countries, including a large fraction from India, showed clearly that the 9 risk factors (relation of smoking, history of hypertension or diabetes, waist/hip ratio, dietary patterns, physical activity, consumption of alcohol, blood apolipoproteins (Apo), and psychosocial factors to myocardial infarction), which were recognized as being strongly linked with CHD across 52 countries, were also effective in South Asians. It was also evidently shown that why Indians experience their first heart attack at an earlier age than other populations.
Results have been obtained in the studies done by (Willet et al., 2016) confirming that higher percentage of Trans fatty acids are known to increase the risk of ischemic heart diseases. A high risk of heart attack was found to be associated with ghee consumption (adjusted relative risk 3.92, 95% CI 1.52 to 10.03), suggesting ghee consumption as potential target for preventive strategies. These results were very much supported by another study conducted by (Ahmad et al., 2013) on risk factors associated with MI, where deep fried food was considered as an important RF for developing Myocardial Infarction. Another study done by Guallar et al. (2012) concluded during a median follow-up of 11 years, 606 coronary heart disease events and 1135 deaths from all causes occurred. On comparing with the lowest quarter of fried food consumption the multivariate hazard ratio of coronary heart disease in the second quarter was 1.15 (95% confidence interval 0.91 to 1.45), in the third quarter was 1.07 (0.83 to 1.38), and in the fourth quarter was 1.08 (0.82 to 1.43; P for trend 0.74). The results did not differ amid those who consumed olive oil for frying and among those who used sunflower oil. Likewise, no alliance was seen between fried food consumption and all cause mortality: multivariate hazard ratio for the highest versus the lowest quarter of fried food consumption was 0.93 (95% confidence interval 0.77 to 1.14; P for trend 0.98) but Frying with other types of fats, reusing oils several times, or consuming fried snacks high in salt may still be harmful.

Bhadoria et al. (2014) conducted a community-based cross-sectional study in 48 villages and 15 urban wards of Jabalpur District of Central India among nine hundred and thirty-nine individuals aged 20 years and above (624 from rural areas and 315 from urban areas) to find the prevalence of hypertension and associated cardiovascular risk factors in the urban and rural populations concluded that the overall prevalence of hypertension was 17%, with 21.4% in the urban population and 14.8% in the rural population. Significantly higher mean values of weight, height, body mass index (BMI), hip circumference (HC), waist circumference (WC), waist hip ratio (WHR), systolic blood pressure (SBP), fasting blood sugar (FBS), and serum cholesterol levels were mapped in the urban population in comparison with the rural population. Multivariate logistic regression analysis identified increasing age, parental history of hypertension, tobacco smoking, tobacco chewing, physical inactivity, high estimated per capita salt consumption, and BMI \( \geq 27.5 \) kg/m\(^2\) as independent
predictors for hypertension in the urban population, while in the rural population, increasing age, physical inactivity, central obesity, tobacco chewing and tobacco smoking were independent predictors for hypertension.

A study done on Dietary fatty acids and the risk of hypertension in middle-aged and older women by (Wang et al., 2010) have reported that the process of oxidation during frying food increases the amount of trans-fatty acids in food and is positively associated with the risk of hypertension, a positive association between dietary intake of trans-fatty acids and the risk of hypertension (adjusted RR in the highest quintile: 1.08; 95% CI: 1.01–1.15) was seen.

Mittleman et al. (1997) in his study concluded that the risk of having a heart attack was relatively high with the participants who has less than high school education (relative risk, 3.3; 95% CI, 2.0-5.4) compared to patients with at least some college education (relative risk, 1.6; 95% confidence interval, 0.9-2.9) stating that socioeconomic factors tends to be a very important factor in determining as a potent modulator of triggering acute Myocardial Infarction. Quite similar results have been found in a study to determine whether disparity in CVD risk factors by ethnicity could be attributed to differences in SES by (Winkleby et al., 2016) stated that women of lower SES from each of the 3 ethnic groups had significantly higher prevalence of smoking and physical idleness and elevated levels of BMI and non–HDL-C than women of higher SES (P<.001).

In a Study on 214 people aged more that 18 years by (Mochari et al., 2007) it was established that more than half of the participants (59%) were unaware of CHD as the leading cause of death, 52% did not know the optimal level of blood pressure, while 60% did not know the optimal cholesterol level. Participants completing less than a high school level of education (OR, 2.0; 95% CI, 1.02–3.87) were linked with lack of knowledge of the optimal BP goal.

Harkins et al. (2010) also found that participants who has low level of knowledge regarding CVD were least interested in engaging themselves in activities involved in preventive activities related to CHD because they had a self-assurance of having a good health and probably did not need it and thus they do not embrace any lifestyle change until they are told they are at threat of developing CHD (Mochari et al., 2007).
In contrast however, several studies have found that the knowledge of CHD RFs is low even in the high-risk population (Murphy et al., 2005) and that CHD knowledge in obese individuals did not differ significantly from individuals’ with a normal weight (Andersson and Leppert, 2001).

In a study conducted by (Mansour et al., 2015) to assess the knowledge in the Taif region regarding Heart Attack it was found that the main risk factors responsible were hypertension (59%), diabetes (35.9%), consuming a highly deep fried food (76.9%), lack of regular exercise (89.7%) and nervous mode (79.5%), this study included participants above the age of 50 and mostly male participants who were at higher risk of developing heart attack in future and as their age was increasing the chances of developing CHD keeps on increasing, another interesting factor in this study was the percentage of people smoking (71.8%) as a very important risk factor which also been mentioned in a study conducted by Jahangir et al., (2012) that smokers have a higher risk of myocardial infarction than non-smokers (significant odds ratio 3.71).

Among men and women studies have been conducted to assess who are more prone to be affected by smoking, a study concluded by Prescott (2016) on 11472 women smokers and 13191 men smokers for a mean 12.3 years, Compared with non-smokers, female current smokers had a relative risk of myocardial infarction of 2.24 (range 1.85-2.71) and male smokers 1.43 (1.26-1.62); ratio 1.57 (1.25-1.97). The risk of heart attack increased with tobacco consumption in both sexes, buy was comparatively higher in inhalers than in non- inhalers. The prevalence of risk was consistently higher in women than men irrespective of their age. This sex difference was not affected by adjustment for arterial blood pressure, total and high density lipoprotein cholesterol concentrations, triglyceride concentrations, diabetes, body mass index, height, alcohol intake, physical activity, and level of education.

Heit et al. (2002) in a study setting conducted on 625 participants it was found that Fifty-nine percent of the cases of venous thromboembolism in the community could be credited to institutionalization (current or recent hospitalization or nursing home residence). Hospitalization for surgery (24%) and for medical illness (22%) accounted for a similar proportion of the cases, while nursing home residence accounted for 13%. The risk estimates for malignant neoplasm, trauma, congestive heart failure, central venous catheter or pacemaker placement, neurological disease with extremity
paresis, and superficial vein thrombosis were found to be 18%, 12%, 10%, 9%, 7%, and 5%, respectively. Together, the existing 8 risk factors accounted for 74% of disease occurrence.

In study conducted on a large demographic area by (Kinra et al., 2010) on 1983 (31% women) people aged 20–69 years (49% response rate) from 18 states of India to find out the risk factors associated with NCDs, it was found that along with age prevalence of RFs increases such as tobacco and alcohol use, low intake of fruit and vegetables, and underweight were more common in lower socioeconomic positions; whereas obesity, dyslipidaemia, and diabetes (men only) and hypertension (women only) were more prevalent in higher socioeconomic positions. Risk factors were generally more prevalent in south Indians compared with north Indians. For example, the prevalence of dyslipidaemia was 21% (17% to 33%) in north Indian men compared with 33% (29% to 38%) in south Indian men, while the prevalence of obesity was 13% (9% to 17%) in north Indian women compared with 24% (19% to 30%) in south Indian women.

In a study done by (Warren et al., 2010) to examine relationship between two sedentary behaviours (watching television and car driving) with CVD among 7,744 men aged 20-89 years in a 21 year follow-up, the results showed that after age-adjustment, time riding in a car and combined time spent in these two sedentary behaviours were positively ($p$ trend <.001) associated with CVD death. Men who reported >10 hrs/wk riding in a car or >23 hr/wk of combined sedentary behaviour had 82% and 64% greater risk of dying from CVD than those who reported <4 hr/wk or <11 hr/wk, respectively. Irrespective of the fact how much sedentary lifestyle they lived, men who were normal weight, physically active, normotensive were associated with reduced risk.

Mahmood et al. (2012) in a lucknow based study on 373 participants found that majority of individuals belonging to the age group of 20-40 years faced the risk factors of CVD such as low fruit intake (88.2%), low vegetable intake (99.1%), increased body mass index (15.9%), increased waist circumference (22.5%), and hypertension (20.9%).

Similar results have been found in a study performed by (Leon et al., 2014) sedentary Lifestyle and Its Relation to Cardiovascular Risk Factors, Insulin Resistance and
Inflammatory Profile, a study setting done on 929 volunteers, results showed that the most sedentary individuals had higher body mass index, greater waist circumference, and higher systolic blood pressure, with a significant upward trend in each tertile. Likewise, they had a worse lipid profile with a higher C-reactive protein level, homeostasis model assessment of insulin resistance index, triglyceride/high-density lipoprotein cholesterol ratio, and insulin concentration. In the multivariate analysis, a significant association was observed between the latter parameters and sitting time in hours (log C-reactive protein \(b = 0.07\), log homeostasis model assessment of insulin resistance index \(b = 0.05\), triglyceride/high-density lipoprotein cholesterol ratio, all of which are some of the highest determining RFs for CVD.

For a similar outlook on the above mentioned results studies done by (Chiuve et al., 2011) have reported that low-risk lifestyle factors (smoking, diet, exercise and weight) are associated with low risk of Sudden cardiac death. Compared to women with 0 low-risk factors, the multivariate relative risk of SCD was 0.54 (95% CI: 0.34, 0.86), 0.41 (95% CI: 0.25, 0.65), 0.33 (95% CI: 0.20, 0.54) and 0.08 (95% CI: 0.03, 0.23) for women with 1, 2, 3, and 4 low-risk factors, respectively. The proportion of SCD attributable to smoking, inactivity, overweight, and poor diet was 81% (95% CI: 52%, 93%). Proving it to be an effective strategy to prevent SCD and cope with CVD. A study done by (Patel et al., 2016) to compare the Coronary risk factors in people from the Indian subcontinent living in West London and their siblings in India it was found that increase in serum cholesterol after migration from India lead to increased coronary risk conferred by high serum lipoprotein concentrations and greater insulin resistance.

In a study done by (Chow et al., 2007) Cardiovascular disease and risk factors among 345 adults in rural India aged 20-90 years it was discovered that the possibility of increasing risk factors such as mean systolic blood pressure 116 (114–117) mm Hg, diastolic blood pressure 73 (114–120) mm Hg, total cholesterol 4.6 (4.5–4.7) mmol/L, HDL-cholesterol 0.8 (0.8–0.9) mmol/L, LDL-cholesterol 3.2 (3.1–3.3) mmol/L and triglyceride 1.3 (1.2–1.4) mmol/L, current smoking 19.9% (15.4–24.4%), hypertension 20.3% (16.2–24.4%), diabetes 3.7% (1.8–5.5%), overweight 16.9% (12.3–21.5%) and obesity 4.4% (1.9–6.8%). A medical diagnosis of cardiovascular disease (previous heart attack, stroke or angina) reported by 2.5% (1.1–3.9%) and a
further 1.1% (0.1–2.1%) had angina by the ‘Rose’ classification are related prevalence of CVD and is an important public health concern.

A study conducted by (Stampher et al., 2000) on 84,129 participants specifically women it was found that most of the low risk factors like non-smokers, low BMI, diet rich in fibre, Folate, PUFA, omega 3 fatty acids, regularly exercised had a relative risk of coronary events of 0.17 (95 percent confidence interval, 0.07 to 0.41) as compared with all the other women. Eighty-two percent of coronary events in the study cohort (95 percent confidence interval, 58 to 93 percent) could be credited to lack of devotion to this low-risk pattern.

Clark et al. (2014) in a study on adolescents (average age 28 years) to find out 30 years risk of “hard” and “general” CVD in relation to gender and race by using Framingham-derived risk perception it was concluded that Average 30-year risks for hard and general CVD were 10.4% (95% confidence interval (CI)=10.1%, 10.7%) and 17.3% (95% CI=17.0%, 17.7%) among men and 4.4% (95% CI=4.3%, 4.6%) and 9.2% (95% CI=8.9%, 9.5%) among women. The Average age-adjusted risks of hard and general CVD were higher among Blacks and American Indians than among Whites and lower among Asian/Pacific Islander women than White women. American Indian men continued to have a higher risk of general CVD after adjustment for socioeconomic status. Four percent of women (95% CI=3.6%, 5.0%) and 26.2% of men (95% CI=24.7%, 27.8%) had a 20% or higher risk of general CVD. Racial differences were detected but were not significant after adjustment for socioeconomic status.

Walker (1990) in his paper talked about the cerebrovascular diseases as ischemic in origin, associating them with atherosclerotic diseases and factors such as increasing age, both systolic and diastolic blood pressure, diabetes, and a history of ischemic heart disease or previous stroke are correlated with the ischemic events. Most of the studies have identified as hypertension as the main risk factor.

Harris et al. (2015) illustrates the risk factor of rheumatic heart disease as generally occurring among the children between 5 and 15 years old for the first time but the effects of rheumatic heart disease often first present in adulthood. Other environmental factors such as poor sanitation and crowded living conditions lead to the infection causing the rheumatic fever.
Mitwalli et al. (2013) conducted a survey on six hundred and seventy-two subjects, 66.6% females, and mean age 36.2 ± 13.9 years found that a total of 114/188 (60.6%) subjects had self-reported HTN while 74/188 (39.3%) subjects (i.e., 74 out of the total sample, which is 672 participants, it is 11%) were found to be hypertensive on blood pressure measuring by research investigators. Almost half of the total hypertensive subjects were diagnosed to be hypertensive within the last 5 years. 33/188 (17.5%) were diagnosed within the previous 10 years, while 22/188 (11.7%) had HTN for the past 15 years. 106/188 (54.2%) were asymptomatic at the time of diagnosis and they were diagnosed to be hypertensive on routine checkups, while 70/188 (37.2%) had symptoms. Of those who had symptoms 52.1% presented with headache, 42/188 (22.3%) had palpitation, 11/188 (5.8%) had angina; Family history of hypertension was present in 354/672 (52.6%) of total participants. As co-morbid factors; diabetes mellitus, obesity, and smoking were salient co-morbidities present in 23%, 19.4% and 8.3%, respectively. Stress at work and lack of exercise were the most prevalent risk factors accounting for (299/672) 44.4% of participants.

In a cross-sectional study of 19 750 randomly selected men and women aged 20–65 y from 3 Dutch municipalities with the objective to describe food consumption patterns in the general Dutch population and their association with cardiovascular risk factors by (Van et al., 2003), it was found that three food consumption patterns were identified: the “cosmopolitan” pattern (greater intakes of fried vegetables, salad, rice, chicken, fish, and wine), the “traditional” pattern (greater intakes of red meat and potatoes and lesser intakes of low-fat dairy and fruit), and the “refined-foods” pattern (greater intakes of French fries, high-sugar beverages, and white bread and lesser intakes of whole-grain bread and boiled vegetables). Higher scores for the traditional pattern were associated with older age, and higher scores for the refined-foods pattern were associated with younger age, but both were associated with lower educational level, cigarette smoking, less physical activity, and higher body mass index. Independent of other lifestyle factors and body mass index, the cosmopolitan-pattern score was significantly associated with lower blood pressure and higher HDL-cholesterol concentrations, and the traditional-pattern score was associated with higher blood pressure and higher concentrations of HDL cholesterol, total cholesterol, and glucose. The refined-foods-pattern score was associated with higher total cholesterol concentrations and lower intakes of micronutrients.
2.2.3 Scales related to Measure CVD

Coronary Risk, Individual Perception (CRIP) scale. The CRIP scale (16 items) focuses on four areas of risk perception: worry (I worry that I might die of a heart attack [4 items]), perceived health status (I’m as healthy as anybody I know [4 items]), self-efficacy (I think my personal efforts will help control my risk of having a heart attack [3 items]), and perceived susceptibility/vulnerability (I’m at lower risk of a heart attack [5 items]). Respondents indicate their level of agreement (1 = strongly disagree to 6 = strongly agree) to 16 statements about CHD risk perception. Cronbach’s α for CRIP is 0.76 (Barnhart et al., 2009).

Azhar et al. (2014) administered a modified Risk and Health Behaviour Questionnaire among 30 respondents aged between 30-70 years. The domains for the risk perception included: a) absolute risk perception for self and peers, b) relative vulnerability, c) perceived severity (general severity assessment, individual severity and perceived threat to one’s own health) and d) perceived control. The mean of cardiovascular risk perception score was found to be 110±34. The Cronbach’s alpha was 0.972, thus indicating excellent reliability.

The Perception of Risk of Heart Disease Scale is basically a 20-item instrument that measure an individual’s insight of developing a heart disease in the future (Ammouri and Neuberger, 2008). This scale hardly takes 20 minutes as it is a self reported scale tested on 295 individuals for internal consistency, test–retest reliability, and construct validity. The items on the scale have a 4 point Likert Scale response that ranges from strongly agree (1) to stringy disagree (4). The perception is calculated by summing up the scores, the higher the score the higher the perception of risk as Dread risk, Risk and Unknown risk having an internal consistency values ranging from .68 to .80. The total scale alpha was .80. Evidence of the instrument's stability over time was supported by subscale test–retest reliabilities ranging from .61 to .76.

Hagenhoff et al. (1994) constructed an inventory consisting 44 questions divided into two sections: the first section focuses on how important information is to know, and the second section focuses on how realistic the information is to learn while hospitalized. Each section includes individual topics grouped into seven categories including: anatomy and physiology, psychological factors, risk factors, medication information, diet information, activity information, and other pertinent information.
Participants rated each topic in each section using a 5-point Likert scale with 0 = not important or not realistic, 1 = somewhat important or somewhat realistic, 2 = important or realistic, 3 = moderately important or moderately realistic, and 4 = very important or very realistic.

**Bergman et al. (2011)** developed a 30-item scale called as Comprehensive Heart Disease Knowledge Questionnaire on the basis of existing literature, in which a questionnaire was constructed basically addressing 5 central domains of heart disease knowledge. In Phase I, 606 undergraduates completed a 82-item questionnaire. In Phase II, 248 undergraduates completed a revised 74-item questionnaire, followed by item clarity and difficulty along with overall factor structure of the questionnaire. Exploratory and confirmatory factor analyses were used to reduce the scale to 30 items with fit statistics, CFI = .82, TLI = .88, and RMSEA = .03. Scores were correlated moderately positively with an existing scale and weakly positively with a measure of health literacy, thereby establishing both convergent and divergent validity.

**Thanavaro et al. (2010)** based on previous surveys conducted on women’s CHD knowledge constructed a 25 multiple choice tool, which was validated by an expert panel for its content. Pilot tested among women’s without CHD in a chest pain centre, which was further directed among laywomen and female cardiovascular nurses to evaluate its validity and reliability consisting of 49 women as the control group (Group 1), 23 cardiovascular nurses as a known group (Group 2), and 22 women with an educational program as the treatment group (Group 3). Knowledge of women in Group 1 was compared with Groups 2 and 3 in known group and predictive validity tests.

**National heart, lung and blood institute (2007)** states the Framingham risk scoring as the determinant of 10-year (short term) risk for developing CHD. The risk factors that are included in the Framingham calculation are age, total cholesterol, HDL cholesterol, systolic blood pressure, treatment for hypertension, and cigarette smoking. The Framingham estimates are more robust for total cholesterol than for LDL because of the presence of a larger database. Though, the main target for therapy is the LDL. The Framingham risk score gives estimates for “hard CHD” which includes myocardial infarction and coronary death.
These categories are based on guidelines established by the National Cholesterol Education Program.

**Highest risk:** A greater than 20% risk that you will develop a heart attack or die from coronary disease in the next 10 years. This risk can be reduced by addressing and managing your risk factors with the help of your doctor.

**Intermediate risk:** there are 10-20% chances of developing a heart attack or dying from CHD in the coming 10 years, this risk is reduced by addressing and managing the lifestyle.

**Low risk:** < 10% risk of developing a heart attack or CHD in the coming 10 years. A Continued management of risk factors is needed to maintain that low profile of risk.

The presence of any cardiovascular disease risk factor, including a family history of cardiovascular disease, requires apposite attention because a single risk factor may mean that an individual has a high risk for developing cardiovascular disease in the long run, even if the 10-year risk does not appear to be high.

**The Heart Disease Fact Questionnaire (HDFQ)** is an instrument consisting of 25 item that specially targets the knowledge of major risk factors for the development of CVD (Wagner et al., 2006; Wagner et al., 2005). The response for each item is ascertained as true, false, or I don’t know. Total scale scores are calculated by summing the total number of correct answers and can range from 0–25. Higher scores indicate a higher level of knowledge. Good internal consistency (Kuder-Richardson r = .77) was demonstrated in a group of 524 ethnically diverse adults with diabetes. Test-retest reliability was .89.

### 2.2.4 Perception of Risks

Risk perception most commonly stated as a judgement that a person makes about the characteristics and severity of risk, mostly explained in terms of health (Tod et al., 2001) explains risk perception a very important predictor that ascertains a person’s commitment towards healthy lifestyle.

**Norman et al. (2014)** in a cross sectional community based study done in 47 villages for a period of 3 years on 3780 adults to assume the 10 years risk of fatal and non-fatal CVD events, it was found that an alarming 15.2% of the population had a high risk (>30%) of getting fatal or non-fatal MI or stroke in 10 years. Older age, lack of education, physical inactivity and family history of MI/ stroke were associated with high risk for CVD.
In a study done by (Lisk and Garu, 2016) to assess the perception of women living with coronary heart disease it was found that most of the participants failed to recognize the significance of risk factors and symptoms, they even refuted the existence of any disease following diagnosis and treatment. Consequences of illness centred on women's efforts to maintain control over their health and their lives. Findings also designate that there is a gap between the craving for knowledge and the aptitude to access and absorb information in key areas concerning CHD and personal health behaviours

Zerwic et al. (2015) in their study conducted on 105 patients, it was reported that 79% could identify at least one risk factor while only 7% recognised all 3 (smoking, hypertension, elevated cholesterol). 64% recognised smoking as a cause of CAD, 15% recognised hypertension as cause while 55% supposed ACD was a chronic disease. The remaining 13% subjects were not sure or believed the situation to be short term (28%). Though the knowledge regarding CAD was present yet they were largely ignorant of their personal risk perception and to some degree of the itinerary of the disease.

Cioe et al. (2014) in a study to assess CVD risk factors and risk perceptions among HIV-infected adults stated that knowledge regarding RFs of CVD was not predictive of perceived risk of CVD $F[1,117] = 0.13, \ p > .05$., the perceived risk was weakly associated with estimated risk but significantly correlated $r(126) = .24, \ p = .01$. (Armitage and Conner, 2000) states that behavioural change is implemented through knowledge and perceived risk that has been stressed through various behaviour motivation theories.

Barnhart et al. (2009) conducted a study to evaluate the perception of an individual’s risk for CVD in contrast to their actual risk for CVD, and subsequent health behaviours. The survey was carried out on 250 people with no less than one CVD RF. The perceived risk was calculated using the Coronary Risk, Individual Perception (CRIP) scale, and summarized scores from self-reported diet and exercise behaviours. A lot of respondents who perceived of being at a low risk were in fact high risk for CVD (more than three risk factors). Thus it gets important to concentrate on an individual’s perception of risk while going through preventive measures.
Homko et al. (2008) in its study on 465 subjects concluded that mean (SD) CVD knowledge score was 63.7% (14.6%), and mean (SD) level of risk perception was 0.35 (1.4). Mostly both the sexes had similar Framingham score but women perceived their risk considerably higher than men also women had better knowledge about CVD. Urban participants had significantly higher actual risks than did their rural counterparts (18.2% [10.7%] vs 16.0% [8.9%], respectively; P = .01) but were significantly less knowledgeable about heart disease and also perceived their risk to be lower. The perception of risk among men was found notably low along with their knowledge levels.

Oli et al. (2014) in its study in a Nepalese community on 13 participants conducted an in depth interview to acquire people’s perception towards risk factors of CVD it was found that perceived dietary factors, particularly consumption of salty, fatty, and oily food, as the main determinants of CVD, respondents commonly linked smoking, alcohol intake, and high blood pressure with cardiac ailments but accounted a mixed opinion regarding the causal role of body weight and physical inactivity.

Another study conducted by (Oertelt et al., 2015) among 1,066 women in the age group of 25-74 years, out of the participants 41.35% could correctly classify their own CVD risk, while 48.65% underestimated it, and age resulted as the most significant predictor for this subjective underestimation (OR=3.5 for age >50 years compared to <50, 95% CI=2.6–4.8, P <0.0001). Even though the socioeconomic factors such as joblessness (OR=1.9, 95% CI=1.4–2.6, P <0.0001) and a set of other social risk factors (low income, limited education, simple job, living alone, having children, statutory health coverage only; OR=1.5, 95% CI=1.1–2.1, P=0.009) also significantly influenced self-awareness, age appeared as the strongest predictor of risk underestimation and at the same time the least perceived cardiovascular risk factor.

Lefler et al. (2009) perceived the risk of 96 women in which a mean perceived risk score was found to be 53.94 ( + 27.64) measured on the VAS scale from 0-100 mm. The perceived risk scores varied greatly from 2 to 97. Forty-one percent (41.4%) of the women thought their risk to be below the 50 mm mark on the VAS or below the median; 34% thought they were at some risk (51-79mm), and 25% believed their risk to be in high-risk range (80-100mm). Racial differences in perceptions of personal risk for MI were not statistically significant: the Black women had a mean perceived
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risk score of 50.3 mm, compared to the White women’s mean of 57.6 ($t = -1.29; p = 0.20$).

Winham and johns (2011) found after conducting a study on 172 African American man and women aged 18-26 years of age to assess the perceived susceptibility and risk related to lifestyle risk factors related to CVD, it was found that almost 17% of the participants strongly agreed that they were at low risk for a heart attack or stroke for their age, whilst the other 43.6% agreed somewhat while the rest 39.5% either disagreed somewhat or disagreed strongly indicating they felt they were at risk.

Andsoy et al. (2015) in a study setting of 300 people in a population in Turkey towards risks of cardiovascular disease from June- August 2012 above the age group of 18 years found that 35% did not find themselves at risk, 41% stated they were usual and there is no such thing as risk while 5.3% found themselves at strong risk.

2.3 Knowledge, Attitude, and Practices related to CVD

2.3.1 Knowledge Related to CVD:

Before reviewing the literature on the knowledge related to CVD it gets very important to understand what does CVD knowledge means, by going through various array of literature one can say that the below-given definition best suits the concept of CVD knowledge;

“CVD Knowledge has been defined as an in-depth understanding, perception of conception of the general pathophysiology, RFs, symptoms, prevention and treatments associated with CVD” (Byrne et al., 2005; Kayaniyil, et al., 2009; Mosca, et al., 2000; Crouch et al. 2010).

In a study done by (Jafray et al., 2005) it was concluded that even in a wide demographic area, a study done on 792 individuals there was a lack of evident knowledge about CHD, in which the participants scored a median knowledge score of 3 out of possible score of maximum 15, he even stated that only 14% could describe what CHD meant, 20% could not even identify a single RF and very few could clearly identify symptoms of angina (chest pain 36% and dyspnoea 24%).

Another Study done on a comparatively large demographic area by (Sanderson et al., 2009) on 1,747 adults in UK, a small proportion (9%) could not recognize any RFs
for CHD. He even concluded that even though people could identify RFs such as unhealthy diet and physical inactivity yet they could not recognize how important smoking cessation can be for their health.

A study done in Scotland by (Marshall, Bower & Schroder et al. 2007) reported that among 188 female respondents were significantly unaware (p<0.01) of the daily salt intake.

Mochari et al., (2007) in his study stated that the participants documented to have a high BP during screening (34%) were never made aware by their health professional of their condition, similarly in the case of high cholesterol level 48% reported of not knowing that they had dyslipidemia, Ironically 24% people suffered from both the conditions. Younger adults were more susceptible of not knowing their condition rather than patients 55 years or older (OR, 8.5; 95% CI, 2.6–28.1).

A very strong evidence appears to be associated between CHD knowledge with educational level of an individual (Andersson & Lepp, 2001) as (Dallongeville et al., 2001) found that nutritional knowledge was significantly related to the level of education (p<0.02).

Also educational level was quite a sturdy predictor of the number of RFs an individual could identify for CHD, in which the educated group could identify more (2.1) than those with comparable less qualifications (1.6) (Sanderson et al., 2009).

In contrast to the knowledge of general patients, a study done on physicians to assess their knowledge regarding secondary prevention by (Mathias et al., 2014) it was found that the knowledge regarding diet was inadequate, exercise and lipids were adequate but not good, but the knowledge on smoking cessation was far higher than other CVD RFs, thus it becomes more important for the common public to identify their RFs and practice themselves to control them.

In a study conducted by (Ahmad et al., 2013) to assess the knowledge in the Taif region regarding Heart Attack it was found that the mean knowledge score of patients recruited in this study was either low (51%) or medium score (29%), and little percentage was either high (14%) or very high (6%) knowledge score, the participants recruited in this study belonged to the age group of above 50.

Awad and Nafisi (2014) in its study on 900 randomly selected Kuwaitis found that the knowledge of the respondents about the types of CVD, heart attack or stroke was
comparatively low. Near about, 60% of the participants had no idea about any type of CVD and among it only CHD was the most identified type (29.0%). Almost two-fifth of the respondents were not aware of any symptom related to heart attack out of which he common identified symptoms were chest pain (50.4%) and shortness of breath (48.0%). Approximately half of respondents were not able to recognize any stroke symptoms, and the most commonly recognized were ‘confusion or trouble speaking’ (36.4%) and ‘numbness or weakness’ (34.7%). The respondents had a moderate level of knowledge regarding CD risk factors. The commonest factors identified by over four-fifths of participants were smoking, obesity, unhealthy diet and physical inactivity. In the multivariate logistic regression analysis, independent predictors of better level of CVD knowledge were females, age 50–59 years, high level of education, regular eating of healthy diet, and had a family history of CVD. Most of respondents only identified the role that pharmacists had to play is to help patients manage their medications, with a minimal role in other aspects of CVD prevention and management.

**Oguoma et al. (2014)** carried out a survey on 74 volunteer participants aged 18-60 years including both male and female in a Nigerian based community to assess the knowledge regarding CVD 41.9% confirmed having a disease condition while 9.5% and 1.4% affirmed suffering from high blood pressure and diabetes respectively. A total of 65% accepted of having the knowledge of ill-health but with KAP gap whereas 16 (47%) participants were unaware of the risk of impaired glucose tolerance progressing to type 2 diabetes mellitus, and 21 (62%) were unaware of the increased risk of CVD.

**Winham and johns (2011)** found after conducting a study on 172 African American man and women aged 18-26 years of age to assess the knowledge related to lifestyle risk factors related to CVD, on asking an open ended question about the leading cause of death 27% of the respondents stated obesity, followed by heart disease (16%), poor diet/unhealthy lifestyle (16%), HIV/AIDS (13%), cancer (11%), diabetes (6%), and other causes (11%). Upon given a closed-ended question for the same answer heart disease was then reported most often (34%), followed by cancer (21%) and HIV/AIDS (12%). Awareness of heart disease as the leading cause of death was significantly higher among college educated ($p = 0.003$) and older respondents ($p =$
0.012). Most participants felt they were moderately well informed about heart disease among African Americans (51%). Slightly less (47%) felt they were well informed about stroke among African Americans. At the same time, 24% stated they were not at all informed about heart disease, and 33% said the same for stroke. The most less known signs and symptoms were nausea (30%), fatigue (50%), sudden severe headache (53%) whereas chest pain (97%), tightness in chest (97%), weakness on one side (85%) was quite commonly known by majority of people.

Pandey and Khadka, (2012) conducted a study among 405 Nepali respondents with a purpose to identify the knowledge on heart disease and its prevention among the adults population residing in Dadhikot VDC of Bhaktapur district by interviewing house to house survey, it was concluded that less than half of the respondents (46.9%) stated age as non-modifiable risk factor for heart disease pursued by hereditary (39.8%) and sex (13.8%). Concerning modifiable risk factors, the most quoted response was the consumption of fatty food (72.6%) followed by smoking (70.4%), stress (63.7%), physical inactivity (61.7%), hypertension (59%), obesity (58.8%), high cholesterol diet (36.5%) and diabetes (30.1%). Majority of the respondents (57.8%) were acquainted with dyspnoea during exertion as symptom of heart disease followed by chest pain (24%). Most of the respondents (80.7%) cited declining fatty diet as anticipatory measure of heart disease following daily exercise (75.6%), eating vegetables and fruits (71.6%), keeping blood pressure under control (59%) and keeping diabetes under control (33.8%) respectively. Knowledge was notably allied with age, gender, education level and family history of heart disease.

2.3.2 Attitude related to CVD

Oguoma et al. (2014) carried out a survey on 74 volunteer participants aged 18-60 years including both male and female in a Nigerian based community to assess the attitude regarding CVD, it was concluded that only 20% indicated that their health condition is not good while only 39.2% could remember having attended a health clinic mostly stating the reason as “There is no ill-health”, “I hardly fall sick”, “I am healthy”, “My health is good”, “It's expensive”, “No money to attend regular check-up”, “Due to financial problem”. Around 28.4% people accepted of visiting the clinic regularly, whereas 10.4% gave no reason for not visiting the doctor, viewed as nonchalant attitude towards health.16.7% quoted the statement as not falling ill or being healthy is a good enough reason to not go to doctor.
Bollu et al., 2015 examined the practice habits of 50 hypertensive patients above the age group of 20 years and concluded that 68% believe that exercise can be beneficial in reducing hypertension, 72% patients can tell that salt intake can be reduced to prevent hypertension. 42% think that regular checking of BP is important

Andsoy et al. (2015) in a study setting of 300 people in a population in Turkey towards risks of cardiovascular disease from June- August 2012 above the age group of 18 years found that the participants gained knowledge regarding CVD through various sources, 30% gathered the information from the doctor, 13.3% from radio/television/ 9.7% from friends/family members and 3.3% from nurses.

In a study done by (Temu et al., 2015) on 300 participants with a mean age being 40 and 64% women it was found that only one third of the participants agreed with the statement “I am at high risk for heart disease”. Women belonging to older age were likely to agree with the statement (P=0.04) than men. Less than half of the participants agreed that CHD is preventable and that changing lifestyle behaviour would reduce their chances of developing CHD. No association was found between risk status and self perceived risk to CHD (P=0.1937). Most (53 %) noted stress, AIDS (17 %) and depression (14 %). Heart diseases were noted by 1 % of the participants, all male (P=0.03). When asked to list the leading cause of death in PLWH, opportunistic infections such as tuberculosis were noted by 94 % of participants.

Mazloomy et al. (2014) in its study on 200 women ages 15-49 years to assess their attitude towards CVD risk factors found that more than 76% of the participants knew that CVD is preventable. Ninety-one percent liked exercising and believed that exercising would make them feel better. The average mean scores for attitudes of participants toward CVD were 30.31 ± 3.21 out of 36

Amarasekara et al. (2016) conducted a study on 423 participants aged 35-55 years attending medical clinics in Sri Lanka to assess their attitude towards CVD, they found that mean attitude was high among respondents, one third population thought that reducing weight was difficult but 91.7% believed the importance of reducing fats and oil consumption. 20% of the respondents were not willing to reduce their salt and sugar intake giving alteration of taste a major reason, 25% did not want to change their lifestyle irrespective of the known risk factors.
Ibrahim et al. (2015) in a cross-sectional descriptive and analytical study to assess the attitude regarding risk factors of CVD among students aged >18 years found that the total score of attitude was $57.12 \pm 5.73$ with a median of 57 ranging between 26 and 70. “I know smoking is bad for health” (93.7%, 149) and “I should be doing exercise to maintain a healthy lifestyle” (87.4%, 139) were the highest marked answer for positive attitude, while “Sometimes I eat supper late at night before sleep” (8.2%, 13), “I prefer to play with my laptop instead of doing exercise” (6.9%, 11) and also “I choose to eat or buy fast food when going out with friends” (6.3%, 10), were among the lowest.

McDermott et al. (2003) assessed the attitude among patients with peripheral arterial disease (PAD), patients with coronary artery disease (CAD), and patients without atherosclerosis (no disease) related to CVD risk factors and concluded that majority of the respondents belonging to CAD reported risks of myocardial infarction, stroke, and death were higher for than for a patient with PAD. The PAD respondents did not associate the PAD is extremely associated with high risk of stroke (13.3% vs 28.7%; $P = .005$) or mortality (10.9% vs 26.6%; $P = .003$). Compared to CAD very few people of PAD reported that cholesterol lowering was very important in PAD (57.5% vs 75.8%; $P = .005$).

2.3.3 Practices related to CVD

Oguoma et al. (2014) carried out a survey on 74 volunteer participants aged 18-60 years including both male and female in a Nigerian based community to assess the practice related to CVD it was found that 64.9% did not indulge in any exercising, while only 1.4% do it for less than 3 hrs / week, whereas a total of 83.5% had not checked their blood pressure in the last 18 months.

Mitwalli et al. (2013) conducted a survey on Six hundred and seventy-two subjects, 66.6% females, and mean age 36.2 + 13.9 years found that 22.3% patients were irregular for their follow-up. 12.2% patients were not adherent to the treatment. Isolated systolic hypertension was more common in men. A point of serious concern was that relatively young health professionals, who were not known to be hypertensive, did not monitor their BP, found to have HTN. 23/188 (12.2%) patients were non-adherent to their medication and they were not regularly taking medicine regularly; 3/188 (1.59%) patients stopped their medication with the commonest reason that they believe that they have improved and their BP has become normal.
Younger participants with age <30 years were less aware of their blood pressure and were diagnosed on surveillance by junior doctors

Andsoy et al. (2015) in a study setting of 300 people in a population in Turkey towards risks of cardiovascular disease from June- August 2012 above the age group of 18 years found that 86.3% were non-alcoholic, 61% were non-smokers, 38% of the respondents did no regular exercising while 15.7% had an exercise level three times per week, more than half of the participants consumed a high protein and fat diet with low in fibre. Majority of the participants were underweight and 15% of them were obese and demonstrated different behaviours according to their exercising and eating characteristics. Additionally one third of the participants have never had their blood glucose tested and two third have never had their blood cholesterol level tested.

Winham and johns (2011) found after conducting a study on 172 African American man and women aged 18- 26 years of age to assess the practices related to lifestyle risk factors related to CVD that more men (48.4%) than women (18.2%) reported exercising four or more times per week, more women (30.9%) were involved in cholesterol screening in the last 18 months than men (16.1%) and respondents (20.9%) who had college education reported their physicians and discussed regarding heart diseases. 70.9% respondents never smoked.

Parmar et al. (2014) administered the practice of 500 respondents above the age of 20 years from Gandhinagar and found that only 20.6% people had their BP regularly checked and only 17% could correctly answer 50% of the practice questions.

Bollu et al. (2015) examined the practice habits of 50 hypertensive patients above the age group of 20 years and concluded that 48% people are regularly visiting the physician, 32% support the fact that only medication is important for treating HTN, 58% were involved in regular exercising and 24% explained that they are following a controlled and planned diet.

Amarasekara et al. (2016) conducted a study on 423 participants aged 35-55 years attending medical clinics in Sri Lanka to assess their practices towards CVD, it was concluded that 78% had a moderate mean score, among the respondents only one third consumed 2 portions of vegetables per day, and general portion size reduction was practiced irregularly by 52% of participants during the past 6 months. Frequent 30 minutes of exercise was never endeavoured by two-thirds (63%), whereas 13.7%
had started but given up exercises. Almost 91% shared family meals, whereas 4% had specially prepared meals, and almost half were not careful of foods eaten outside the home.

Ibrahim et al. (2015) in a cross-sectional descriptive and analytical study to assess the practices regarding risk factors of CVD among students aged >18 years found that practice on healthy lifestyles was not very good. Only 3.1% (5) avoided fast food and 13.8% (11) always spend their leisure time to exercise. Though, there were 51.6% (82) of the respondents who agreed that they walked for 10 minutes to places like cafe, mosque and between two classes. Moreover, 47.2% (75) admitted to always taking vegetables in their diet. The mean total scores for practice were 26.7±3.51 with a median of 27 and ranging from 16 to 37.

Muhammad et al. (2012) conducted a study on 448 women aged between 25 to 65 years in Malaysia and found that of all 3.1% were smokers and 41.1% suffered from a medical illness. The most common of it was (23.6%), almost 87% recognised smoking a risk factor. However, very few knew about menopause being a risk factor. A Population of less than 20% knew cholesterol as a risk, whereas only 13% agreed to exercise on a daily basis. The mean (SD) for knowledge and practice score were 70.6(13.76) and 63.7(13.59) accordingly. The median (IQR) for attitude score was 88.2 (14.71). Thus the good knowledge, attitude and practice score were 55.6%, 55.1 % and 51.1% respectively.

Phase II- Interventional studies Related to KAP among CVD

Mohammadifard et al. (2002) administered a Isfahan Healthy Heart Programme (IHHP), a five to six year integrated community based programme aimed for reducing CVD associated risk factors and improving cardiovascular healthy behaviour in a target population started late in 1999 and continued till 2005-2006 among 12,600 individuals ((6300 in interventional counties Isfahan and Najaf-Abad)) and 6300 in the reference county (Arak))above the age of 19 years, data collected through a 30 minute interview comprising questions on demography, socioeconomic status, smoking behaviour, physical activity, nutritional habits and other behaviour regarding CVD. Blood pressure and body mass index (BMI), fasting blood, Lipid profile, twelve-lead electrocardiogram (>35 years), Community-wide surveillance of deaths, hospital discharges, myocardial infarction and stroke registry were recorded. Four to
five year of intervention through various modes like mass media, community partnerships, health system involvement and policy and legislation with the objective of improvement of health behaviour, reducing blood cholesterol level by 5 mg/dl, blood pressure by 2 mm Hg and cigarette smoking by 3% in the population and increasing population physical activity levels by 50 Kcal/day, thus reducing CVD mortality by 15%.

William et al. (2007) conduct a trial including 100 adult patients (age 18 and above) irrespective of the sex constituting of the population that reported at the Emergency Department at an inner city tertiary care level I trauma centre hospitals from January 2002-may 2004 with objecting of intervening the group for knowledge of cardiac risk factors through and American Heart Association Educational Video which mostly emphasized on improving the people perception towards risk of cardiac problems and associated risk factors.

Eastwood et al., 2013 in a study setting constituting of Hindu and Bangladeshi people aged 30-67 years old both male and female in London organized a heath check with the motive of intervening people through 40 minute appointment including anthropometrics, blood pressure, point-of-care cholesterol and glucose testing and lifestyle assessment, followed by tailored advice on lifestyle improvement. The content of the topic guide included prior knowledge of CVD risk factors, barriers and facilitators to lifestyle modification, why and how to involve in health checkups, impact of the check on participants.

Jafar et al. (2015) did a trial follow up on 1341 individuals 40 years or older with hypertension (systolic BP 140 mm Hg or greater, diastolic BP 90 mm Hg or greater, or already receiving treatment). It included a 2 x 2 factorial, cluster randomized controlled trial, the combined home health education (HHE) and trained general practitioner (GP) intervention delivered over 2 years, an additional 7 years follow-up inclusive of 5 years of post intervention period of COBRA trial participants to assess the effectiveness of the interventions on BP during extended follow-up,

Miyazaki et al. (2015) conducted a pedometer-based walking programme for assessing the relationship between the number of daily steps and change in CVD RFs for one year among 36physically active older people (68.3 ± 5.8 years). The mean number of steps were increased by week 21 and maintained at week 59 (10 000 steps, increase in 1500 steps from the baseline; $P < .05$) measuring the CVD risk parameters
at baseline and at weeks 21 and 59. A minor but sustained physical activity could achieve further protecting against CVD was conclude in this intervention.

Phase III- Post- Intervention

2.5 Personal Attributes vs. CVD

Sarrafzadegan et al. (2009) in their five to six years integrated community based intervention on 12,600 individuals above 19 years of age through various modes like mass media, community partnerships, health system involvement and policy and legislation found a change from baseline in mean dietary score differed considerably between the intervention and control areas (+2.1 points versus -1.2 points, respectively; \( P < 0.01 \)), as did the change in the percentage of individuals following a healthy diet (+14.9% versus -2.0%, respectively; \( P < 0.001 \)). Daily smoking had declined by 0.9% in the intervention areas and by 2.6% in the control area at the end of the third year, but the dissimilarity was not significant. Investigation by gender revealed a noteworthy decreasing trend in smoking among men (\( P < 0.05 \)) but not among women. Energy expenses for total daily physical activities showed a decreasing trend in all areas, but the mean drop from baseline was significantly smaller in the intervention areas than in the control area (-68 metabolic equivalent task (MET) minutes per week versus -114 MET minutes per week, respectively; \( P < 0.05 \)). Leisure time devoted to physical activities showed an increasing trend in all areas.

Rani et al. (2013) educated a group of 181 students in two private schools of Chennai with the objective of improving their lifestyle under a Nutrition Education Programme and concluded that following the programme the students gained a satisfactory dietary knowledge, an improvement was observed from 37% to 67% (\( p<0.001 \)). A positive attitude was seen among students towards healthy diet which subsequently increased from 18% to 40% (\( p<0.001 \)). The proportion of students taking soft drinks reduced from 20% to 10% (\( p<0.01 \)) and ingestion of fast food items through fast food restaurants reduced significantly.

2.6 Risk Factors of CVD

A health check organised by (Eastwood et al., 2013) in a study setting constituting of Hindu and Bangladeshi people consisting of a 40 minute appointment including anthropometrics, blood pressure, point-of-care cholesterol and glucose testing and
lifestyle assessment, followed by tailored advice on lifestyle improvement unanimously reported a positive experience and lifestyle change, especially the small changes were focused in their lifestyle, most commonly exercising, diet modification (using less oil), trying to quit smoking and losing weight. This check-up facilitated them towards changes which were more sustainable, as learning about their own risk prior would help them better in identifying and tackling their needs towards better health.

Ramanath et al. (2012) in a prospective, randomized and interventional study on 52 hypertension patients for enhancing the QOL through patient counselling, patient information leaflets (PILS), and frequent telephonic reminding by using Morisky Medication Adherence Scale (MMAS) and Medication Adherence Report Scale (MARS) Questionnaires and SF-12v2 Quality of life Questionnaire found that systolic blood pressure P value in the second follow-up was 0.086+ when compared to baseline follow-up P value 0.094, diastolic blood pressure reading of the intervention group at the second follow-up was 77.73 ± 3.63 in mmHg when compared to the baseline, i.e. 86.62 ± 11.35 in mmHg. The QOL score P values of physical component scale and mental component scale showed highly significant and there was a definite impact of clinical pharmacist provided patient counselling medication adherence and QOL.

Khosravi et al. (2010) in their five to six years integrated community based intervention on 12,600 individuals above 19 years of age through various modes like mass media, community partnerships, health system involvement and policy and legislation saw there was a non-significant decrease in prevalence of HTN from 20.5%to 19.6%, in the interventional area whereas in the reference area, it increased from 17.4% to 19.6% (P = 0.003). The associated treatment, awareness and control rates towards HTN showed a better improvement in urban and rural part of the interventional area compared to reference area. The awareness, treatment, and control rates of hypertension increased significantly in the age groups of more than 40 years, as well as in all groups of body mass index in interventional areas without significant change in the reference area. Mean systolic blood pressure of study population in the interventional area decreased from 116.13 ±19.37 to 112.92 ± 18.27 mmHg (P < 0.001) without significant change in reference area.
Sarrafzadegan et al. (2013) intervened a targeted population of 2180000 in three districts of central Iran with the target to educate regarding healthy nutrition, increased physical activity, tobacco control and coping with stress among 6175 and 4719 participants in intervention area, and 6339 and 4853 in reference area, respectively it was concluded that incidence of abdominal obesity, hypertension, hypercholesterolemia, hypertriglyceridemia and high LDL-C decreased significantly in the intervention area versus the reference area in both sexes, however overweight and obesity reduction was highly significant in female (p<0.05), with no major changes in DM. In the intervention area, the pervasiveness of hypercholesterolemia dwindled from 23.5% to 12.5% among females with no such transformation among females in the reference area (p < 0.0001). In males, hypercholesterolemia decreased significantly in both intervention area (18.5% to 9.6%) and reference area (14.4% to 9.8%; p = 0.005). Mean triglyceride levels had a noteworthy drop off in the intervention area and a non-significant decrease in the reference area (p < 0.0001).

Steptoe et al. (2012) during a randomized controlled trial of behavioural counselling for reducing stages of change in fat intake, physical activity, and cigarette smoking on 883 patients among whom either of the RFs cigarette smoking, high cholesterol, or a combination of a high body mass index and low physical activity was present were included. The results revealed that the odds of moving to action/continuation for behavioural intervention vs. control patients at 4 months were 2.15 (95% confidence interval [CI] = 1.30, 3.56) for fat reduction, 1.89 (95% CI = 1.07, 3.36) for increased physical activity, and 1.77 (95% CI = 0.76, 4.14) for smoking cessation. The probability of attaining action/maintenance was related to baseline stage for all 3 behaviours.

Cook et al. (2007) examined the outcome of reduction in dietary sodium intake on cardiovascular events using data from two completed randomised trials, TOHP I and TOHP II (follow up of 10-15 years), in 10 clinic sites in 1987-90 (TOHP I (744 participants)) and nine sites in 1990-5 (TOHP II (2382 participants)), follow up conducted by post and phone through comprehensive education and counselling, it was observed that total sodium diminution in the intervention groups was 44 mmol/24 h and 33 mmol/24 h, respectively. The risk of cardiac events was 25% lower in intervention group (relative risk 0.75, 95% confidence interval 0.57 to 0.99, P=0.04), accustomed for trial, clinic, age, race, and sex, and 30% lesser after additional
amendment for baseline sodium excretion and weight (0.70, 0.53 to 0.94), with similar results in each trial.

**Jafar et al. (2015)** in a trial follow up on 1341 individuals 40 years or older with hypertension (systolic BP 140 mm Hg or greater, diastolic BP 90 mm Hg or greater, or already receiving treatment), a 2 x 2 factorial, cluster randomized controlled trial, the combined home health education (HHE) and trained general practitioner (GP) intervention delivered over 2 years, an additional 7 years follow-up inclusive of 5 years of post intervention period of COBRA trial participants to assess the effectiveness of the interventions on BP during extended follow-up. After a 7 years follow up it was observed that, systolic BP levels among those randomised to combined HHE plus trained GP intervention were significantly lower (2.1 [4.1–0.1] mm Hg) compared to those randomised to usual care, (P = 0.04). Participants receiving the combined intervention compared to usual care had a greater reduction in LDL-cholesterol (2.7 [4.8 to 0.6] mg/dl

### 2.7 Knowledge, attitude and Practices

**William et al. (2007)** conduct a trial including 100 adult patients (age 18 and above) irrespective of the sex constituting of the population that reported at the Emergency Department at an inner city tertiary care level I trauma centre hospitals from January 2002-may 2004 with objecting of intervening the group for knowledge of cardiac risk factors through and American Heart Association Educational Video found that most of the information was not retained at 30-day follow up, Nevertheless there was an appreciable improvement in the knowledge when compared to the pretested baseline scores, An overestimated risk perception was observed when compared to an objective measure of risk, it was observed that that simple educational intervention at a teachable moment (eg, just experienced Heart Attack) significantly improved the patients knowledge of risk factors immediately post-intervention.

**Sarrafzadegan et al. (2006)** in their five to six years integrated community based intervention on 12,600 individuals above 19 years of age through various modes like mass media, community partnerships, health system involvement and policy and legislation saw a improved knowledge about healthy lifestyle among Physicians, nurses and health trainees in the interventional group when compared to reference group (p<0.05).
Buckley et al. (2006) on a randomised controlled trial of 200 participants with a history of CHD having almost equal baseline knowledge, attitude and beliefs towards CHD underwent CHD associated counselling and education, I was observed that the intervention resulted in enhanced knowledge of CHD, AMI warning signs and the apposite response to symptoms that was persistent for 12 months (p=0.02). No such difference was observed between group’s beliefs and attitude through time. Short individual teaching and counselling was linked to improved knowledge of CHD, AMI symptoms and the appropriate response to symptoms in people at risk of AMI sustained to 12 months.

Sadeghifar et al. (2013) intervened 96 patients through face to face educational intervention related to CVD RFs, it was found that the there was a significant difference (p<0.001) regarding CVD in pre (25.93) and post (36.19) education along with significant differences in pre and post test by education of couple (P<0.03) and sex (P<0.05). A significant mean attitude score was observed between pre (23.5) and post (35.7) education.

Shah et al. (2010) evaluated the impact of school-based health and nutritional education programme on knowledge and behaviour of urban Asian Indian school children by educating 40196 children (aged 8–18 years), 25000 parents and 1500 teachers about health, nutrition, physical activity, non-communicable diseases and healthy cooking practices in three cities of North India. A pre-tested questionnaire was used to measure randomly selected 3128 children, 2241 parents and 841 teachers before intervention and 2329 children after intervention. A quite low knowledge and behaviour score was reported among government schools (75-94%) as compared to 48–78 % private school children, across all age groups. Very few government schools gave correct answers about protein (14–17 %), carbohydrates (25–27 %) and saturated fats (18–32 %). A better performance was seen among Private school children, parents and teachers than government school subjects (P < 0.05). The intervention scores revealed improved scoring irrespective of the type of school (P < 0.001). A significantly higher improvement was observed in younger children (aged 8–11 years) as compared with those aged 12–18 years, in females compared with males and in government schools compared with private schools (P < 0.05 for all).
2.8 Web based Interventional Modules

Oenema et al. (2008) evaluated the short-term (1 month) efficacy of an Internet-delivered, computer-tailored lifestyle intervention targeting saturated fat intake, physical activity (PA), and smoking cessation, it was found that The intervention resulted in a significantly lower self-reported saturated fat intake ($b = -0.76$, $p < 0.01$) and a higher likelihood of meeting the PA guidelines among respondents who were insufficiently active at baseline ($OR = 1.34$, $95\% CI = 1.001-1.80$). No significant intervention effects were found for self-reported smoking status. Of the participants, 81% actually visited the website.

In a study setting on 400 contacts by email, Web pages, interactive voice response, and short message service technology conducted a happy ending (HE) one year smoking cessation programme by (Brendryen et al., 2008) on a two-arm randomized controlled trial recruited via Internet advertisements and randomly assigned to condition, it was found that participants in the intervention group reported clinically and statistically significantly higher repeated point abstinence rates than control participants (20% versus 7%, odds ratio [OR] = 3.43, 95% CI = 1.60-7.34, $P = .002$). Although no differences were observed at baseline, by the end of the preparation phase, significantly higher levels of coping planning ($t(261) = 3.07$, $P = .002$) and precession self-efficacy ($t(261) = 2.63$, $P = .01$) were observed in the intervention group compared with the control group.

Study done by (Meyer et al., 2008) on a randomized controlled trial testing a computer-tailored smoking cessation intervention based on the transtheoretical model in a general population setting in Germany found that based on 7-day point-prevalence abstinence and 6-month prolonged abstinence as the outcome measures, the study identified no significant differences between the intervention and control groups. Modelling the full longitudinal data in generalized estimation equation analyses, using different nonresponsive procedures, and adjusting for covariates did not alter the result.