Clinical Practice Guidelines on

Primary & Secondary Prevention of Cardiovascular Disease 2017

Ministry of Health Malaysia

Academy of Medicine Malaysia

National Heart Association of Malaysia

Primary & Secondary Prevention of Cardiovascular Disease 2017

STATEMENT OF INTENT

This guideline was developed to be a guide for best clinical practice in the prevention of cardiovascular disease, based on the best available evidence at the time of development. Specific attempts were made to use local data and publications to ensure local relevance. Adherence to this guideline does not necessarily lead to the best clinical outcome in individual patient care as this depends on other clinical factors like co-morbidities, acceptance of patients towards recommended therapy etc. Every health care provider is responsible to individualise the management of his/her unique patient based on the clinical presentation and management options available locally.

REVIEW OF THE GUIDELINE

This guideline is issued in 2017 and will be reviewed in 2022 or earlier if important new evidence becomes available.

CPG Secretariat

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Available on the following websites:
http://www.moh.gov.my
http://www.acadmed.org.my

MESSAGE FROM THE DIRECTOR GENERAL OF HEALTH

Cardiovascular Diseases (CVD) has been the leading cause of death in Malaysian since the early 1980s. The National Burden of Disease Study in early 2000s showed that coronary artery disease (CAD) and cerebrovascular disease (CVA) are the top two causes of death for both men and women. What is of concern is that the age of onset of CVD in Malaysia is younger compared to our neighbors and some western nations.

Equally of concern is that the incidence of the major risk factors contributing to CVD has shown an increasing trend over the last 3 decades. The Ministry of Health (MOH) in conjunction with the Academy of Medicine and Professional Non-Governmental Organisations had since the mid-1990s had published Clinical Practice Guidelines (CPGs) on the Management of major risk factors for CVD. This is followed by CPGs on the Management of Acute Myocardial Infarction, Heart Failure and Cerebrovascular Accidents. More recently, in 2010, the MOH launched the National Strategic Plan for Non-Communicable Disease (NSP-NCD) in response to the global challenge in combatting NCD in general and CVD in particular. This document is now being updated by the MOH to reflect latest developments in the field and more current global targets set by the World Health Organisation (WHO).

What has been missing thus far is an integrated approach to combat CVD at both the primary and secondary prevention levels. This is where this pioneering **CPG on Prevention of CVD** is a most welcome addition to compliment earlier initiatives to confront the scourge of CVD. The integrated approach adopted in this CPG engaging a wide spectrum of health care professionals (from dieticians to clinicians) is most commendable. It is my wish that this CPG is widely available and adopted by all health care professionals involved in the management of CVD. I strongly believe that, God Willing, compliance to the recommendation made in this CPG will go a long way to improve the quality of care we offer to reverse the rising tide of this preventable disease.

Datuk Dr Noor Hisham Abdullah
Director General of Health Malaysia

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ABBREVIATIONS

A1c	Haemoglobin A1c
ABI	Ankle-brachial Index
ACC	American College of Cardiology
ACMOMS	Asian Consensus Meeting on Metabolic Surgery
ACS	Acute Coronary Syndrome
AF	Atrial Fibrillation
AHA/ACC	American Heart Association / American College of Cardiology
AHI	Apnea-Hypopnea Index
AMI	Acute Myocardial Infarction
BMI	Body Mass Index
BP	Blood Pressure
CABG	Coronary Artery Bypass Surgery
CAC	Coronary Artery Calcium
CAD	Coronary Artery Disease
CCF	Congestive Cardiac Failure
CDC	Centres for Disease Control
CHD	Coronary Heart Disease
CHO	Carbohydrate
CIMT	Carotid Intima-Media Thickness
CKD	Chronic Kidney Disease
CKD-EPI	Chronic Kidney Disease Epidemiology Collaboration
COC	Combined Oral Contraceptive
CPAP	Continuous Positive Airway Pressure
CPG	Clinical Practice Guidelines
CPTR	Control For Tobacco Products Regulations
CRP	C-Reactive Protein
CT	Chelation Therapy
CV	Cardiovascular
CVA	Cerebrovascular Accident
CVD	Cardiovascular Disease
DALY	Disability Adjusted Life Year
DAPT	Dual Antiplatelet Therapy
DASH	Dietary Advice To Stop Hypertension
DHA	Docosahexaenoic Acid
ECG	Electrocardiogram
ED	Erectile Dysfunction
EDTA	Ethylenediamine Tetraacetic Acid
eGFR	Estimated Glomerular Filtration Rate

ABBREVIATIONS

EPA	Eicosapentaenoic Acid
ESC	European Society Of Cardiology
ESRD	End-Stage Renal Disease
ET/EPT	Oestrogen Therapy/ Oestrogen Progesterone Therapy
FBC	Full Blood Count
FBG	Fasting Blood Glucose
FCTC	Framework Convention for Tobacco Control
FRS	Framingham Risk Score
GDM	Gestational Diabetes Mellitus
GFR	Glomerular Filtration Rate
GI	Glycemic Index
GL	Glycemic Load
GLP-1	Glucagon-like peptide–1
GRAS	Generally Recognized As Safe
GTT	Glucose Tolerance Test
HDL-C	High Density Lipoprotein Cholesterol
HIV	Human Immunodeficiency Virus
IFG	Impaired Fasting Glucose
IGT	Impaired Glucose Tolerance
IHD	Ischaemic Heart Disease
KOSPEN	Komuniti Sihat Perkasa Negara
LCD	Low Carbohydrate Diets
LDL-C	Low Density Lipoprotein Cholesterol
LFD	Low-Fat Diet
LV	Left Ventricular
LVH	Left Ventricular Hypertrophy
MHT	Menopausal Hormone Therapy
MI	Myocardial Infarction
MOH	Ministry of Health
MSSM	Metabolic Syndrome Study of Malaysia
MUFA	Monounsaturated Fatty Acid
NCCFN	National Coordinating Committee on Food and Nutrition Malaysia
NCD	Non-Communicable Diseases
NCVD-ACS	National Cardiovascular Disease – Acute Coronary Syndrome
NGO	Non-Governmental Organization
NHMS	National Health and Morbidity Survey
NOAC	Newer Oral Anticoagulant
NRT	Nicotine Replacement Therapy

ABBREVIATIONS

OGTT	Oral Glucose Tolerance Test
OSA	Obstructive Sleep Apnea
PA	Physical Activity
PAD	Peripheral Arterial Disease
PCI	Percutaneous Coronary Intervention
PCOS	Polycystic Ovarian Syndrome
PD	Periodontal Disease
PSA	Prostate Specific Antigen
PUFA	Polyunsaturated Fatty Acid
PWV	Pulse Wave Velocity
RA	Rheumatoid Arthritis
RNI	Recommended Nutrition Intake
SACN	Scientific Advisory Committee On Nutrition
SBP	Systolic Blood Pressure
SFA	Saturated Fatty Acid
SLE	Systemic Lupus Erythematosus
T&CM	Traditional And Complementary Medicine
T2DM	Type 2 Diabetes Mellitus
TC	Total Cholesterol
TCM	Traditional Chinese Medicine
TFA	Trans Fatty Acid
TG	Triglyceride
TIA	Transient Ischaemic Attack
TRT	Testosterone Replacement Therapy
USRDS	United States Renal Data System
VTE	Venous Thromboembolism
WHO	World Health Organisation

RATIONALE AND PROCESS OF GUIDELINE DEVELOPMENT

Rationale:
Cardiovascular disease (CVD) is an important cause of morbidity and mortality in Malaysia. The National Health and Morbidity Surveys (NHMS) have shown that the prevalence of the cardiovascular (CV) risk factors – hypertension, hypercholesterolemia, diabetes, overweight/obesity and smoking – has been on an increasing trend. The National Cardiovascular Disease – Acute Coronary Syndrome (NCVD-ACS) Registry has also shown that Malaysians are developing heart disease at a younger age than that seen in the neighbouring countries.

This Clinical Practice Guidelines (CPG) on the Prevention of Cardiovascular Disease, 1ST Edition, is timely. It is directed at both individuals with and without established CVD. It has been drawn up by a committee appointed by the National Heart Association of Malaysia, Ministry of Health (MOH) and the Academy of Medicine. It comprises of cardiologists, endocrinologists, general and family physicians and physicians from the MOH, Public Health Division, government and private hospitals and the universities.

Objectives:
The objectives of this CPG are to:
- Look critically at the available evidence on the effectiveness of strategies for the primary and secondary prevention of CVD.
- Educate healthcare workers on methods of assessing and stratifying CV risk in our local population.
- Suggest appropriate preventive steps against CVD at the individual, community and governmental level.

Process:
A review of current medical literature on Cardiovascular Disease Prevention for the last 10 years was performed. Literature search was carried out using the following electronic databases – PubMed and Cochrane Database of Systemic Reviews.The search was conducted for the period January 2006 till 31st August 2016. Literature search was carried out using the following electronic databases – PubMed and Cochrane Database of Systemic Reviews. The following MeSH terms or free text terms were used either singly or in combination:

“Primary Prevention of Heart Attacks/stroke”, “Secondary Prevention of Heart Attacks/strokes”, “Dietary therapy for prevention of cardiovascular disease”; Physical Activity for primary prevention; Physical activity for secondary prevention;

Obstructive sleep apnoea for prevention of heart attack/stroke"; "Hypertension and prevention of cardiovascular disease" Erectile dysfunction and cardiovascular disease"; "Combined oral contraceptives", "Hormone replacement therapy";

The search was filtered to clinical trials and reviews, involving humans and published in the English language. The relevant articles were carefully selected from this huge list. In addition, the reference lists of all relevant articles retrieved were searched to identify further studies. Local CPGs were also studied. Experts in the field were also contacted to obtain further information. International guidelines mainly that from the American Heart Association/ American College of Cardiology (AHA/ACC) and the European Society of Cardiology (ESC) were used as main references.

All literature retrieved were appraised by members of the Expert Panel and all statements and recommendations made were collectively agreed by the group. The grading of evidence and the level of recommendation used in this CPG was adapted from the AHA/ACC and the ESC (pg 14).

After much discussion, the draft was then drawn up and submitted to the Technical Advisory Committee for Clinical Practice Guidelines, MOH Malaysia and key health personnel in the major hospitals of the MOH and the private sector for review and feedback.

Clinical Questions Addressed:

- How common are the CV risk factors in Malaysia?
- How cost effective is CVD prevention?
- What are the types of CVD one should target for prevention?
  - What are the risk factors?
  - Are there any other conditions/risk markers beyond the traditional risk factors?
- How do you assess CV risk for:
  - Primary prevention?
  - Secondary prevention?
- What steps should be taken to prevent CV risk at the:
  - Individual level?
  - Community, population and governmental level?

Target Group:

These guidelines are directed at all healthcare providers – all medical practitioners, allied health personnel, traditional and complementary medicine practitioners.

Target Population:
These guidelines are developed to prevent CVD (heart disease and strokes) in all individuals.

Period of Validity of the Guidelines:
These guidelines need to be revised at least every 5 years to keep abreast with recent developments and knowledge regarding preventive strategies against CVD.

Implementation of the Guidelines:
The implementation of the recommendations of a CPG is part of good clinical governance. To ensure successful implementation of this CPG we suggest:

- Increasing public awareness of CVD in general and educating them on the importance of knowing their individual CV risk.
- Continuous medical education and training of healthcare providers on CV risk assessment tools and the implementation of appropriate preventative strategies depending on each individual's CV risk status. This can be done by road shows, electronic media, in-house training sessions.
- Performance measures that include:
  - Achieving of NCD Targets (Section 14, pg 133)
  - Hospital admissions and discharges
  - Periodic national health surveys
  - Mortality statistics
  - Burden of disease studies conducted every 10 years

Facilitators, Barriers and Resource Implications
In the prevention of CVD, the emphasis is on lifestyle measures and the use of medications that are already available in the hospitals of the Ministry of Health. It however entails:

- Education of the healthcare providers on:
  - What constitutes a healthy diet
  - How to teach simple practical exercises that even a busy/elderly person can perform. These simple exercises should be tailored to the physical capabilities of the individual.
  - Where to go if individuals want help to quit smoking
  - Practical tips on losing weight and where to refer overweight/obese invididuals with co morbidities

Although there a number of strategies to prevent /reduce the burden of Non-Communicable Diseases being undertaken at the governmental level, there are problems of implementation. (e.g. no smoking in areas gazetted as NO Smoking Areas) This has to be overcome by education beginning from the young in schools and also via the mass media. Occasionally legislation and penalty may be necessary.

GRADES OF RECOMMENDATION AND LEVEL OF EVIDENCE

GRADES OF RECOMMENDATION	
I	Conditions for which there is evidence and/or general agreement that a given procedure/therapy is beneficial, useful and/or effective.
II	Conditions for which there is conflicting evidence and/or divergence of opinion about the usefulness/efficacy of a procedure/therapy.
II-a	Weight of evidence/opinion is in favour of its usefulness/efficacy.
II-b	Usefulness/efficacy is less well established by evidence/opinion.
III	Conditions for which there is evidence and/or general agreement that a procedure/therapy is not useful/effective and in some cases may be harmful.

LEVELS OF EVIDENCE	
A	Data derived from multiple randomized clinical trials or meta analyses.
B	Data derived from a single randomized clinical trial or large non randomized studies.
C	Only consensus of opinions of experts, case studies or standard of care.

Adapted from the American College of Cardiology Foundation / American Heart Association and the European Society of Cardiology

(Available at: http://assets.cardiosource.com/Methodology_Manual_for_ACC_AHA_Writing-_Committees and at http://www.escardio.org/guidelines-surveys/escguidelines/about/Pages/rules-writing.aspx).

SUMMARY

Magnitude of the problem:

- The prevalence of the common CV risk factors (Hypertension, smoking, hypercholesterolemia, diabetes, overweight and obesity) in Malaysia is high and shows a rising trend.

Prevention- Primary and Secondary

- Prevention of CVD includes:
  - Primary prevention strategies directed at:
    - Healthy general population – Section 3
    - Individuals with multiple CV risk factors or very high levels of a single CV risk factor – Section 4
    - Individuals who are at high risk for a CV event – Section 5 & 6
  - Secondary prevention strategies directed at individuals who:
    - Have established CVD.
- CVD includes:
  - Coronary heart disease (CHD)
  - Cerebrovascular accident (CVA)
  - Peripheral artery disease (PAD)
  - Asymptomatic individuals with:
    - "Silent" myocardial ischemia (MI) detected by non-invasive testing.
    - Significant atheromatous plaques in any vascular tree detected by imaging.
- CV risk factors may be:
  - Non-modifiable – increasing age, gender, family history of premature CVD, ethnicity.
  - Modifiable – diet and dietary patterns, smoking, physical inactivity, obesity/overweight, hypertension, dyslipidemia and pre-diabetes/diabetes.
- In addition, there are other conditions associated with increased CV risk. Risk markers may also be used to indicate individuals who are at higher risk for a CV event.
- In primary prevention, the committee advocates:
  - Screening at >30 years of age. (Section 3.2, pg 31)
  - Opportunistic rather than mass screening.
  - The use of the Framingham Risk Score (FRS) General CVD Risk Score to assess future CV risk (Tables 1-3, pg 18-20, Appendix 2, pg 166-167)

Intensifying risk factor reduction efforts and treatment goals

- Treatment targets will depend on the individual's CV risk (Table 3, pg 20)
- Individuals who at **Very High** and **High** CV risk (Table 3, pg 20) include those who:
  - Have established CVD (secondary prevention)
  - Multiple CV risk factors – 10 year risk of a CV event >20%
  - At high risk for a CV Event – e.g. chronic kidney disease (CKD), diabetes
- In these individuals, all risk factors should be treated intensively to target levels via lifestyle modification and drug therapy as indicated, in accordance with the respective CPGs. (Table 4, pg 21)
- In individuals at **Low** to **Intermediate (Moderate)** CV risk the emphasis is on lifestyle modification to achieve targets.

Management – General measures

- Nutrition – A diet high in fibre, fruits and vegetable, wholegrain, low in salt and saturated/trans-fat is associated with lower CV risk. A healthy food portion recommendation is the #QuarterQuarterHalf plate (Tables 5 & 6, pg 22-23)
- Physical activity (PA):
  - Any amount of PA is better than none.
  - Regular PA reduces all causes and CV mortality.
- Smoking:
  - Is an independent and strong risk factor for CVD.
  - There is no safe level of exposure to second-hand tobacco smoke.
  - Smoking should be strongly discouraged and individuals referred to the MQuit services.
- Overweight and obesity
  - Overweight and obese individuals should be counselled on lifestyle changes that can produce at least a 5-10% weight loss. (Appendix 10, pg 175)
  - A small 3-5% weight loss itself is associated with a clinically significant reduction in CVD risk factors – blood pressure (BP), blood glucose and lipid.
  - Bariatric surgery may be considered as a treatment option for obesity if body mass index (BMI):
    - >35 kg/m^2 with or without co-morbidities.
    - >32 kg/m^2 with co-morbidities.
    - >30 kg/m^2 if central obesity + 2 CV risk factors.
  - Bariatric surgery has been shown to improve CV risk factors in the short term. There is a reduction in CV events and mortality during long term follow up.

- At present, national policies are mainly directed at tobacco control, salt reduction and modifying the obesogenic environment.

Treatment of individual risk factors (Table 4, pg 21)

- Treating BP and lipids (particularly low density lipoprotein cholesterol (LDL-C)) to the recommended targets have been consistently shown to reduce CVD.
- Good glycemic control reduces the risk of microvascular diseases (retinopathy, nephropathy) in the short term and reduces CV events (MI and CV mortality) in type 2 diabetes mellitus (T2DM) during long term follow up (Legacy effect). In patients with CVD, the newer diabetic medications have shown to cause a reduction in composite CV events.

Antiplatelet/anticoagulant therapy

- Antiplatelet therapy:
  - Primary prevention- not routinely recommended.
  - Secondary prevention:
    - After an acute coronary syndrome (ACS), dual antiplatelet therapy is indicated for at least a year followed by antiplatelet monotherapy irrespective of whether percutaneous coronary intervention (PCI) with stenting or coronary artery bypass surgery (CABG) was performed.
    - Established CHD >1 year: antiplatelet monotherapy indefinitely.
    - Following a stroke or TIA, antiplatelet monotherapy indefinitely.
- Anticoagulant therapy:
  - Anticoagulation with either warfarin or the newer oral anticoagulants (NOACs) for the prevention of stroke is indicated in individuals with:
    - Atrial fibrillation
    - Left ventricular (LV) thrombus demonstrated by echocardiogram and an established stroke or transient ischaemic attack (TIA).

Adherence

- Full adherence to therapy proven to reduce CVD (aspirin, BP and cholesterol lowering drugs) has been estimated to reduce the risk of the first or second CVD event by approximately 80%.

Traditional and Complementary Medicine (T&CM)

- Herbal medicine, acupuncture and other forms of T&CM should be used with caution in the prevention and treatment of CVD.

Table 1 & 2: FRAMINGHAM RISK SCORE FOR ASSESSMENT OF CVD RISK*

Table 1A: Estimation of 10-year CVD Points for MEN (Framingham Point Scores)

Points	Age, yr	HDL-C	TC	SBP (not treated)	SBP (treated)	Smoker	Diabetes
-2		1.6+		<120			
-1		1.3-1.6					
0	30-34	1.2-<1.3	<4.2	120-129	<120	No	No
1		0.9-<1.2	4.2-<5.2	130-139			
2	35-39	<0.9	5.2-<6.3	140-159	120-129		
3			6.3-<7.4	160+	130-139		Yes
4			>7.4		140-159	Yes	
5	40-44				160+		
6	45-49						
7							
8	50-54						
9							
10	55-59						
11	60-64						
12	65-69						
13							
14	70-74						
15	75+						
Points allotted							

Grand Total: _____points

Table 1B: CVD Risk for Men

Total Points	10-year Risk %	Total Points	10-year Risk %
≤-3	<1	8	6.7
-2	1.1	9	7.9
-1	1.4	10	9.4
0	1.6	11	11.2
1	1.9	12	13.2
2	2.3	13	15.6
3	2.8	14	18.4
4	3.3	15	21.6
5	3.9	16	25.3
6	4.7	17	29.4
7	5.6	18+	>30

** D'Agostino RB Sr, Vasan RS, Pencina MJ, Wolf PA, Cobain M, Massaro JM, Kannel WB: General cardiovascular risk profile for use in primary care: the Framingham Heart Study. Circulation. 2008; 117(6):743.*

Table 2A: CVD Points for Women

Points	Age, yr	HDL-C	TC	SBP (not treated)	SBP (treated)	Smoker	Diabetes
-3				<120			
-2		1.6+					
-1		1.3-1.6			<120		
0	30-34	1.2-<1.3	<4.2	120-129		No	No
1		0.9-<1.2	4.2-<5.2	130-139			
2	35-39	<0.9		140-149	120-129		
3			5.2-<6.3		130-139	Yes	
4	40-44		6.3-<7.4	150-159			Yes
5	45-49		>7.4	160+	140-149		
6					150-159		
7	50-54				160+		
8	55-59						
9	60-64						
10	65-69						
11	70-74						
12	75+						
Points allotted							

Grand Total: _____points

Table 2B: CVD Risk for Women

Total Points	10-year Risk %	Total Points	10-year Risk %
≤-2	<1	10	6.3
-1	1.0	11	7.3
0	1.2	12	8.6
1	1.5	13	10.0
2	1.7	14	11.7
3	2.0	15	13.7
4	2.4	16	15.9
5	2.8	17	18.5
6	3.3	18	21.5
7	3.9	19	24.8
8	4.5	20	28.5
9	5.3	21+	>30

** D'Agostino RB Sr, Vasan RS, Pencina MJ, Wolf PA, Cobain M, Massaro JM, Kannel WB: General cardiovascular risk profile for use in primary care: the Framingham Heart Study. Circulation. 2008; 117(6):743.*

Table 3: Risk Stratification of Cardiovascular Risk

- **Very High Risk** individuals are those with:
  - A FRS-CVD score that confer a 10-year risk for CVD of >30%
  - Established CVD
  - Diabetes mellitus with proteinuria
  - CKD with glomerular filtration rate (GFR) <30 Ml/ min^{-1}/ 1.73 m^2 (Stage ≥4)
- **High Risk** Individuals include:
  - Have a FRS-CVD score that confer a 10-year risk for CVD of >20%
  - Diabetes mellitus without target organ damage
  - CKD with GFR >30 - <60 Ml/ min^{-1}/ 1.73 m^2 (Stage 3)
  - Very high levels of individual risk factors (LDL-C >4.9 mmol/L, BP >180/110 mmHg)
- **Intermediate (Moderate) Risk** Individuals:
  - Have a FRS-CVD score that confer a 10-year risk for CVD of 10-20%
- **Low Risk** Individuals:
  - Have a FRS-CVD score that confer a 10-year risk for CVD <10%

Table 4: Targets of Individual Risk Factors

Targets of Individual Risk Factors			Grade of Recommendation/ Level of Evidence
Smoking	**Complete Cessation**		I,B
Physical Activity	Minimum 30 min/day, 5 days/week of moderate intensity PA (i.e. 150 min/week) ***or***		
	15 min/day, 5 days/week of vigorous intensity PA (75 min/week) ***or***		I,B
	a combination of both		
Dyslipidemia	LDL-C:		
	This should be the target of therapy.		
	Treatment targets will depend on an individual's CVD Risk Classification (Table 3, pg 20)		
	Very High Risk: LDL-C goal: <1.8 mmol/L (*or* a reduction of at least 50% from baseline)		I,A
	High Risk: LDL-C goal: <2.6 mmol/L (*or* a reduction of at least 50% from baseline)		I,A
	Intermediate (Moderate) and Low Risk: LDL-C goal: <3.0 mmol/L		
BP*	<140/90 mmHg in most individuals <80 years of age		I,A
	<150/90 mmHg in individuals >80 years of age		I,A
Diabetes**	Pre-prandial blood sugar or fasting:	4.4 – 7.0 mmol/lL***	I,C
	Post prandial blood sugar (90-120 mins after a meal)	4.4 – 8.5 mmol/L***	I,C
	A1c	≤ 6.5%***	I,A
	BP: ≤135/75 mmHg		I,B
	LDL-C	≤2.6 mmol/L (the lower the better) <1.8 mmol/l in diabetics with CVD	I,A I,A
	HDL-C	>1.0 mmol/L (males) >1.2 mmol/L (females)	-
	Triglycerides	≤1.7 mmol/L	-
Overweight/ Obesity**	Weight loss	Aim for 5-10% in 6 months and maintain the weight in the next 1-2 years.	I,A

**Malaysian Clinical Practice Guidelines on Hypertension, 4th Ed 2013. Available at www.acadmed.com.my*
***Malaysian Clinical Practice Guidelines on Management of Type 2 Diabetes Mellitus, 5th Ed 2015. Available at www.acadmed.org.my*
****Glycaemic target should be individualised depending on the patient's profile to minimise risk of hypoglycaemia*

Table 5: Malaysian Healthy Eating Recommendations

A diet high in fruits, vegetables, wholegrains and fish and low in salt and saturated/trans-fat is linked to a lower CV risk.

The #QuarterQuarterHalf plate recommendation of food portions consist of:

- Quarter of the plate* being carbohydrate – rice, noodles, bread, cereals and other cereal products and/or tubers.
- Quarter of the plate* being protein- fish, poultry, meat and/or legumes.
- Half of the plate* being fruits and vegetables.
- Drinking plain water (instead of sugary drinks).

Together with the following 5 key recommendations, consume:

- 3 regular healthy main meals everyday.
- 1-2 servings of healthy snacks when necessary.
- At least half of your grains from whole grains.
- Non-fried & santan-free dishes everyday.
- Home cooked foods more often.

Remember and Practice Daily: ***88888*****

- Stop eating before you are full (approximately ***80%***).
- Have your dinner before ***8*** pm.
- Drink ***8*** glasses of water.
- Sleep ***8*** hours.
- Walk at least ***8000*** steps a day (10,000 steps are better).

**10 inches or 25 cm plate*
***Ministry of Health Malaysia. Healthy Eating. Recipes for Healthy Living.2013. Available at: www.moh.gov.my/images/gallery/publications/cny2013/Healthy_Eating2.pdf*

Table 6: Nutritional Recommendations

A	Recommended Nutrient Intake	Grade of Recommendation and Level of Evidence
	Fat requirements	
	• 20-25% with an upper safe limit of 30% of energy from fat ➢ 7-10% saturated fatty acid (SFA) ➢ Substitute SFA with monounsaturated fatty acid (MUFA)/ polyunsaturated fatty acid (PUFA) ➢ PUFA/MUFA should represent the rest of the calorie intake from fat	I,B I,B
	• <1% trans fatty acid (TFA) ➢ Minimise consumption of high fat processed meat (sausages, corned meat, nuggets, salami, burger, pepperoni, ham, serunding etc) and bakery products including cakes, biscuits, frozen pizza, cookies, crackers, and hard margarines and other spreads ➢ Reduce consumption of partially hydrogenated fats	I,A
	Cholesterol rich foods/eggs • No evidence for restriction.* However, it must be cautioned that dietary cholesterol-rich foods such as beef and pork also carry significant content of SFA which are known to increase TC and LDL-C levels.	IIa,B
	Protein • 10-20% of energy intake	I,B
	Carbohydrate (CHO) • 50-60% of energy intake ➢ Encourage high fiber, complex carbohydrate (CHO), wholegrains, fruits, vegetables ➢ Limit intake of sugar to 5-10% of energy intake. This includes sugar sweetened beverages, kuihs etc	I,B I,A
	Malaysian Healthy Plate and Current Healthy Eating Recommendation • Increase plant-based foods such as nuts, legumes, beans, fruits and vegetables. (taufu, tempe, 'ulam') • Consume whole grain foods (oats, barley, bran, brown rice) • Eat fish more often (oily/marine fishes - e.g. oily 'kembong/pelaling', patin, keli, terubuk) • Consume low-fat dairy products • Consume less sweet foods (no added sugar, limit canned and carbonated drinks, fruit juices and 3in1 beverages) • Healthy oils (use blended oils, peanut oil, sunflower oil, olive oil, canola oil and corn oil) • Reduce intake of processed /salty foods.	I,B
B	**Individual Dietary Pattern**	
	• Dietary fiber of 20-30 g fiber per day (vegetables, fruits, legumes and whole grain cereals are encouraged)	I,B
	• Whole grain should form 50% of the total grain intake	I,B
	• 5 servings of fruits and vegetables per day	I,B
	• 30 gram unsalted nuts per day	IIa,B
	• <10% of total energy intake from added sugar. This is equivalent to 50 g (or around 12 level teaspoons) for an adult of healthy body weight consuming approximately 2000 calories per day	I,A
	• <5 g salt or 1 level teaspoon per day or (2000 mg sodium per day)	I,A
	• Abstinence or not more than 1-2 standard servings of alcohol intake per day.	IIa,B

**In individuals with Very High and High CV risk advice <200 mg cholesterol a day*

1. Introduction

1.1 Epidemiology of Cardiovascular Disease

CVD is the main cause of global mortality and a major contributor to disease related disability.[1,2] In Malaysia, CVD has been the leading cause of morbidity and mortality for more than a decade.[1–5]

There is limited data on the exact prevalence of CVD locally. The data available is from the NCVD-ACS Registry. This is a voluntary registry of patients admitted with ACS to public and private hospitals. Data from the 2011-2013 registry indicated that Malaysians developed ACS at a younger age than that seen in neighbouring countries.[6] The mean age was 58.5 years and the peak incidence was in the 51-60 year age group.[6] This is younger than that noted in Thailand (63.5 years)[7] and Singapore (median: 68.3-69.2 years).[8]

1.2 Prevalance of Cardiovascular Risk Factors in Malaysia

There is more representative information on the prevalence of CV risk factors locally from the National Health and Morbidity Surveys (NHMS).

The Malaysian adult population (≥18 years) has high levels of CV risk factors.

- 63.6% of men, and 64.5% of women are either overweight or obese.[9]
- 43% of men smoke,[9] 59% of men between the ages 21-30 smoke.[10]
- 43.5% of men, and 52.2% of women have hypercholesterolemia.[9]
- 30.8% of men, and 29.7% of women have hypertension.[9]
- 16.7% of men, and 18.3% of women have diabetes mellitus.[9]

Data from NHMS V 2015 showed that the prevalence of these CV risk factors begin to increase from the age of 30 years.[9] (Table 7, pg 28)

The projected adult population (≥18 years of age) in this country for 2016, stands at 21.5 million, with 11 million men and 10.5 million women. The prevalence of CV risk factors above translates into the following estimates:

- 13.8 million adults are either overweight or obese; 7.0 million men and 6.8 million women.
- 10.3 million adults have hypercholesterolemia; 4.8 million men and 5.5 million women.

- 6.5 million adults have hypertension; 3.4 million men and 3.1 million women.
- 4.8 million men smoke.
- 3.8 million adults have diabetes mellitus; 1.8 million men and 1.9 million women.

Clustering of these five CV risk factors is common, occurring in almost half of Malaysian adults:

- 43.2% had at least 2 of the risk factors stated above.[11]
- 47% of those ≥30 years were at increased CV risk;[12] based on the FRS;
  - 26.7% were at high CV risk.
  - 20.3% were at intermediate CV risk.

In the INTERHEART study, these 5 modifiable risk factors (abnormal lipids, hypertension, current smoking, diabetes and abdominal obesity) contributed to about 80% of myocardial infarcts (MI).[13] Smoking and abnormal lipids accounted for 2/3 of the MIs in this study.[13]

1.3 Impact of Reducing/ Modifying CV Risk Factors

Diet and lifestyle factors such as smoking, physical inactivity and alcohol consumption, may contribute by as much as 70% towards the development of other CV risk factors such as abdominal obesity, hypertension, diabetes and hypercholesterolemia.[14–17] Together they contribute to more than 95% of acute coronary events.[18]

A decrease in these CV risk factors has been shown to reduce CV morbidity and mortality in both people without (primary prevention) and with established CVD (secondary prevention).[19]

Mortality risk reductions can be as large as 15-50% in the general population and by 20-45% in those with CVD.[20] This magnitude is more than the mortality risk reductions (range 18-26%) seen in the secondary prevention drug interventional trials.[20]

Reductions in CV mortality can be achieved with reductions in CV risk factor levels and improved treatment strategies. In Scotland, there was a 30% reduction in CV mortality between 1975 –1994,[21] and in England and Wales, reductions in CV risk factors accounted for 79% of life years gained over 20 years.[22] In Finland, mortality due to CHD decreased by 82% in men and 84% in women between the years 1969-1972 and 2012.[23,24]

Reductions in the 3 major CV risk factors – smoking, high cholesterol and high BP accounted for almost all of the observed CHD mortality reduction during the first 10 years of the study and about 69% in men and 66% in women in the last 10 years.[24]

It was estimated that there would be over 5000 fewer deaths per year in the UK if the total cholesterol was reduced by 1 mmol/L, the smoking prevalence was reduced from 30% to 18% and there was a 3.2 mmHg reduction in diastolic BP.[25]

To tackle the CV epidemic in this country, dietary and lifestyle changes in the general population have to be emphasized. This CPG aims to address this by recommending the appropriate preventive measures, to be implemented in a pragmatic way.

Key Message:

- The prevalence of the common CV risk factors (hypertension, smoking, hypercholesterolemia, diabetes, overweight and obesity) in Malaysia is high and shows a rising trend.
- A decrease in these CV risk factors has been shown to reduce CV morbidity and mortality in both people without (primary prevention) and with established CVD (secondary prevention).

Recommendation:

- To tackle the CV epidemic in this country, efforts should be made to reduce global CV risk. Dietary and lifestyle changes in the general population should be emphasized.

2. Prevention of CVD

Prevention of CVD includes:

- Primary Prevention Strategies -
  This is directed at:
  - The healthy general population. (Section 3)
  - Individuals with multiple CV risk factors. (Section 4)
  - Individuals who are at a high risk for a CV event. (Section 5 & 6)
- Secondary Prevention Strategies -
  This is directed at individuals who:
  - Already have an index CV event* (Section 7)

**An index event is defined as ACS (ST elevation myocardial infarction, Non-ST elevation myocardial infarction unstable angina, chronic stable angina, and coronary revascularization by PCI or CABG), cerebrovascular accident (stroke), TIA and/or peripheral vascular disease (PAD) manifesting as gangrene or intermittent claudication.*

Population preventive measures (the Rose approach) and strategies specifically seeking out and treating high-risk individuals (secondary prevention) are complementary. However, the Rose approach (population based strategies) is more cost effective.[26]

Individuals with a low risk CV profile in middle age have dramatically lower total, CV and non-CV mortality rates, greater longevity, and substantially lower rates and remaining lifetime risks for CVD events compared with individuals without the profile.[27–29] Similarly a healthy lifestyle in young adulthood has been shown to be strongly associated with a low CVD risk profile in middle age.[30]

Recommendation:

- In the prevention of CVD, population preventative strategies are more cost effective and needs to be encouraged.

3. Estimation of Global Cardiovascular Risk

3.1 Primary Prevention

I, B Based on the prevalence of CV risk factors in our local population, the committee advocates screening in adults >30 years of age. (Table 7, pg 28)

Table 7: Prevalence of CV Risk Factors among Adults >18 years of age in Malaysia According to Age*

Age Group	Hyper-cholesterolemia	Hypertension	Diabetes	Overweight BMI: 23-27.5 kg/m^2	Obesity BMI: > 27.5 kg/m^2	Current tobacco smoking ** (Males only)
18-19	22.0	6.7	5.5	20.8	20.2	49.6
20-24	26.5	9.4	5.9	24.3	20.8	59.3
25-29	33.7	13.2	8.9	27.8	26.1	
30-34	44.0	15.9	10.6	34.2	30.5	56.8
35-39	49.7	23.9	12.9	36.0	35.6	
40-44	57.2	32.2	17.9	36.9	36.6	48.5
45-49	60.1	38.8	22.0	38.4	37.0	
50-54	65.5	49.3	27.0	41.1	36.6	40.8
55-59	68.8	55.5	32.9	39.7	37.5	
60-64	65.3	65.0	38.3	37.9	36.9	35
65-69	61.6	67.8	38.0	37.9	34.2	
70-74	62.7	75.4	39.1	39.2	26.0	
75+	58.3	73.4	37.0	37.3	15.1	

**Institute for Public Health (IPH) 2015. National Health and Morbidity Survey 2015 (NHMS 2015). Vol. II: Non-Communicable Diseases, Risk Factors & Other Health Problems; 2015.*
*** Lim HK, Ghazali SM,Kee CC,Lim KK,Chan YY et al. Epidemiology of smoking among Malaysian adult males: prevalence and associated factors. BMC Public Health 2013, 13:8.*

The following information should be obtained for CV risk assessment:

- History of smoking (and vaping)
- BP
- BMI and waist circumference
- Lipid profile (TC, LDL-C, HDL-C, TG)
- Blood glucose/A1c

I, C The committee advocates opportunistic rather than mass screening. Healthcare professional should take the opportunity of any clinic encounter with an individual to screen for CV risks (as listed above) and manage accordingly.

In primary prevention, the individual's global CV risk should be determined to help guide the intensity of risk factor reduction efforts. Individuals with established CVD are already at High Risk. (Section 3.1)

There are many CV risk prediction models available. (Appendix 1, pg 165) Ideally, the CV risk model used should be based on data derived from our local population. A Malaysian CV risk score, however is currently not available.

However, in the local population, the FRS-General CVD Risk Score for primary care that predicts an individual's 10-year future risk of developing CVD (heart disease, strokes, PAD and heart failure) is commonly used. [31] It has been validated for Malaysians of both gender in 2 independent studies.[32,33]

I, A For primary prevention, the committee recommends the use of the FRS General CVD Risk Score for risk stratification. This risk score can be calculated using lipid levels or BMI. Both FRS risk calculators based on lipid levels and BMI were validated in the local population.[32,33]

The new 2013 ACC/AHA risk calculator has the advantage that it is gender specific.[34] In a local study, however, this risk model overestimated the proportion of individuals requiring statins based on the pooled risk profile.[35]

The WHO/ISH CV risk prediction model is not recommended as it does not work well for the Malaysian population.[32]

The FRS General CVD Risk Score can be calculated using Tables 1 & 2, (pg 18-19) or online at https://www.framinghamheartstudy.org/risk-functions/cardiovascular-disease/10-year-risk.php (Appendix 2, pg 166-167)

- In calculating the risk scores (Table 1A & B, 2A & B, pg 18-19), the total cholesterol (TC) and high density lipoprotein cholesterol (HDL-C) should be the average of at least 2 measurements.
- The average baseline BP should be obtained from an average of several readings.
- A "smoker" means any cigarette smoking in the past month.
- This risk score cannot be used to track changes in risk over time as risk factors are modified.

Based on the 10-year CV risk, individuals may be classified as:

- >30% - **Very High CV Risk**
- >20% - **High CV Risk**
- 10-20 % - **Intermediate (or Moderate) CV risk**
- <10% - **Low CV risk**

Individuals who have a 10-year CVD risk of <10% are **Low Risk**. Low-risk individuals should be given advice to help them maintain this status.

Many young individuals may fall into the category of **Low Risk** but they may have a high lifetime risk if their individual risk factors are high due to prolonged exposure. These include individuals with:

- BP >180/110 mmHg
- LDL-C >4.9 mmol/L

In these individuals, their lifetime CV risk can be assessed using vascular age derived from the Framingham Risk Score.[31] (Table 8, pg 32) This lifetime risk model has not been validated in our local population.

I, C Most individuals who are at **Low** and **Intermediate (or Moderate) Risk** can be managed by lifestyle changes alone. Those at **High Risk** and **High Lifetime Risk** may require pharmacotherapy in accordance with the CPGs.[36-38]

Lifestyle changes involves:

- A diet low in saturated fats, high in fiber and low in sodium (Section 8.1)
- Regular exercise (Section 8.2)
- Smoking cessation (Section 8.3)
- Maintaining an ideal body weight (Section 8.4)

These individuals should be assessed and counseled appropriately at regular intervals to ensure adherence to a healthy lifestyle and to determine if treatment goals are achieved.

I, A Smoking is an important CV risk factor in our local population and efforts should be taken to encourage cessation.[39,40] (Section 8.3)

3.2 Secondary Prevention

Individuals with established CVD are at a high risk of a recurrent CV event.

I, A All CV risk factors in these patients should be treated to target via lifestyle modification and drug therapy as indicated, in accordance with the respective CPGs.[36-38]

Recommendations:

- For primary prevention, the committee advocates:
  - Screening at >30 years of age
  - Opportunistic rather than mass screening
  - The use of the FRS General CVD Risk Score to assess the 10-year risk of developing CVD and guide risk reduction efforts (Tables 1-3, pg 18-20)
- The intensity of risk reduction efforts and treatment goals will depend on the individuals' baseline CV risk. (Table 3, pg 20)
- **Very High Risk** individuals are those with:
  - Have a FRS-CVD score that confer a 10-year risk for CVD of >30%
  - Established CVD
  - Diabetes with proteinuria or with a major risk factor such as smoking, hypertension or dyslipidaemia
  - CKD with GFR <30 Ml/ min^{-1}/ 1.73 m^2 (≥Stage 4 CKD)
- **High Risk** Individuals include:
  - Have a FRS-CVD score that confer a 10-year risk for CVD of >20%
  - Diabetes without target organ damage
  - CKD with GFR >30 - <60 Ml/ min^{-1}/ 1.73 m^2 (Stage 3 CKD)
  - Very high levels of individual risk factors (LDL-C >4.9 mmol/L, BP >180/110 mmHg)
- In these Very High Risk and High Risk individuals, all risk factors should be treated intensively to target via lifestyle modification and drug therapy as indicated, in accordance with the respective CPGs. (Table 4, pg 21)
- All other individuals should also be treated to target primarily by lifestyle modification. If goals are not achieved, then drug therapy may be necessary.

Table 8A: Heart Age/ Vascular Age for Men*

Points	Heart age, y
< 0	<30
0	30
1	32
2	34
3	36
4	38
5	40
6	42
7	45
8	48
9	51
10	54
11	57
12	60
13	64
14	68
15	72
16	76
≥17	>80

Table 8B: Heart Age/ Vascular Age for Women*

Points	Heart age, y
< 1	<30
1	31
2	34
3	36
4	39
5	42
6	45
7	48
8	51
9	55
10	59
11	64
12	68
13	73
14	79
15+	>80

** D'Agostino RB Sr, Vasan RS, Pencina MJ, Wolf PA, Cobain M, Massaro JM, Kannel WB: General cardiovascular risk profile for use in primary care: the Framingham Heart Study. Circulation. 2008; 117(6):743.*

4. Types of CVD

CVD includes:

- CHD - This includes:
  - Stable angina
  - ACS
  - Non-obstructive coronary artery disease
- Cerebrovascular accident (CVA) - This has a heterogeneous aetiology and includes:
  - Atrial fibrillation (AF) with embolization
  - Carotid artery and proximal aortic atherosclerosis and thromboembolism
  - Intracranial haemorrhage (including intracerebral and subarachnoid haemorrhage)
- PAD including aortic aneurysm
- Asymptomatic individuals with:
  - "Silent" myocardial ischemia detected by non-invasive testing
  - Significant atheromatous plaques detected in any vascular tree by imaging

For a detailed account of the manifestations of CVD please refer to the appropriate CPGs.[41-45]

5. Risk Factors for CVD

CV risk factors include:

- Non-modifiable risk factors
  - Increasing age
  - Gender – females develop CVD about a decade later
  - Family history of premature CVD
  - Ethnicity
- Modifiable risk factors:
  - Diet/Dietary patterns
  - Smoking
  - Physical inactivity
  - Obesity/Overweight
  - Hypertension
  - Dyslipidemia
  - Diabetes mellitus
  - Cardio Metabolic Risk

5.1 Non-modifiable CV Risk Factors

5.1.1 Increasing Age

The incidence of CVD increases with age.[46] This is due to the combined effects of age related changes in the vascular system as well as the increased prevalence and duration of exposure to adverse CV risk factors.[47,48]

5.1.2 Gender

The main cause of mortality in both gender in Malaysia is CVD.[1]

The onset of CHD may be delayed by about 10 years in women.[18,49–51] The prevalence is low before menopause but in mid-life, a woman's risk for CVD increases dramatically.[51] One explanation is the increase in prevalence of CV risk factors seen at this time. It is still unclear if this increase is due to oestrogen deficiency or part of the "ageing" process.

5.1.3 Family history of premature CVD

Familial and genetic factors may play an important role in the determination of some major risk factors, especially hypertension, lipid abnormalities and glucose intolerance. In addition, there appears to be a familial predisposition to CVD. The presence of CVD (CHD and stroke) in first degree relatives (parent or sibling) before 55 years in men and 65 years in women is an independent risk factor for future CVD.[52–56] This risk is increased:

- When the affected individual is a first-degree relative.
- With the higher number of family members with CVD.
- With the younger the age at which family members develop CVD.
- If the affected individual is an identical twin.
- If there is a maternal history of MI than a paternal history of MI.[57,58]
- When there is a history of MI in second degree relatives.[59]
- If there is a parental history of premature stroke.[60,61]

Despite earlier referral and treatment of individuals with a positive family history of premature CVD, the excess risk still persists.[62]

5.1.4 Ethnicity

South Asians (Indians) have a higher prevalence of CHD and CV mortality compared with Europeans.[63] East Asians (Chinese and Japanese) exhibit consistently higher rates of stroke.[64,65]

While conventional CV risk factors such as smoking, BP and total cholesterol predict risk within these ethnic groups, they do not fully account for the differences in risk between ethnic groups, suggesting that alternative explanations might exist.[66]

5.2 Modifiable CV Risk Factors

In 2010, CVD, diabetes and CKD accounted for 33 % of all deaths world-wide.[67] The 4 modifiable CV risk factors – hypertension, hypercholesterolemia, raised blood glucose and high BMI – together accounted for 63% of these deaths.[67] Data from the United States showed that in persons >35 years of age, smoking alone accounted for 33 percent of all deaths from CVD and 20 percent of deaths from ischemic heart disease.[40] Even among individuals at high genetic risk, a favorable lifestyle was associated with a 46% lower relative risk of CV events than an unfavorable lifestyle.[68]

5.2.1 Diet/Dietary Patterns

Diet plays an important role in the pathogenesis of cardiometabolic diseases such as obesity, diabetes and CVD. At present, the emphasis is on dietary patterns instead of focusing on single foods or nutrients.

A Mediterannean diet significantly reduces CV events.[69-75] The DASH diet is associated with a significant reduction in hypertension.[76] A 'high-fat/low-fibre' a 'high-sugar' diet showed a trend for an increased risk of CV events in older men aged 60-79 years.[77]

5.2.2 Smoking

Smoking is an independent risk factor for CVD and is estimated to increase the risk of CVD (CHD and strokes) by 2-4 times.[78] The risk is dose related. In addition, smoking appears to have a multiplicative interaction with the other major CV risk factors.[40] For instance, if the presence of smoking alone doubles the level of risk, the simultaneous presence of another major risk factor is estimated to quadruple the risk (2 × 2).[40] The presence of two other risk factors with smoking results in approximately eight times the risk (2 × 2 × 2) of persons with no risk factors.[40]

In women, even with minimal use, CVD risk is elevated (RR: 2.4 for 1.4 cigarettes/day).[79,80] Young women who smoke and use combined oral contraceptive (COC) have a very high CVD risk.[81,82]

Non-smokers exposed to second-hand smoke increase their risk of developing CVD and lung cancer.[78,83] Scientific evidence indicates that there is no risk-free level of exposure to second-hand smoke.[83]

5.2.3 Physical Inactivity

Regular exercise has a favorable effect on many of the other established CV risk factors. Although the effect on any single risk factor is generally small, regular physical exercise, in combination with a healthy life style, has a significant effect on overall CV risk.

In addition, PA reduces CV risk on its own, independent of its effect on other CV risk factors.[84] Individuals exercising for an equivalent of 150 min/week of moderate-intensity exercise had a 14% lower CHD risk compared with those reporting no exercise.[84] This association was more pronounced in women.[84] In a study done in Australia, physical inactivity was found to be the most important contributor to heart disease in women at the population level.[85]

A sedentary lifestyle (combination of screen time - watching television and videos and using a computer - and sitting time) has been shown to increase the risk of both fatal and non-fatal CVD.[86,87] Any form of physical exercise is better than none.[84] Unfit, lean men had a higher risk of all-cause and CVD mortality than did men who were fit and obese.[88]

5.2.4. Obesity/Overweight

Obesity is often associated with other CV risk factors such as hypertension, dyslipidemia and diabetes. However, obesity, by itself, is also an independent CV risk factor.[89–91] With increasing body mass, both CHD mortality and all-cause mortality are increased.[89,92-94] In women, even a modest weight gain (4 to 10 kg) during adulthood, was associated with 27% increased risk of developing CHD compared with women with a stable weight after adjusting for PA and other CV risk factors.[95]

Weight loss is associated with a significant improvement in CV risk factors especially diabetes and hypertension. An observational study showed a 25% reduction in mortality rates in overweight diabetic individuals following an intentional weight loss of 20-29 lb (9-13 kg).[96] A randomized trial however, focusing on weight loss using intensive lifestyle intervention, did not reduce the rate of CV events in overweight or obese adults with type 2 diabetes.[97]

Bariatric surgery in obese individuals has been associated with improved survival in the long term.[98-100]

5.2.5 Hypertension

Epidemiological studies have shown that CV risk rises in a strong, independent, graded and continuous manner as BP levels increases, starting at ≥115/75 mm Hg.[101,102] The report on the Global Burden of Disease 2015 states that worldwide, about 54% of stroke and CHD were attributable to hypertension.[103,104] It is a major cause of deaths (about 20%) and disability.[103-105] In the Asia-Pacific region, up to 66% of some subtypes of CVD can be attributed to hypertension.[106] Reduction in BP has consistently shown a reduction in CV events in both primary and secondary prevention.[107]

5.2.6 Dyslipidemia

Genetic and epidemiological studies have consistently shown an association between elevated TC, LDL- C levels and CVD. Randomized controlled trials have also shown that lowering of the TC and LDL-C levels reduces CV events and CV mortality.[108-123]

5.2.7 Prediabetes and Diabetes

Individuals with pre-diabetes, undiagnosed type 2 diabetes, and long-lasting type 2 diabetes are at high risk of CVD. More than 70% of patients with type 2 diabetes died of CV causes.[124] Women with diabetes are 44% more likely to develop CHD than men[125-129] Diabetic women are 50% more likely to have fatal CHD than men.[128]

Based on early studies, diabetes was considered a CHD risk equivalent, i.e. the CV risk of an individual with diabetes is the same as that in an individual who had a prior cardiac event.[130] Contemporary data however, indicate that individuals with diabetes have a significantly lower risk of CHD than those with a prior cardiac event across all ages and in both gender.[131,132]

In individuals who have diabetes of long duration (>10 years) the CV risk is similar as in those with a prior CV event.[131-134] In these individuals, the risk of PAD and carotid atherosclerosis is similar as those with pre-existing CHD.[135]

5.2.8 Cardio Metabolic Risk

Cardio metabolic risk refers to a cluster of CV risk factors that predispose to diabetes and CVD. The common denominator is insulin resistance which is characterized by abdominal obesity. The previous terminology was metabolic syndrome. This term, however, is no longer in favour because only about 80% of individual with the metabolic syndrome actually have biochemically confirmed insulin resistance.[136] Further more, the syndrome does not necessarily predict a CVD risk that is beyond the sum of the individual components.[137] It also does not provide better predictive power than the FRS.[138]

Key Messages:

- CV risk factors may be:
  - Non-modifiable – increasing age, gender, family history of premature CVD, ethnicity
  - Modifiable – hypertension, dyslipidemia, pre-diabetes/diabetes, smoking, physical inactivity, obesity/overweight
- The CV risk in individuals with long standing diabetes (>10 years) is similar to those with a prior CVD.

Recommendation:

- In addition to therapeutic lifestyle changes, individuals with modifiable CV risk factors should be treated appropriately to target in accordance with the respective CPG's.

6. Other Conditions Associated with Increased CV Risk

6.1 Chronic Kidney Disease

Based on NHMS 2011, the prevalence of CKD in adults (≥18 years of age) was 9.07%.[139] This was based on estimated glomerular filtration rate (eGFR) calculated by the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equation.

Risk factors for CVD and CKD overlap significantly. Traditional risk factors similar to both include increasing age, diabetes mellitus, hypertension, dyslipidemia, smoking and obesity.

In patients with CKD, non-traditional risk factors may also come into play and the interaction of these factors is likely to explain why there is an increase in the risk of CVD beyond traditional risk factors.[140] These non-traditional risk factors include "uremic" type factors such as albuminuria, hyperuricemia, anemia, hyperparathyroidism, metabolic bone disease, hyper-homocysteinemia, inflammation and endothelial dysfunction.[140,141]

CV mortality increases linearly as the eGFR decreases below a threshold of <75 mL/min per 1.73 m^2.[140,142–144] CV mortality was about twice as high in patients with stage 3 CKD (eGFR 30–59 mL/min per 1.73 m^2) and three times higher in stage 4 CKD (eGFR 15–29 mL/min per 1.73 m^2) than that in individuals with normal kidney function.[140,142-144]

Albuminuria was also associated with all-cause mortality.[140,142,143,145] It had no threshold effect, even after adjustment for traditional CV risk factors and eGFR.[140,145]

According to the United States Renal Data System (USRDS) 2016, the prevalence of CVD among patients aged 66 and older who have CKD is 68.8%, compared to 34.1% among those who do not have CKD.[146]

Death from CVD is far more common in patients with CKD than progression to end-stage renal disease (ESRD).[146] CVD accounted for about 35% of deaths in patients on dialysis in Malaysia.[147] The two-year survival following an AMI in patients without a diagnosis of CKD is 80%, compared to 69% for stage 1-2 CKD patients and 53% for stage 4-5 CKD patients.[146]

MI in patients with CKD is due to premature atherosclerosis as well as arteriosclerosis.[148,149] In one study, up to 50% of non-diabetic dialysis patients with symptoms of MI did not have large-vessel CAD.[150] In these patients, ischemia may be secondary to the combined effects of volume overload and left ventricular hypertrophy (LVH) which cause increased oxygen demand, and small-vessel coronary disease which cause decreased oxygen supply.

In patients on dialysis, only 25% of CV mortality are due to MI, whereas the other 75% are labelled as sudden or arrhythmic.[151]

Almost all risk scores do not incorporate CKD in their risk equations. The FRS in particular, is less accurate in CKD patients.[152] Some guidelines however, have incorporated eGFR and micro-albuminuria into their risk stratification.[153] Patients aged more than 50 years with CKD (eGFR <60 ml/min/ 1.73m^2 or albuminuria >30 mg/day or both) are regarded as high CV risk.[153]

6.2 Infections and the Heart

6.2.1 Influenza

A meta-analysis of case control studies done in non-tropical regions, have shown an association between a recent influenza infection, influenza-like illness or respiratory tract infection and acute myocardial infarction (AMI).[154]

In patients with CVD, influenza vaccination may reduce CV mortality and combined CV events.[155-158] However, additional higher-quality evidence is necessary to confirm these findings.[159]

In patients without CVD, there is not enough evidence to establish whether influenza vaccination has a role to play in primary prevention.[159]

The Centres for Disease Control (CDC) and the American College of Cardiology (ACC) have however, been advocating influenza vaccination in patients with CVD since 2010-2011.

IIa,C To date, however, there is no supportive data of the benefits of influenza vaccination in tropical regions. It is not recommended as routine.

6.2.2 Periodontal Disease

Epidemiological studies have shown that there is an association between periodontal disease (PD) and CVD.[160,161] These were largely association studies focusing on surrogate markers of CVD and on clinical events (i.e. CHD, MI, strokes and PAD). These associations do not imply causality.

Treatment of PD has been shown to result in improvement in surrogate markers of inflammation and endothelial function but there have been no interventional studies to show that it can prevent CVD.[160-163]

6.2.3 Human Immunodeficiency Virus (HIV)

With the use of new and effective anti-viral therapy, the life expectancy of patients infected with HIV is almost approaching that of the general population.[164] CVD is becoming an important cause of mortality accounting for 6-11% of deaths.[164,165]

HIV infected individuals of both gender, are at increased risk of:

- Premature CVD.[166-171]
  - Atherosclerosis tends to be diffuse, circumferential and is often accelerated[172-175]
  - This increased CVD risk cannot be explained by the traditional risk factors alone.[176]
  - The causes are multifactorial and it has been postulated to be due to systemic immune activation from various mechanisms resulting in endothelial activation and atherosclerosis, metabolic derangements due to anti-retroviral therapy and also the high prevalence of traditional risk factors such as smoking and obesity in these patients.[171,176–182]
- Arrhythmias including sudden cardiac death[183,184]
- Heart failure[185-188]
- Pulmonary hypertension[189,190]
- Ischemic strokes[191]

I,C Patients infected with the HIV should be screened and counselled about their CV risk factors. They should be encouraged to adopt a healthy lifestyle with smoking cessation and regular exercise. The traditional risk factors (hypertension, diabetes, dyslipidaemia, obesity) should be treated appropriately.

6.3 Cancer and the Heart

Cancer may involve the heart by:[192-194]
- Direct extension of the tumour to the pericardium and myocardium
- Co-existing hypercoagulable state giving rise to acute thrombotic occlusion
- Toxicity of therapy – both chemotherapy and radiotherapy

6.3.1 Chemotherapeutic Agents

These can give rise to:
- Depression of LV function
- Vascular toxicity
- Hypertension
- Arrhythmias

6.3.2 Radiation

- Thoracic/mediastinal/neck radiation may result in an increased risk of:
  - CAD (5-10% of patients)[195]
  - Cardiac failure due to CAD, myocarditis and cardiomyopathy
  - Acute (usually asymptomatic) and late pericarditis (5% of cases if the radiation dose >40 Gy)[195] including constrictive pericarditis,[193]
  - Valvular disease (20% of patients) [195]
  - Conduction abnormalities (5% of cases)[195]
  - Sudden death
  - Ischemic strokes and TIAs[196,197]
- CAD is more likely to occur if the patient was young at the time of the irradiation (≤21 years) and/or if other CV risk factors are present.[194,195]
- Ostial stenosis is typical for radiation induced CAD.[198]
- Radiation induced heart disease usually occurs after a long latent period especially if the dose exceeded 30 Gy.[194,199] It tends to be progressive.[194,199]
- Women receiving left sided radiation for early breast cancer had a higher prevalence of coronary artery abnormalities as compared to those who had right sided radiation.[200,201]

6.4 Connective Tissue Diease

CVD is the leading cause of death in patients with connective tissue disease. The chronic systemic inflammatory state may contribute to the susceptibility for CVD particularly ischaemic heart disease (IHD).

In patients with rheumatoid arthritis (RA), CV events accounted for 40-50% of deaths.[202-204] These patients have 1.5-2x the risk of myocardial ischemia compared to the general population.[205-207] Duration of disease, baseline c-reactive protein (CRP) and rheumatoid factor positivity in addition to established CV risk factors have all been shown to correlate with atherosclerosis and risk of subsequent CV mortality.[202,208-211] Lipid profile in these patients tend to show a low HDL-C and LDL-C with an elevated very low density lipoprotein cholesterol (VLDL-C) and triglycerides - lipid paradox.[212] Lower lipid profile is associated with more severe inflammation. More recent prospective studies tend to indicate a lower CV case fatality rate in currently treated low disease activity RA.[213]

Congestive cardiac failure (CCF), more than IHD, appears to be an important contributor to the excess overall mortality among RA patients.[214] The risk of developing CCF in RA is twice the risk of developing CCF in persons without RA, and this excess is not explained by traditional CV risk factors and/or clinical IHD.[215]

Drugs used for the treatment of RA can exacerbate CCF such as non-steroidal anti-inflammatory drugs, COX-2 inhibitors and glucocorticoids. The use of TNF-alpha antagonist and methotrexate in these patient group have shown some degree of protection for CV events.[216]

In patients with systemic lupus erythematosus (SLE), there is a 7.5 to 17-fold excess risk of CVD even after adjustment for the baseline Framingham risk estimates.[217-220] Although there is a high frequency of traditional risk factors in these patients, it does not fully explain the excess CV morbidity and mortality.[220] In addition to inflammation, steroid use has also been implicated.

6.5 Sleep Disorders

The most common sleep disorders are insomnia and sleep apnoea. Based on epidemiological data, both short sleep duration (<7 hours per night) and long sleep duration (>9 hours per night) disorders as well as obstructive sleep apnea (OSA) and insomnia are associated with poor cardiometabolic risk and outcomes.[221]

Insomnia is characterized by 3 primary symptoms:[221]
- Difficulty falling asleep
- Difficulty staying asleep and/or
- Early morning awakenings that occur at least 3 nights a week for at least 3 months

The American Academy of Sleep Medicine and the Sleep Research Society recently released a statement in favor of ≥7 hours of sleep per night for adults "to promote optimal health".[222]

Sleep apnoea is defined as at least 5 respiratory events (apnea or hypopnea) per hour of sleep (the apnea-hypopnea index (AHI)) on average and symptoms of excessive daytime sleepiness.[223]

There are three types of sleep apnoea:
- Obstructive
- Central
- Mixed

Of the three, OSA is the most prevalent sleep disordered breathing.[221] In a local cross-sectional screening survey, the prevalence of obstructive sleep symptoms – habitual snoring, breathing pauses and excessive daytime sleepiness were 47.3%, 15.2% and 14.8% respectively.[224]

Epidemiological studies have consistently shown an association between sleep disorders and CVD (arrhythmias, CHD, heart failure, hypertension and stroke) and metabolic disorders (e.g. obesity, T2DM and dyslipidemia).[221,225,226]

High risk individuals who should be evaluated for OSA include:[227]

- Obesity (BMI >35 kg/m^2)
- AF
- CCF
- Treatment refractory hypertension
- T2DM
- Nocturnal dysrhythmias
- Stroke
- Pulmonary hypertension
- High risk driving population such as commercial truck drivers
- Pre-operative bariatric surgery

IIa,B It is advisable to screen these high-risk individuals, if they have daytime sleepiness, for OSA.[227] A commonly used assessment guide (STOP-BANG questionnaire) is listed in Appendix 3, pg 168.

The diagnosis of OSA is confirmed with a formal full-night polysomnography (sleep study). The number of individuals who are diagnosed and treated is very small (tip of the iceberg) compared to >85% who remain undiagnosed.[225]

Management of OSA includes:

I,A
- Weight loss - This has been shown to be effective in improving and in some cases resolving OSA.[221]

IIa,B
- Continuous positive airway pressure (CPAP):
  - Improves quality of life and daytime sleepiness.[228]

IIa,B
  - Has a small effect on BP (2.6 mmHg difference in systolic BP and a 2 mmHg difference in diastolic BP).[229] Combining weight loss and CPAP may result in incremental reductions in BP as compared with either intervention alone.[230]

III,A
  - Does not result in weight loss.[221]

III,B
  - Does not reduce CV events in patients with moderate-to-severe OSA and established CVD.[228]

- Others:
  - Custom made oral appliances such as mandibular repositioning appliances and tongue retaining devices.

IIb,B
  - Surgery - There is insufficient evidence at present that surgery improves OSA.[231]

6.6 Psychosocial Factors/ Depression

Clinical depression and depressive symptoms predict incident CHD[232-234] and worsen its prognosis.[234-236] Both acute stress (e.g. natural catastrophic disasters, acute outbursts of anger or grief, death of a spouse) as well as chronic stress (e.g. at work or within the family) increase the risk of a CV event.[237] The INTERHEART study has shown that a cluster of psychosocial risk factors (i.e. social deprivation, stress at work or in family life, financial stress and depression) is associated with increased risk for MI.[238]

In a local study carried out among cardiac patients admitted to an urban hospital, the presence of significant levels of depression and or life events were ten times more likely to be associated with a recurrent cardiac event.[239]

There is strong association between psychosocial stress (especially depression) and new onset and recurrent CVD.[240] Psychological intervention has been shown to improve symptoms of depression and anxiety but its effects on CV events however, appear mixed.[241-243]

Coronary patients with clinically significant depression can be safely and effectively treated with:

IIa,B • Psychotherapy[244-248] or

IIa,B • Selective serotonin re-uptake inhibitors.[249-251]

IIa,B A prudent approach at present is to offer patients with clinically significant depression or anxiety treatment with psychotherapy and antidepressant/ anxiolytic medication. Those not accepting treatment should be followed closely, and treatment offered again if symptoms persist for 4–6 weeks

6.7 Gender Specific Issues

6.7.1 Erectile Dysfunction

Erectile dysfunction (ED) is defined as persistent or recurrent inability to achieve and maintain a penile erection of sufficient rigidity to permit satisfactory sexual activity for at least 3 months duration.[252] It is the commonest sexual problem affecting men. The prevalence of moderate to severe ED in a multi-ethnic Malaysian male population aged between 50-65 years old, was about 20%.[253]

The presence of ED is a reflection of the generalized vasculopathy present in these men rather than indicating a cause and effect relationship with CVD.[254]

Many risk factors are common to both ED and CVD, the higher the number of CV risk factors present, the higher the prevalence of ED.[254] The presence of ED increases the risk of future CV events in men with and without established CVD.[255] ED often precedes the occurrence of CVD by 2 to 5 years (average 3 years).[256] It is also a marker of CHD severity and correlates with the extent of the disease.[257,258]

It is important to make the public and healthcare providers aware that ED is not merely a sexual health issue. It is indicative of a generalized vascular problem.

I,C Regardless of age, all individuals presenting with ED should be screened for CV risk factors and the presence of occult CVD. Since ED often precedes CVD, it gives a window of opportunity for intervention.

I,B Lifestyle modification by exercise, improved nutrition, smoking cessation and weight control, has been shown to reduce CV risk and also improve sexual function.[259-261]

I,C Risk factors such as BP, lipids and diabetes should be treated to target in accordance with the respective CPGs.

III,C However, the use of drug therapy to improve ED (e.g. sildenafil, tadalafil) does not result in a reduction in CV risk.

6.7.2 Pre-eclampsia/Pregnancy

Women with preeclampsia have an increased future risk of developing CHD, stroke and venous thromboembolic events.[262-265] It is not known if this association is due to a common cause for pre-eclampsia and CVD, an effect of pre-eclampsia on disease development, or both.

As there is a long latent period before these women develop CVD, it gives them an opportunity and ample time to improve their CV health.

I,C It is important that they be referred for CV risk factor monitoring and control in the years after pregnancy.

6.7.3 Hormonal Female Contraceptives

Current or prior use of low-dose COC is associated with a small (2-3 fold) increased risk of MI in healthy non-smokers who are younger than 35 years. The risk of MI in this population is however very low and thus the CV risk is also small.[84,266,267] This risk is increased, however, if the women is diabetic, obese, smokes, or has hypertension.

It is the estrogen component of COC that increases a woman's CVD risk especially at doses of 50 mcg or higher.[266] The risk of thrombotic stroke, venous thromboembolism (VTE), and MI increases as the dose of estrogen increases.[266] The risk for stroke and MI from the progestin component of COC is relatively small.[268,269] Progesterone-only pills do not increase the risk of CV events.[268,269] A recent review showed that third- and fourth-generation progestin products containing desogestrel or drospirenone however, almost doubles a woman's risk for VTE compared with taking levonorgestrel-containing pills.[270-272]

There are conflicting data regarding non-oral contraceptives (i.e. transdermal system, vaginal ring) and CV risk. Both have VTE risks similar to those associated with COCs.[270,273]

I,C Before prescribing COCs, it is important to screen for CV risk factors and have them optimally controlled. WHO has published a medical eligibility criteria for COC use depending on the individual's medical history.[274]

6.7.4 Menopausal Hormone Therapy– (Oestrogen Therapy/ Oestrogen Progesterone Therapy – ET/EPT)

Menopausal hormone therapy (MHT) is widely used for controlling menopausal symptoms.

The link between MHT and CVD can be summarised as follows:

- Observational studies showed that postmenopausal women receiving MHT had lower CHD event rates[275]
- Primary prevention:
  - Randomized controlled trials however showed that MHT increases CV risk.[276-278] These were conducted mainly in the elderly.
  - In a sub-study, women receiving estrogen alone post-hysterectomy did not have an increase CHD event rate but there was a small increase in stroke.[278]
  - Recent cohort studies showed that early initiation of MHT (defined as within 5 years of the onset of menopause) were associated with a decreased risk of future CHD and the surrogate marker (Carotid Intima-Media Thickness (CIMT)), whereas late initiation (>5 years of menopause) was associated with an increased risk for CHD.[279-,280]
- Secondary prevention:
  - There is no benefit of MHT in women with established CHD[281-284]
  - There was no difference demonstrated between oral and transdermal preparations on CIMT progression.[285]

III,A In summary, MHT in whatever form should not be started solely for the purpose of either primary or secondary prevention of CVD.

I,A It is however effective for the treatment of menopausal symptoms (flushes, vaginal dryness etc.). Its usage should be reviewed after 5 years.

IIa,C We recommend that treatment decisions should be individualised taking into account:[286,287]

- Age
- Time since menopause
- Menopausal symptoms
- Treatment preference
- Overall CVD risk profile

6.7.5 Testosterone Replacement Therapy (TRT)

Male hypogonadism is defined as symptoms and signs of testosterone deficiency in the presence of low testosterone levels measured by at least two early-morning blood samples of free testosterone or total testosterone obtained before 10:00 a.m.

The goal of TRT is to restore testosterone to physiologic ranges and reverse symptoms of hypogonadism.

III,A The issue of TRT is complicated by:

- The abuse of testosterone as an anti-aging preparation (for cosmetic reasons)[288]
- The prescription of testosterone in men who have age-related non-specific symptoms in the presence of low total testosterone levels
- The prescription of testosterone in men who have ED (but not hypogonadism) in the presence of low total testosterone levels
- The concern about increased CVD risk among those taking testosterone.[289-291]

6.7.5.1 Testosterone and CVD

Testosterone decreases with age and age itself is associated with an increase in CV risk. It is not clear whether the association of CVD with low testosterone is causal or simply a reflection of poor health.[292,293]

The issue of increased risk of CVD with the use of testosterone is still unresolved.[289-291]

I,A As such TRT should strictly only be used in patients with confirmed hypogonadism.[294,295] These patients should be monitored regularly with full blood count (FBC) and prostate specific antigen (PSA) levels.[296]

III,B It is not recommended for primary or secondary CV prevention.

Key Message:
Conditions that are associated with increased CV risk are:

- Chronic kidney disease
- Certain infections like HIV infection
- Certain cancers and its treatment (chemotherapy and radiotherapy)
- Connective tissue diseases
- Obstructive sleep apnoea
- Psychosocial stress/ depression
- Gender specific issues:
  - Erectile dysfunction: ED is an indicator for generalized vasculopathy. Lifestyle modifications reduces the prevalence of CVD and also improves sexual health
  - Pre-eclampsia/ Pregnancy
  - Combined oral contraceptives
  - Sex hormone therapy – menopausal hormone therapy and testosterone replacement therapy

Recommendation:

- In these patients who are at increased CV risk, all CV risk factors should be treated to target in accordance with the respective CPG's.

7. Other Risk Markers of CVD

In addition to the conditions mentioned in Section 4, there are other markers that indicate an increased risk for CVD and are sometimes used to help refine CV risk assessment beyond the traditional risk factors found in the Framingham Risk Score. These may be useful in risk stratifying individuals at Intermediate (or moderate) CV risk.

7.1 Electrocardiogram (ECG)

After controlling for traditional risk factors, ECG abnormalities found at rest and during exercise are associated with an increased risk of CV events.[297]

IIa,B ECG is advisable in the initial assessment of adults with hypertension and/or diabetes for CV risk assessment.[298,299] The presence of resting ECG abnormalities indicates the need for intensive risk factor reduction.

III,C Exercise stress testing is not recommended in the routine CV assessment of asymptomatic individuals.

IIa,B It may have a role in the CV assessment of the asymptomatic individual with an interpretable resting ECG who has a high pre-test likelihood of CAD and is at intermediate to high CV risk. (Refer Appropriate Use Criteria for Investigations and Revascularizations in Coronary Artery Disease)[300]

7.2 Echocardiography

Echocardiography in patients with:

- Hypertension:
  - Is more sensitive than ECG for the detection of LVH
  - IIa,B Should be considered in patient with ECG evidence of LVH. LVH in the resting ECG is associated with increased all-cause mortality.[301,302]
- Breathlessness - helps in the detection of LV function (systolic and diastolic dysfunction).

III,C The routine use of echocardiogram as a screening tool in the asymptomatic population has not been proven beneficial. It may increase costs and potential harm due to further downstream testing.

7.3 Biochemical – hs-CRP

An elevated hs-CRP level (>3 ng/mL) predicts a higher risk of CV event independent of Framingham risk factors.[121,303]

IIa,B It may be used in individuals at intermediate risk to reclassify them to high risk.[303]

III,C It is not useful for further risk stratification in asymptomatic high risk adults, or low risk asymptomatic adults.

However, there is insufficient evidence that reducing hs-CRP levels will prevent CV events.[303]

7.4 Subclinical Vascular Damage

7.4.1 Ankle-branchial Index (ABI)

The ABI is performed in a similar manner to a BP measurement. It is cheap and reproducible. A value of <0.9 is indicative of arterial stenosis and the presence of PAD.

Amongst patients with pre-existing CVD and/ or diabetes in an urban local setting, the prevalence of PAD was estimated at 23%, of whom only a quarter were asymptomatic.[304]

The presence of PAD indicates generalized atherosclerosis and a high CV risk individual.

IIa,B It is reasonable to measure ABI in adults in the intermediate risk group for further stratification.[305]

7.4.2 Carotid Ultrasound

Carotid artery stenosis is a risk factor for stroke.

Screening with carotid ultrasound in the general population with a low prevalence of carotid stenosis (0.5-1%) may yield many false positives leading to unnecessary interventions and harm.[306]

III,C It is not recommended as a routine screening tool in primary prevention.

In the presence of carotid bruits, it is useful for quantification of stenosis.

7.4.3 Carotid Intima-Media Thickness (CIMT)

CIMT is a measure of early atherosclerosis in the carotid artery. Its extent is associated with increasing CV risk, being more predictive in women than in men.[307] Many of the published studies were however performed in the research setting.

A meta-analysis reported in 2012, found a lack of usefulness of CIMT as a screening tool, taking into account the variation in its measurement and the low reproducibility.[308]

III,B It is therefore not recommended as a screening tool in the asymptomatic population.[308]

7.4.4 Coronary Artery Calcium (CAC)

CAC score is measured via a multi-slice CT and quantified using the Agatston score. The presence of calcification within the coronary vessel indicates atherosclerosis.[309] The higher the value, the more extensive is the plaque burden.[310]

It has a high negative predictive value. A score of 0 carries an almost 0% cardiac mortality risk for the next 5 years.[311]

In addition to traditional CV risk factors, CAC:

- IIa,B Improves CV risk prediction in individuals at intermediate risk.[312,313]
- III,A Should not be used for CV risk assessment in individuals at low risk.[314]

7.4.5 Arterial Stiffness

Arterial stiffening is measured using pulse wave velocity (PWV) either from the carotid to femoral or radial to femoral arteries. Elevated PWV is associated with increasing stiffness and may predict future CV events.[315] At present, its utility is confined to the research environment.

III,C It cannot be recommended as a screening tool for the asymptomatic population.

Recommendation:

- Risk markers that may be used to refine CV risk assessment beyond the traditional risk factors found in the Framingham Risk Score include:
  - Resting ECG
  - Echocardiography- to look at LV function
  - Biochemical – hs CRP
  - Subclinical vascular damage
    - Ankle brachial index
    - Coronary Artery Calcium
- They are most useful in further risk stratifying individuals at Intermediate (or moderate) CV risk.

8. Interventions to Prevent CVD

8.1 Nutrition

Dietary habits influence a variety of cardio-metabolic risk factors such as body weight, cholesterol, BP, glucose metabolism, oxidative stress and inflammation.[316,317] It is being increasingly recognized that instead of focussing on specific nutrients, it is more important to look at specific foods and overall dietary patterns.[316,317]

General recommendations should fit in with the local culture. Energy intake should be adjusted to avoid overweight/obesity.

8.1.1 Nutritional Composition of Food

The recommended nutrition intake (RNI) by the National Coordinating Committee on Food and Nutrition Malaysia (NCCFN) 2017,[318] states that the total daily calorie intake should consist of:

- CHO: 50-60%
- Total fat: 20-25% with an upper safe limit of 30%
- Protein: 10-20%

This concept is however difficult for most people to interpret and implement. Thus, the focus at present, has shifted from concentrating on individual nutrients to food groups and dietary patterns

8.1.1.1 Fats

I,B It is generally recommended that total fats contribute to about 20-25% with an upper safe limit of 30% of the total calorie intake.[153,318-320]

For the prevention of CVD, the types of fatty acids consumed are more important than the total fat content.[153,320]

Fatty acids are divided into:

I,B

1. SFA – The current recommendation is that the intake of SFA to be <10% of total calorie intake.[153,319,320] Sources of SFA are primarily from animal products, but also includes tropical plant oils.
2. Unsaturated fatty acid- Depending on the number of double bonds, these can be further classified as:
   - PUFA – These contain 2 or more double bonds. PUFA is divided into two subgroups:
     - **Omega-3 Fatty Acid** - This consists of:
       - o Alpha-linolenic acid - found in vegetable oils such as corn, soybean, safflower and sunflower oil.
       - o Eicosapentaenoic acid (EPA) - found in marine oils
       - o Docosahexaenoic acid (DHA) - found in marine oils

     Sources of DHA & EPA are higher-fat, cold-water fish such as salmon, mackerel (*kembong*), herring, oily kembong (*pelaling*), patin, keli, terubuk.[321]

     - **Omega-6 Fatty Acid** - This consists of linoleic acid, an essential fatty acid that can be found in vegetable oils such as soybean, corn, and safflower.
   - Monounsaturated fatty acid (MUFA) - MUFAs are primarily from plants and include olive oil, canola oil and peanut oil.

A central issue in the relationship between SFA and CVD is the specific macronutrients that are used to replace it in the diet.[153,320]

When PUFA, MUFA or CHO are used to replace SFA in the diet, TC, LDL-C, apoprotein B and to a lesser extent HDL-C levels are all significantly reduced.[322] Replacing SFA with PUFA leads to the most favourable lipoprotein profiles.[322]

Excess CHO intake also causes other metabolic derangements such as insulin resistance, obesity and diabetes. The quality of the CHO (low versus high glycaemic index, refined starches and sugar rich beverages versus grains and fruits) was not however addressed in the studies.[317]

When PUFA is used to replace SFA, there is consistent data that CV events and coronary mortality are reduced.[320] It is estimated that replacing 1% of energy from SFA with PUFA lowers CHD incidence ≥2-3%.[317,323] The evidence is not that clear that replacing SFA with MUFA or CHO lowers CVD risk.[317,320]

The total matrix of a food is more important than just its fatty acid content when predicting the effect of a food on CVD risk, e.g., the effect of SFA from cheese on blood lipids and CVD may be counter-balanced by the content of protein, calcium, or other components in cheese.[316] In addition, the special fatty acid profile of the SFA (short-chain vs medium-chain vs long chain) may modify the effect on CHD risk.[317]

Taking PUFA or MUFA (e.g. 1 teaspoon of olive oil) without cutting down SFA intake will not confer CV benefit. (Appendix 4, pg 169 for fat and calorie content of common Malaysian food)

Trans Fatty Acid (TFA)

This is a type of fat formed by the process of hydrogenation to increase its shelf life.[324]

Trans fat appears to increase the risk of CVD more than any other macronutrient on a per calorie basis.[324] A meta-analysis has shown that on average a 2% increase in energy intake from TFA increases CHD risk by 23%.[324,325] Total TFA intake was associated with all-cause mortality, CHD mortality and total CHD.[326,327] Industrial, but not ruminant, TFA were associated with CHD mortality and CHD.[327]

I,A The current recommendation is for TFA to contribute <1% of total energy intake and the lower the better.[153,319,320] TFA may be found in partially hydrogenated margarines, snack foods, bakery products and deep fried fast foods.[324]

The most recent analysis from the CDC USA showed a remarkable improvement in the lipoprotein profile of the American population. It was suggested that this was due to the reduction of TFA in the diet.[328] This followed the FDA removing TFA from the Generally Recognized As Safe (GRAS) Status.

8.1.1.2 Dietary Cholesterol/Eggs

The impact of dietary cholesterol on serum cholesterol level is weak when compared with the impact of the fatty acid composition of the diet (section 8.1.1.1). Lowering of SFA intake usually also leads to a reduction in dietary cholesterol.[153,320]

Some nutrition guidelines do not give specific recommendation on the intake of dietary cholesterol.[153,320] Although the evidence linking dietary cholesterol and CVD is weak, dietary cholesterol often co-exists with SFA (e.g. in meat, fried food). To avoid confusion and as practical advice, most international guidelines advise limiting the intake of dietary cholesterol to less than 300 mg/day.[329]

In contrast to SFA and TFA, dietary cholesterol in general and cholesterol in eggs in particular, have limited effects on the blood cholesterol level and on CVD.[153,320,330,331] Egg consumption of 4-7 eggs per week was shown not to be associated with an increased CVD risk in diabetic or non-diabetic individuals at high CV risk.[332,333]

8.1.1.3 Carbohydrates

Carbohydrates in the diet may take the form of:

- Starches - These include:
  - Starchy vegetables like sweet potatote, tapioca, yam, pumpkin, breadfruit, corn and potatotes
  - Dried beans, lentils and peas such as as mung beans (green grams), chickpea, red gram, yellow dhal, lotus seed and baked beans
  - Grains like rice, oats, barley -these may be whole grain (entire grain kernel e.g. brown rice, whole meal flour) or refined grains (e.g. white rice, white flour)
- Fibers - This is the indigestible part of plant foods, including fruits, vegetables, whole grains, nuts and legumes.
- Sugars - These include:
  - Naturally occurring sugars such as those in milk or fruit
  - Added sugars

When recommending diets to reduce the risk of CVD and diabetes, the nature of CHO is of considerable importance.[334] Whole grains, fruits, vegetables and legumes are the most appropriate sources as compared to sugars.

CHO may also be categorized by their:

- Glycemic index (GI) which is a measure of how quickly food glucose is absorbed
- Glycemic load (GL) which is a measure of the total absorbable glucose in food

CHO with a low GI value (55 or less) are usually rich in fibre and are preferred because they are more slowly digested, absorbed and metabolized. This results is an improvement in post prandial hyperglycemia.

It is important to consider both GL and GI:
GL = GI x CHO (g)/ 100

In the Nurses' Health Study, women who consumed diets with a high GL (refined CHO) were at increased risk of CHD at 10 years compared with those with a lower consumption.[334,335] This effect appeared to be independent of total energy intake and other CV risk factors.

A high dietary GL from refined CHO increases the risk of CHD, independent of known coronary disease risk factors.[335]

Please refer to Appendix 5 & 6, pg 170-171 for CHO content of common Malaysian food and their GI.

8.1.1.4 Protein

This includes both animal and vegetable sources such as meat, poultry, seafood, beans and peas, eggs, processed soy products, nuts and seeds.

Substituting animal for vegetable protein has not been shown to be associated with an increased risk for CHD.[336,337] Protein intake from red and processed meat, dairy products, fishes, nuts, eggs, and legumes were all found not to be significantly associated with CHD risk.[336]

Partially replacing dietary CHO with protein either from animal or vegetable sources, led to significant BP reductions.[338]

High protein diets increase short-term weight loss and improve blood lipids, but high quality long-term data are lacking. The available data seem to suggest that in the long term, a low CHO high protein diet is associated with increased CV risk.[339,340]

8.1.2 Individual Food Groups

8.1.2.1 Whole Grains and Dietary Fibre

Whole grain can be found in whole wheat, whole rice, barley, corn rye, oats, millet, sorghum, canary seed and brown/red/wild rice ('padi huma').

Whole grain food are rich sources of many nutrients such as complex CHO, dietary fibre, minerals, vitamins, antioxidants and phyto-oestrogens such as lignans most of which are lost from the grain during processing.[341] They are not merely sources of dietary fibre.[341] Studies have shown that the intake of whole grain was associated with a reduction in CV, total cancer and all-cause mortality.[342,343]

I,B

Dietary fibre can be divided into:

- Insoluble fibre, which includes cellulose and lignin. This is found in vegetables, some fruits and whole grains
- Soluble fibre which is present in fruits, pectin, guar gum, legumes and in oat bran.[344,345]

Prospective cohort studies have shown that a higher intake of total fibre is associated with lower risk of:[344-348]

- CHD
- Stroke
- Diabetes

An adequate intake is 14 g total fibre per 1,000 kcal, or 25 g for adult women and 38 g for adult men.[349]

Our local recommendation, in accordance with NCCFN 2005[350] and Scientific Advisory Committee On Nutrition (SACN) 2015,[351] is 20 to 30 g per day of dietary fibre. The dietary fibre content of common food is as in Appendix 7, pg 172.

I,A

8.1.2.2 Sugar

There is consistent evidence indicating an association between a high intake of sugar and the risk of obesity, diabetes, hypertension and CVD.[320] Strong evidence supports the association of added sugars with increased CV risk in children through increased energy intake, increased adiposity and dyslipidaemia.[352]

I,A It is recommended that children consume ≤25 g (100 Cal or ≈6 teaspoons) of added sugars per day and to avoid added sugars for children <2 years of age.[352]

I,A For adults, <10% of total energy intake should be from added sugar. This is equivalent to 50 g (or around 12 level teaspoons) for a person of healthy body weight consuming approximately 2000 calories per day.[319,353] An intake of sugar contributing to <5% of total energy intake has additional health benefits.[319]

Sugars may be naturally occurring as occurs in fruits, or, it may be added as occurs in soft drinks packet drinks, cordials, local drinks such as 'air sirap bandung', 'teh tarik'. Individuals who consumed >25% of their daily calories as added sugars were twice as likely to die of CHD as those who consumed <10%.[354]

Replacing sugar-containing sweeteners with low-calorie sweeteners reduces calorie intake, body weight, and adiposity.[320] However, the long-term effects of low-calorie sweeteners are still unknown and thus this practice is not recommended.[320]

Research, to date, is inconclusive whether using non-nutritive artificial sweeteners to replace caloric sweeteners, i.e. added sugars, in food and beverages, can reduce carbohydrate and calorie intake, body weight, appetite or lower cardiometabolic risk factors associated with diabetes and CVD.[355] Substituting non-nutritive sweeteners for added sugars may help in weight loss/weight control – as long as if there is no compensatory increase in energy intake from other sources.[355] Non-nutritive sweeteners include food additives such as aspartame, acesulfame-K, neotame, saccharin, sucralose, and plant-derived stevia.[355]

Fructose is considered the most hypertriglyceridemic sugar and is thought to account for the hypertriglyceridemic effect of sucrose.[356] High-fructose corn syrups are similar in composition and metabolic effects as sucrose.[357]

High intake of fructose present in fruit juices and products containing high-fructose corn syrups (present in most biscuits, cakes, 3 in 1 beverages, carbonated drinks, jams, peanut butter) is associated with unfavorable effects on obesity, blood lipids, fatty liver and insulin resistance.

I,C The drinking of water instead of sweetened beverages should be encouraged.

8.1.2.3 Vegetables and Fruits

Eating more fruit and vegetables has been shown to decrease the risk of CVD and lower BP.[358-363] The mechanism of action is not known, but it is assumed that the health effect of vegetables and fruits can be attributed to the dietary fibre and antioxidants in these food item. It also acts as a low calorie, low-sodium and satiating food.

I,B WHO recommends 5 servings of fruits and vegetables a day (3 servings of vegetables and 2 servings of fruit)[318] Daily intake of fresh fruit and vegetables (including berries, green leafy and cruciferous vegetables and legumes), in an adequate quantity (400-500 g per day), is recommended to reduce the risk of CHD, stroke and high BP.[364]

(Appendix 8, pg 173 – for serving size and weight of selected fruits and vegetables)

8.1.2.4 Nuts

Despite being high in fat, higher intake of nuts (tree nuts and peanuts) has been associated with reduced risk of CVD, total cancer and all-cause mortality.[365]

IIa,B Daily consumption of 30 g of nuts reduces the risk of CVD by almost 30%[365,366]

8.1.2.5 Dairy Products

The studies looking at the effects of full-fat dairy milk on CVD outcomes have shown conflicting results.[367-369] In general, of the limited number of studies that examined the association between the intake of total high-fat or low-fat dairy products and the risk of CHD or stroke, most studies showed no association, pointing to the need for long-term intervention studies.[367-369] A recent meta-analysis has shown that dairy consumption may be associated with reduced risks of CVD especially stroke risk.[370,371]

The complex matrix of dairy foods, rather than individual milk components, may be as important to improving CV health.

8.1.2.6 Fish

Eating fish at least 2-4 servings a week resulted in a 21% reduction in the risk of dying from CHD and a 6% reduction in the risk of stroke.[372,373] For this reason, most guidelines advice eating fish at least 2-4 servings a week. The protective effect of fish on CVD is attributed to the omega 3 fatty acid content.

Observations from some prospective cohort studies, however, have found no association between consumption of fish and CVD.[374-376]

Earlier studies showed that the supplemental use of n-3 fatty acids reduces CV morbidity and mortality.[377-379] More recent trials conducted in patients with established CVD or multiple CV risk factors have been negative.[380-382]

IIb,B Fish oil supplements are not effective in reducing CV risk.[380-383]

IIa,B Fresh fish is preferred and the method of preparation is also important (deep frying should be discouraged).[372,373]

8.1.2.7 Salt - Sodium and Potassium

A low sodium diet has been shown to reduce both systolic and diastolic BP in normotensive and hypertensive patients.[384,385] There was a direct relationship between increased sodium consumption and subsequent risk of CVD, heart failure and stroke.[386]

Based on the results of the DASH trial, most guidelines have recommended a daily salt intake of <2,300 mg.[387]

Following more critical analysis of the data, the United States Department of Agriculture Scientific Report of the 2015 Dietary Guidelines Advisory Committee concluded that the evidence is inconsistent and insufficient to conclude that lowering sodium intakes below 2,300 mg/day either increases or decreases risk of CVD outcomes (including stroke and CVD mortality) or all-cause mortality in the general population.[320]

IIa,B Currently, a reduction in sodium intake by approximately 1,000 mg/day is advocated.[320] This would result in a reduction in CV events by about 30 percent.[320,388]

A higher dietary sodium intake is associated with a greater risk for fatal and non-fatal stroke and CVD.[320]

In a more recent analysis, it was found that a high sodium intake was associated with an increased risk of CV events and death in hypertensive populations but not in normotensives.[389] A low sodium intake however, was found to be associated with an increased risk of CV events and death in both normotensives and hypertensives.[389]

This data suggests that lowering sodium intake is best targeted at populations with hypertension who consume high sodium diets.[389]

There is a relationship between the effects of sodium and potassium on BP. Two meta-analysis found that increasing the intake of potassium and reducing the intake of sodium in patients with high BP led to a reduction in BP.[390,391] In the general population however, there is inadequate data at present, to indicate that increasing potassium intake would result in a decrease in BP or CV morbidity and mortality.[320]

I,A WHO recommends <2000 mg of sodium (which is equivalent to 5 g of salt = 1 leveled teaspoon) per day for children and adults.[388] (Appendix 9, pg 174 for salt content of common Malaysian food)

IIa,B However, a low sodium diet is not recommended in populations with a low salt intake.[389]

8.1.2.8 Alcoholic Beverages

There is J shaped curve between alcohol intake and a variety of adverse health outcomes.[392] Low levels of alcohol intake have been found to reduce all-cause mortality in both men and women.[393,394]

IIa,B In non-pregnant women, this should not exceed 1 drink (10 g/day) per day and in men 2 drinks a day. (Appendix 10, pg 175)

8.1.3 Dietary Patterns

Dietary patterns, is a term used to describe combinations of different foods or food groups that characterize relationships between nutrition and health promotion and disease prevention.[395]

8.1.3.1 Mediterranean Diet

A Mediterranean Diet has been associated with a lower risk of CVD.[70,71,396,397] It has been associated with:

- An approximately 30% relative risk reduction in rate of major CV events in high risk individuals.[70,71]
- A lower risk of diabetes.[70,398]
- A lower BP especially the diastolic BP.[399]

When compared to low carbohydrate diet (LCD) or low fat diets, a Mediterranean diet has been associated with:

- A greater amount of weight loss in overweight/ obese individuals.[400]
- The prevention in the development of the metabolic syndrome.[401,402]
- Improvement in CV risk factors and inflammatory markers.[403]

There are many different "Mediterranean diets" among different countries but in general, the key components of the diet, in addition to regular physical activity are:

- High intakes of extra virgin olive oil (as the principal source of fat), vegetables (including leafy green vegetables), fresh fruits (consumed as desserts or snacks), cereals (mostly wholegrains), nuts and legumes.
- Moderate intakes of fish (especially marine blue species), seafood, poultry, dairy products (principally cheese and yogurt) and red wine (with the exception of Muslim populations).
- Low intakes of eggs, red meat, processed meat and sweets.

Total fat in this diet is 25% to 35% of calories, with saturated fat at ≤8% of calories.[404] There is a high monounsaturated/saturated fat ratio.[405]

8.1.3.2 DASH Diet

The DASH Diet (Dietary Advice to Stop Hypertension) consists of vegetables and fruits, low fat dairy products, whole grains, chicken, fish and nuts. It is low in fat, meat, sweet and sodas. It provides more calcium, potassium, magnesium and dietary fibre and less fat, SFA, cholesterol and sodium than the typical western diet.[406]

DASH diet has been shown to reduce systolic and diastolic BP in normotensive and hypertensive individuals.[368] The BP lowering effects is enhanced if there is in addition, restriction of sodium and lifestyle changes such as reducing weight and increasing physical activity.[369,407]

8.1.3.3 Low Carbohydrate Diets

LCD or "ketogenic" diets restrict CHO intake to 20 to 60 g per day (typically less than 20 percent of the daily caloric intake).[407] The remaining calories come from either fat or protein.

A LCD has been shown to have favourable short term changes on body weight and major CV risk factors i.e. low HDL-C and raised TG.[400,408,409] It is difficult to sustain and as a result weight gain often recurs.[400]

The effects of this dietary pattern on long-term health are unknown.[410,411]

For these reasons, it is not encouraged.

8.1.3.4 Low Fat Diet

In a low-fat diet (LFD) <30% of daily energy intake is from total fat and <7% from SFA.[412]

Clinical trials have shown that LFD:

- Results in less weight loss and lower CV risk reduction as compared to LCD, Mediterranean or high fat diets [400,413,414]
- Did not reduce the risk of CVD even when coupled with an increased intake of vegetables, fruits, and grain[415]

8.1.3.5 Malaysian Healthy Eating Recommendations - #QuarterQuarterHalf Diet

The Malaysian Healthy Plate Guideline promotes the #QuarterQuarterHalf plate which is a visual tool that shows the proportion of food groups that is recommended to be eaten during a meal in order to achieve a balanced and healthy diet.

It is a general recommendation for assisting in food portions and unlike the Mediterranean and DASH diets, its effect on CVD has not been studied.

I,B The Healthy Plate Guideline aims to encourage Malaysians to increase the intake of fruits and vegetables, consume wholegrain cereals in reasonable portions along with an adequate intake of protein and to drink plain water.

Recommendation:
The Malaysian Healthy Eating Recommendations is the #QuarterQuarterHalf plate which consists of:

- Quarter of the plate being CHO – rice, noodles, bread, cereals and other cereal products and/or tubers
- Quarter of the plate being protein – fish, poultry, meat and/or legumes
- Half of the plate being fruits and vegetables
- Drinking plain water

The five key recommendations that accompanies the Malaysian Healthy Plate guideline are:

1. Consume 3 regular healthy main meals everyday
2. Consume 1-2 servings of healthy snacks when necessary
3. Consume at least half of your grains from whole grains
4. Consume non – fried & santan free dishes everyday
5. Consume home cooked foods more often.

8.2 Physical activity

Any amount of physical activity (PA) is better than none; adults engaging in any amount of PA gain some form of health benefits.[86] It is beneficial in both primary and secondary prevention.

- **Primary prevention:**
  - Regular PA effectively reduces the risk of all-cause and CVD mortality in healthy individuals by 20–30%[86,416–419]
  - Physically active men and women generally have a 25% to 30% lower risk of CVD than the less active[419-423]
- **Secondary prevention:**
  - Regular PA confers significant mortality and morbidity reductions following an acute cardiac event[424-427]

PA is any bodily movement that substantially increases energy expenditure. This includes: (Table 9, pg 72)

- Leisure-time physical activities
- Occupational activities
- Commuting activities
- Exercise: a subset of PA that is planned and structured, involving repetitive bodily movement done with a goal to improve or maintain physical fitness

I,B The recommended duration of PA in healthy adults regardless of age is:[416,417] (Tables 9-11, pg 72-74)

- At least 150 minutes a week of moderate intensity or
- 75 minutes a week of vigorous intensity PA or an equivalent combination

In addition, individuals are encouraged to engage in resistance and flexibility exercises whenever possible or necessary. (Table 10, pg 73) A practical simplified approach to exercise is as in Table 11, pg 74.

I,B At each clinic visit, the importance of regular PA should be emphasized. The MOH Malaysia advocates walking 10,000 steps a day. This is a practical and easily achievable goal for most individuals.[428]

Wherever possible, individuals should be referred to physiotherapists/ exercise physiologists for exercise prescribtion for primary prevention of CVD.

I,A Following an acute cardiac event or post cardiac surgery, patients should be enrolled into a cardiac rehabilitation program. This is a medically supervised program consisting of exercise training, education on heart healthy living and counselling to reduce stress and help patients return to an active lifestyle and recover more quickly. It:

- Helps the identification and management of comorbid conditions and psychosocial disorder (anxiety and depression)[429,430]
- Ensures patient adherence to medical and lifestyle therapies to achieve CVD prevention goals[431]

For a more detailed discussion on cardiac rehabilitation, refer to the Malaysian Clinical Practice Guidelines on Management of ST Elevation Myocardial Infarction.[43]

Key Messages:

- Regular physical activity reduces all cause and CV mortality.

Recommendations:

- All individuals should be encouraged to exercise.
- Any amount of physical activity is better than none

Table 9: Classification of Physical Activity*

PA Intensity	Leisure time & sports	Occupational	Commuting	Exercises
Low	• Walk with pet • Push stroller with child • Bowling, recreational • Golf, recreational • Slow ballroom dancing	• Sweeping floor, mopping, vacuuming • Washing car • Doing laundry, washing dishes, cooking • Childcare & elderly care • General plumbing & light gardening • Commercial driving, moderate machinary operation • Typing, deskjob, light officework	• Driving automobile/ light trucks • Pushing wheelchair on flat surface • Walking from house to car/bus to places/ worksite	**Aerobic exercise:** • Walking (4.0-4.8 kmh) • Yoga • Stretching • Pilates • Rowing machine, moderate pace **Resistance training (moderate effort):** • Circuit training
Moderate	• Vigorously playing with children • Non-competitive sports: ➢ Cricket ➢ Ping-pong ➢ Badminton ➢ Basketball ➢ Kayaking/ paddle boat ➢ Snorkelling ➢ Backpacking	• Scrubbing bathroom • Carrying/ moving boxes • Using a hoe & spade, mowing lawn, shovelling 10-15 minutes vigorously • Moderate yard work, using power tools,	• Cycling • Walking and carrying approx. 7 kg load • Walking uphill • Using crutches	**Aerobic exercise:** • Fast walking (5-8 kmh) • Combination of jog & walk (<10 minutes jogging) • Stationary bicycle • Elliptical machine • Slow- moderate swimming • Water-based aerobics **Resistance training, (vigorous effort)** • Weight training
High	• Rope skipping • Marathon, mountain biking • Football, hockey, martial arts, rugby, rollerblading, volleyball • Track & field	• Carrying load up stairs • Heavy carpentry/ farming • Farming vigorously • Fire fighting • Commercial fishing • Factory work	• Fast stair climbing • Hiking cross country	**Aerobic exercise:** • Jog/ run >8 km/hr • Vigorous swimming or calisthenics • Stair-treadmill

**Adapted from Ainsworth BE, Haskell WL, Hermann SD et al. The Compendium Of Physical Activities Tracking Guide. Healthy Lifestyles Research Centre, College of Nursing & Health Innovation, Arizona State University.*

Table 10: Recommendation of PA in Adult for CVD Prevention

PA type	Starting point	PA Goal	
Aerobic activity	1. Identify current aerobic PA & its **intensities** (see table 9). 2. Total up weekly **duration** of PA engagement. 3. Start with 60 min/ week of PA time, this can be broken down to daily, 3 days/ week or once-a-week **commitment** (i.e. 10 minutes daily; 20 minutes every other day) 4. In **unfit or inactive** individuals it is recommended to start with low intensity PA, 60 min/ week at a time commitment they can sustain.	Aim for: **Frequency**: 3 or more days/ week **Intensity**: moderate intensity aerobic PA **Duration**: 150 min/ week	Additional benefits for weight loss and lipid control can be gained by increasing aerobic PA to 250- 450min/ week moderate intensity or 150min/ week high intensity PA
Strength training	1. Identify any ongoing orthopaedic or musculoskeletal (MSK) issues. 2. Identify contraindications for strength training: • Unstable angina • Uncontrolled hypertension (systolic blood pressure ≥160 mm Hg and/or diastolic blood pressure ≥100 mmHg) • Uncontrolled dysrhythmias • Unevaluated/ symptomatic congestive heart failure • Severe stenotic or regurgitant valvular disease • Hypertrophic cardiomyopathy 3. Candidates for strength training should be involving in moderate intensity aerobic PA for at least 4 weeks.	Aim for: 2-3 sets 8–12 repetitions 60–80% individual's 1 repetition maximum 2 days/week or more Whenever possible, refer to **physiotherapist** or in cases of established CVD to **cardiac rehabilitation (CR) team** for assessment & prescription of exercises. Indicate concomitant orthopaedic/ MSK conditions.	Strength training helps in lipid and BP control plus increase insulin sensitivity in combination with aerobic exercise. It stimulates bone formation, reduces bone loss, preserves and enhances muscle mass, strength, power and functional ability.
Flexibility exercises	1. Identify any ongoing orthopaedic or MSK issues. 2. Flexibility training complements aerobic exercises and should be done during cool down phase after aerobic activities. 3. Start at 3 sets of 15 seconds stretch of key muscles as tolerable.	Aim for: 5 sets 30 seconds stretch Full joint ROM 2-3 days/ week Breathe normally Refer to **physiotherapist or CR team** for exercise prescription	Lack of flexibility in the elderly contributes to reduce ability to perform activities of daily living. Adequate joint ROM is required for optimal musculoskeletal function.

Table 11: Practical Physical Activity Tips

- Spend 10 minutes a day walking up and down the stairs.
- Walk five minutes for a least every two hours. Desk job workers, you will get extra 20 minutes by end of the day.
- Make one social outing per week an active one eg bowling, bike ride, badminton match, nature walk.
- Hook on a step tracker, and aim for an extra 1,000 steps a day
- Wash something thoroughly once a week. Scrub your bathroom tiles, floor, couple of windows, or your car for at least 30 min will burn 120 kcal. Equivalent to half-cup of vanilla frozen yogurt.
- Walk an extra mile. Park your car further away.
- Walk while talking on a phone.
- Reduce 1 hour of screen time (ipad/ tv/ video/or social media)

Selected Physical Activity That Able To Burn 500 Calories

Physical activity	Duration	
	Male (75 kg)	Female (55 kg)
Cycling (21km/h)	50 minutes	1 hour 10 minutes
Jogging (9.6km/h)	1 hour	1 hour 20 minutes
Football	1 hour	1 hour 20 minutes
Basketball	1 hour 10 minutes	1 hour 30 minutes
Volleyball	1 hour 15 minutes	2 hours
Ballroom dancing	1 hour 15 minutes	2 hours
Simple household chores	1 hour 40 minutes	2 hours 40 minutes
Walking (3.2km/h)	1 hour 50 minutes	2 hours 35 minutes

Reference:
Ainsworth, B. E., Haskell, W. L., Whitt, M. C., et al. 2000. Compendium of physical activities: an update of activity codes and MET intensities. Med. Sci. Sports Exerc., 32(9) S498 – S516

8.3 Smoking Intervention

Cigarette smoking is a major cause of CVD[99,432-434]

- Tobacco smoking and exposure to secondhand smoke together are responsible for about 6.3 million annual deaths worldwide.[432]
- Smoking accounted for 33% of all deaths from CVD and 20% of deaths from IHD in persons ≥35 years old.[39]

Smoking is an independent risk factor for CVD[40]

- It also interacts with other CV risk factors, such as glucose intolerance and low serum levels of HDL-C in a multiplicative manner.[40,435,436] Examples:
  - The presence of smoking alone is reported to double the level of risk, but the simultaneous presence of another major risk factor is estimated to quadruple the risk (2 × 2).[40]
  - The presence of two other risk factors with smoking may result in approximately eight times the risk (2 × 2 × 2) of persons with no risk factors.[40]

Smoking is an important cause of plaque rupture leading to ACS.[80] Data from the NCVD-ACS Registry showed that 18.8% in 2007-2009, and 23% in 2010-2012 of patients were smokers.[6] In the INTERHEART study, a dose response relationship was demonstrated between the number of cigarettes and MI, where smokers who smoked >40 cig/day were found to have a 9-fold relative risk of MI compared with non-smokers.[437]

Changing cigarette designs such as filtered, low-tar, and "light" variations, have not reduced overall disease risk among smokers.[40]

I,B Stopping smoking after an MI is the most effective prevention measure.[39,40] There is significant reduction on morbidity within the first 6 months of quitting and the risks of CVD almost equals the risk of never smokers after 10-15 years of cessation.[40,434]

8.3.1 Smoking Cessation Interventions

A person with nicotine dependence develops both physiological and psychological dependence, i.e. tolerance, physical dependence, and a withdrawal syndrome when stopping smoking.[438]

Cigarette smoking is a learned behavior that becomes part of the daily routine of a smoker and is often used to cope with stress, anxiety, anger, and depression.[439] Thus, an effective smoking cessation strategy should include physiological and psychological intervention, and pharmacotherapy.

I,B Many studies have shown that a combination of these methods is a more effective smoking cessation strategy.[440-443]

A meta-analysis showed that abrupt cessation and smoking reduction produced comparable quit rates in smokers.[444]

8.3.1.1 Psychosocial counselling

Psychosocial counselling interventions range from brief counselling by the physician to intensive, cognitive-behavioral counselling interventions over several weeks.

The efficacy of behavioral counselling interventions for smoking cessation has a dose-response relationship; that is, the efficacy increases with increased intensity and duration of the program.[442,443]

The most successful counselling interventions for cardiac inpatients include high-intensity baseline counselling with sustained contacts after discharge for prevention of relapse. However, even with the most successful counselling interventions, at least 40% of smokers who have cardiac disease, resume smoking within one year.[445] Guidelines for smoking cessation recommend the addition of pharmacotherapy to counselling as pharmacotherapy has the potential to improve smoking cessation rates in smokers with CVD.[440-443]

I,B The committee recommends that these patients be referred to the MQuit Services. Currently this smoking cessation service is being implemented at all health clinics throughout the country, selected pharmacies and online. More information is available at www.JomQuit.com.my

8.3.1.2 Pharmacotherapy

The approved pharmacotherapy for tobacco dependence (first-line therapies) are:[440-443]

- **Nicotine Replacement Therapy (NRT)**
  - There are 5 types of NRT (gum, transdermal patch, nasal spray, vapour inhaler, and lozenge)
  - The choice of the NRT will depend on:[420]
    - Clinician familiarity with the product
    - Patient preferences
    - Contraindications – e.g. history of depression, concerns about weight gain
  - The patch features a slow (2–3 hours) onset with steady levels over a 16- or 24-hour period which provides long-term relief of withdrawal symptoms.[446]
  - The disadvantage is the inability of users to self-titrate their nicotine levels in the way they had while they were smoking.[446]
  - The remaining four NRT products feature a more rapid onset, but shorter duration of action, requiring repeated administration to maintain patient comfort and relief from withdrawal symptoms.[446]
  - A combination of short- and long-acting NRT products are more effective than using a single NRT product.[446]
  - NRT is safe in patients with CVD.[447-449]
- **Varenicline**
  - Clinical trials report varenicline to be superior to bupropion in promoting smoking cessation, and prolonged administration has been shown to reduce relapse in smokers who had been abstinent 12 weeks after initial therapy[446]
  - A meta-analysis conducted by FDA found that the risk of a major CV end point with varenicline was low but advised that physicians weigh the risks of varenicline against the benefits of its use.[450]
- **Bupropion (sustained-release)**
  - This drug, an anti-depressant, is also a recommended therapy for smoking cessation. However, in Malaysia, its use for this purpose is off label
  - The major risk of bupropion is that it lowers a person's seizure threshold. There is a risk of about 1 in 1000 of seizures associated with bupropion use.[445]

There is no evidence to support the use of alternative therapies such as acupuncture or hypnosis for smoking cessation.[443]

8.3.2 Environmental Tobacco Smoke

Environmental Tobacco Smoke is the smoke that fills homes, restaurants, offices or other enclosed spaces when people burn tobacco products such as cigarettes, bidis and water-pipes.[85]

I,B There is no safe level of exposure to second-hand tobacco smoke.[85]

Non-smokers exposed to second-hand smoke increase their risk of developing:[85]

- CHD by 25-30%
- Stroke by 20-30%
- Lung cancer by 20-30%

8.3.3 Electronic Cigarettes

Electronic cigarettes (e-cigarettes) are battery-operated devices that simulate combustible cigarettes by heating nicotine and other chemicals into a vapour that is inhaled.

The prevalence of e-cigarette users in Malaysia in 2015, was found to be 3.2% and 10% of the regular users were reported to be <18 years old.[452] The prevalence of shisha smoking among students was reported to be about 30%.[453]

The long-term safety of e-cigarette and shisha smoking is however unknown.

The latest report of the US Surgeon General states that:[454]

E-cigarette aerosol is harmful.[453]

- The use of products containing nicotine poses dangers to youth, pregnant women, and fetuses.
- Nicotine exposure during adolescence can cause addiction and can harm the developing adolescent brain.

III,B The use of e-cigarettes and shisha are not recommended.

Key messages:

- Smoking is an independent and strong cause of CVD.
- There is no safe level of exposure to second-hand tobacco smoke.

Recommendations:

- Smoking should be strongly discouraged and individuals should be referred to the MQuit smoking clinics.

8.4 Obesity and Body Weight

The NHMS 2015 showed that about 30.0% and 17.7% of adults over the age of 18 years were overweight and obese respectively by the WHO criteria.[9] (Table 12, pg 79) This is a significant increase compared to 1996, when only 16.6% and 4.4% were overweight and obese.[456] The Malaysian NCVD-ACS Registry 2011-2013 showed that 76.5% of subjects who underwent PCI for ACS were either overweight or obese.[6]

Obesity increases the risk of:[115,457-459]

- All-cause mortality about 20%.
- Overall CV mortality by 50%.
- CHD mortality by about 50% in women and about 60% in men.

Every 5 kg/m² higher BMI, was associated on the average with a 30% higher overall mortality and 40% increase for vascular mortality.[115] In morbid obesity (BMI ≥40 kg/m²) CV mortality is increased by 200% to 300%.[460]

I,B Modest weight loss of between 5 to 10%, can reduce BP, improve glycaemic control, lipid profile, and quality of life.[461]

Table 12: Classification of weight by BMI*

Classification	BMI(kg/m²)	Risk of co-morbidities
Underweight	<18.5	Low (but increased risk of other clinical problem)
Normal range	18.5-22.9	Optimal
Overweight	≥23.0	-
• Pre Obese	23.0 – 27.4	Increased
Obesity	>27.4	-
• Obese I • Obese II • Obese III	27.5-34.9	High
	35.0-39.9	Very High
	≥40.0	Extremely high

**Clinical Practice Guidelines on Management of Obesity.Malaysia: Ministry of Health Malaysia, Academy of Medicine of Malaysia, Malaysian Association for the Study of Obesity, Malaysian Endocrine and Metabolic Society;2004.*

Waist circumference:

- Is an indirect measure of visceral adiposity.
- Is a stronger predictor of diabetes, CHD and all-cause mortality than BMI.[462-464]
- Should be used in conjunction with BMI to identify CV risk.[465]

I,A

- Cutoffs for men <90 cm and for women <80 cm should be used.[465]

8.4.1 Management of Overweight and Obesity

Weight loss is a challenge and preventing weight regain after weight loss may be even more difficult.

I,B The goals of therapy are to achieve 5 to 10% weight loss[461,466-470] and to maintain this over a period of 1-2 years before attempting further weight loss.

I,C The following individuals should be considered for referral to a specialist obesity clinic for futher weight management:

- Obese individuals with BMI >35 kg/m².
- Those with existing co-morbidities and BMI >32 kg/m².

8.4.1.1 Non-pharmacological Interventions

I,B Weight-loss strategies include:

- Dietary interventions:
  - Negative deficit of 500 calories is a practical initial target and easily implemented. This results in weight loss of 0.5 kg/week.
  - For a greater weight loss, calories restriction of 1200 to 1500 kcal/day is recommended.[467] This can be achieved by using meal replacement or calorie counting.
  - Calories restriction 400-800 kcal/day has to be clinically supervised.
  - Nutritional counselling is highly recommended to maintain long term adherence. (Appendix 11, pg 176 for tips on losing weight)

I,B

- Physical Activity is important to maintain the weight loss (Appendix 11, pg 176, Tables 9&11, pg 72 & 74).
  - PA is recommended to be started slowly for unfit persons and to increase gradually each week, such as starting at 60 minutes per week and slowly increase to 150 min per week.
  - For weight loss, increased PA of approximately 250 to 450 minutes of moderate-intensity PA per week, including strength training 2 to 3 times per week is required.[471]

I,B

- Behavioural modifications
  - Multiple behavioral strategies such as self-monitoring of eating habits and PA is necessary to maintain the lifestyle intervention.[472]
  - In primary care, however, behavioural weight loss interventions yield very small reductions in body weight.[473]

8.4.1.2 Pharmacological Interventions

Drug therapy should be considered for overweight and obese people with:[474]

- BMI >25.0 kg/m^2 plus 2 CV risk factors or
- BMI ≥ 27.0 kg/m^2 after failing to lose weight despite 6 months of lifestyle modification.

Two anti-obesity drugs that are available locally are:[475-479]

IIa,B

- Sympathomimetic (Phentermine) – this drug should not be used continuously for longer than 6 months at any one time.
- Lipase Inhibitor - Orlistat
- Glucagon-like peptide 1 Receptor Agonist - Liraglutide[479]

Anti-obesity drugs may enhance weight loss by an additional 3-5%. In addition, the use of Orlistat in obese individuals had shown a reduction in diabetes incidence by 37.3% with a mean weight reduction of 5.8 vs 3.0 kg compared to placebo.[476]

8.4.1.3 Bariatric Surgery

Bariatric surgery is currently the most effective method for attaining significant and sustainable weight loss. It is recommended when lifestyle and pharmacological interventions have failed in the severely obese patients. There may be a role for bariatric/metabolic surgery in reversing metabolic abnormalities such as glucose intolerance, hypertension and dyslipidemia in the obese.

I,A

The Asian Consensus Meeting on Metabolic Surgery (ACMOMS) recommends that bariatric surgery be considered as a treatment option for obesity in Asians if BMI:[480]

- >35 kg/m^2 with or without co-morbidities.
- >32 kg/m^2 with co-morbidities.
- >30 kg/m^2 if central obesity + 2 CV risk factors.

It is essential that a comprehensive evaluation be performed by a multidisciplinary team consisting of medical, surgical, psychiatric, rehabilitation physician and nutritional expertise prior to surgery. This is important to minimize the complications of surgery and to maintain weight loss post-surgery.

Following bariatric surgery, mean excess weight loss is 61.2%, ranging from 47% for gastric banding to 70% for gastric bypass.[481] Sleeve gastrectomy appeared to be more effective in weight loss than adjustable gastric banding and comparable with gastric bypass.[482]

In addition to the weight loss, there is improvement in CV risk factors.[479,481-489] CV events and mortality.[492–496]

Risks of complication, reoperation and death post bariatric surgery is small but do exist.[482] Long term follow up is needed in a person who has undergone bariatric surgery since nutritional complications can occur especially following the malabsorptive procedure.[497]

Key messages:

- Overweight and obese individuals should be counselled that lifestyle changes can produce a 5-10% rate of weight loss that can be sustained over time and that this can be associated with clinically meaningful health benefits.
- Bariatric surgery may be considered as a treatment option for obesity if BMI:
  - >35 kg/m^2 with or without co morbidities.
  - >32 kg/m^2 with co-morbidities.
  - >30 kg/m^2 if central obesity + 2 CV risk factors
- Bariatric surgery has been shown to improve CV risk factors, CV events and mortality.

Recommendation:

- For weight loss, in addition to dietary intervention, adults should engage in 150–420 minutes of moderate-intensity physical activity per week.

9. Management of Individual Risk Factors

In the primary prevention of CVD, the emphasis should be on the assessment and management of the global risk of the individual and not solely concentrating on individual risk factors. The global CV risk can be calculated using many different CV risk calculators. The risk calculator that has been validated in our local population is the Framingham General CV Risk Calculator for primary care.[31] (Tables 1-3, pg 18-20), Appendix 2, pg 166-167.

9.1 Hypertension

The NHMS 2015 showed that the prevalence of hypertension among adults 18 years old and above is 30.3%.[9] It is now estimated that there are 6.4 million individuals with hypertension in Malaysia. According to NHMS 2011, almost two thirds (61%) of individuals with hypertension in Malaysia were unaware they were having hypertension.[498] Of all patients with hypertension and on treatment, only 35% of them achieved target BP.[498] With the anticipated doubling of CVD burden especially in the developing world in the next few decades, it is imperative that major risk factors like hypertension be optimally managed.

9.1.1 Preventing Hypertension

9.1.1.1 The Population Approach

The objective is to prevent hypertension by lowering the average BP by a relatively small amount across a whole population. In a study done in UK, it was estimated that a reduction in SBP as low as 2 mmHg could prevent >14,000 deaths per year.[499] By encouraging enough people to change their lifestyles sufficiently to lower their BP, large numbers are shifted to below the threshold for hypertension (140/90 mmHg).[499]

The main lifestyle changes required to achieve this are:

- Reducing the population average intake of salt to 5 g per day (65-75% of salt intake is from processed foods)[500] (Appendix 9, pg 174 for salt content of common Malaysian food)
- Increasing potassium intake by increasing fruit and vegetable intake to at least five portions a day
- Controlling weight to achieve a 5-10% weight loss in overweight or obese people
- Increasing habitual PA to a total of at least 30 minutes a day of at least moderate-intensity activity, on five or more days of the week for adults, and at least 60 minutes each day for children

- Avoiding alcohol or controlling alcohol intake within recommended benchmark limits for either sex

9.1.1.2 The 'At-risk' Individual or Group Approach

This approach focuses on people known to be at higher risk of developing hypertension than the general population. This includes:
- Those with a family history of hypertension.
- Obese individuals.
- Older people (>65 years).
- Presence of other CV risk factors.

9.1.2 Managing Hypertension for the Prevention of CVD

Reducing BP to target values will result in a reduction in CV events in both primary and secondary prevention.[37,107,499,501]

The objectives of treatment are:[37]
- Preventing the complications of hypertension by reducing BP to target levels and
- Reducing the global CV risk of the individual by detecting and correcting other CV risk factors simultananeously.

As far as possible, this should be achieved without causing the individual adverse effects from medications or other interventions.

Once hypertension is diagnosed, the patient should be risk stratified (Table 14, pg 86) and staged accordingly. (Table 13, pg 86) The algorithm for management of hypertension is in Fig 1, pg 87.

All patients should be counselled on non-pharmacological measures as outlined in Section 9.1.1.

Drug treatment should be instituted at the outset in the following scenario:[37]
- Stage 2 hypertension or beyond (SBP ≥160 and or DBP ≥100 mmHg)
- Presence of target organ damage (left ventricular hypertrophy, microalbuminuria)
- Patients with moderate, high and very high CV risk (Table 14, pg 86)

In primary prevention, it is the reduction of BP per se which provides the main benefits. All drug classes are equally effective.[107,501]

9.1.2.1 Stage 1 Hypertension

In patients with stage 1 hypertension, treatment should be started with a single drug at low dose. If after a sufficient period of treatment (up to six weeks) with monotherapy, BP is still not controlled, there are three options:

- The dose of the initial drug can be increased
- The drug can be substituted with another class of drug
- A second drug can be added

Increasing the dose of the initial anti-hypertensive agent or adding a second agent is preferred if the patient shows response to the initial drug but target BP is not achieved. Increasing the dose of the initial drug to the maximal dose, may however give rise to dose-related adverse effects.

Properly selected anti-hypertensive combinations may also mitigate the adverse effects of each other. To improve compliance, a single pill combination drug may be considered. If the patient does not show response or does not tolerate the initial drug, drug substitution is recommended.

9.1.2.2 Stage 2 Hypertension and Higher

In patients presenting with stage 2 hypertension or beyond, combination therapy is recommended. Efforts should be made to reach target BP. (Table 4, pg 21)

In general, once the BP is controlled, most patients will require life-long treatment.

9.1.2.3 Resistant Hypertension

This is defined as BP still >140/90 mmHg with three drugs, inclusive of a diuretic, at near maximal doses. The possible causes of resistant hypertension include:

- Medication non-adherence
- Secondary hypertension
- White coat hypertension
- Excessive sodium intake, excessive liquorice intake and drug interactions.
- Complications of long standing hypertension such as nephrosclerosis, loss of aortic distensibility and atherosclerotic renal artery stenosis.

9.1.2.3.1 Management of Resistant Hypertension

In these patients:

- Secondary causes of hypertension should be excluded
- A 4th anti-hypertensive agent should be added. This would include either/or:
  - β-beta blockers.
  - Spironolactone.
  - α-blockers.
  - Combined α and β-blocker.
  - Vasodilators.
- Referral to a specialist is often necessary.

Table 13: Criteria for Staging Hypertension Based on Clinic, Home and Ambulatory Blood Pressure Monitoring

Category	Clinic BP (mmHg)	Home BP Monitoring Average or Ambulatory BP Daytime Average (mmHg)
Stage I Hypertension	≥140/90	≥135/85
Stage II Hypertension	≥160/100	≥150/95
Severe Hypertension	SBP ≥180 or DBP ≥110	-

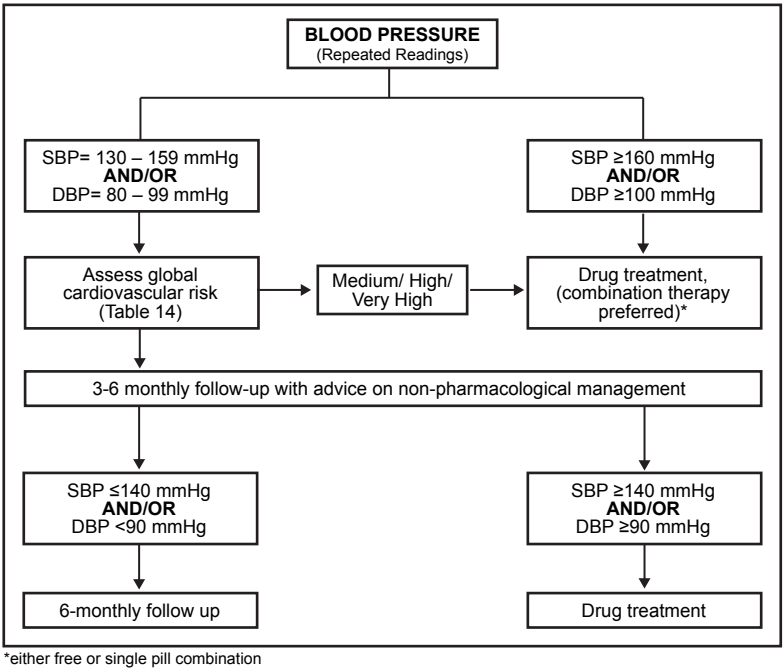
*Adapted from National Institute for Health and Clinical Excellence (NCE) Hypertension, 2011
[Available at: www.nice.org.uk/guidance/CG127 (accepted 8th September 2013)]

Table 14: Risk Stratification*

Co-existing Condition / BP Levels (mmHg)	No RF No TOD No TOC	TOD or RF (1-2) No TOC	TOC or RF (≥3) or Clinical atherosclerosis	Previous MI or Previous stroke or Diabetes
SBP 130 – 139 and/or DBP 80 – 89	Low	Medium	High	Very high
SBP 140 – 159 and/or DBP 90 – 99	Low	Medium	High	Very high
SBP 160 – 179 and/or DBP 100 – 109	Medium	High	Very high	Very high
SBP >180 and/or DBP>110	High	Very high	Very high	Very high

TOD = Target organ damage (LVH, retinopathy, proteinuria)
TOC = Target organ complication (heart failure, renal failure)
RF = additional risk factors (smoking, TC > 6.5 mmol/L, family history of premature vascular disease)
Clinical atherosclerosis (CHD, carotid stenosis, peripheral vascular disease, transient ischaemic attack, stroke)
** Malaysian Clinical Practice Guidelines on Hypertension, 4th ed, 2013*

Figure 1: Algorithm for the Management of Hypertension



*either free or single pill combination

Recommendation:

- Once hypertension is diagnosed, the patient should be risk stratified (Table 13, pg 86) and staged accordingly. (Table 14, pg 86) The algorithm for management of hypertension is in Fig 1, pg 87.
- All patients should be counselled on non-pharmacological measures.(Section 9.1.1.)
- Drug treatment should be instituted at the outset in the following scenario:[37]
  - Stage 2 hypertension or beyond (SBP ≥160 and/ or DBP ≥100mmHg)
  - Presence of target organ damage (left ventricular hypertrophy, microalbuminuria)
  - Patients with moderate, high and very high CV risk (Table 14, pg 86)
- In primary prevention, it is the reduction of BP per se which provides the main benefits. All drug classes are equally effective.

9.2 Dyslipidaemia

Elevated cholesterols (especially LDL-C) is an important CV risk factor. Studies done in western countries and in New Zealand have shown that the biggest benefits with regards reduction in CHD mortality using the Scottish CHD mortality model, have come from reductions in smoking.[24] However, in the UK, reductions in cholesterol seem to have even greater potential to further reduce CHD mortality rates.[25]

Importantly, it was estimated that population CHD mortality is reduced more by a 1% relative reduction in cholesterol than by a 1% relative reduction in population mean BP or smoking prevalence.[25]

9.2.1 Management

Numerous studies have conclusively shown that LDL-C reduction leads to a reduction in CV mortality and CVD.[108-123] A 1 mmol/L reduction in LDL-C reduces vascular mortality by 22%.[502] Statins have consistently been shown to be beneficial in both primary and secondary prevention.[108-123]

Observational studies indicate that a low HDL-C and raised TG are associated with adverse CV outcomes.[503-505] However interventional trials that increase HDL-C and/or reduce TG levels have not shown any CV benefit.[506-510]

9.2.2 Targets of therapy

I,A LDL-C is the primary target of therapy.[108-123,502]

I,A The target LDL-C level will depend on the individual's global risk. (Table 3, pg 20)

Both the absolute on treatment LDL-C level and the percentage LDL-C reduction achieved have been found to correlate with the observed CV benefits.[113,510-515] (Table 15, pg 90)

Non-HDL-C may be considered as a secondary target when treating patients with:

- Combined hyperlipidaemias
- Diabetes
- Cardiometabolic Risk
- CKD

In measuring lipid levels:

- A standard lipid profile includes measurement of plasma or serum TC, LDL-C, HDL-C and TG.
- LDL-C is usually calculated by the Freidewald equation which is not valid in the presence of elevated TG (TG >4.5 mmol/L).
- Both fasting and non-fasting samples may be used for lipid measurement.[516]

All individuals should be risk stratified using Table 3, pg 21. The target lipid levels will depend on their CV risk (Table 15, pg 90). In individuals who are **Very High** Risk and **High** Risk, drug therapy should be initiated at the same time as therapeutic lifestyle changes. (Table 16, pg 90). Statins are the drugs of choice because they have been the most well studied and have been consistently shown to be safe and effective.

In patients at **Low** and **Intermediate (Moderate)** Risk, the emphasis should be on therapeutic lifestyle changes. (Section 8). If target goals are not achieved, statins may be initiated after discussion with the patient.

Table 15: Target LDL-C Levels

GLOBAL RISK	LDL-C Levels to initiate Drug therapy (mmol/L)	Target LDL-C levels (mmol/L)
Low CV Risk*	clinical judgement**	<3.0
Intermediate (Moderate) CV Risk*	>3.4 **	<3.0
High CV risk ➢ > 20% 10-year CVD risk ➢ Diabetes without target organ damage, ➢ CKD with GFR 30-<60)	> 2.6	**≤2.6 or a reduction of >50% from baseline*** **
Very high CV risk ➢ Established CVD, ➢ Diabetes with proteinuria ➢ CKD with GFR <30 but not dialysis dependent)	>1.8	**<1.8 or a reduction of > 50% from baseline*** **

**Low and Intermediate (Moderate) CV risk is assessed using the Framingham General CVD Risk Score[31]*
***After a trial of 8-12 weeks of Therapeutic Lifestyle Changes (TLC) and following discussion of the risk: benefit ratio of drug therapy with the patient*
****whichever results in a lower level of LDL-C*

Table 16: Lipid Modifying Therapy for Dyslipidemia

The Primary Target of Therapy is LDL-C:
The target will depend on the Individuals' CV Risk (Table 1 & 2, pg 18-19)

Pharmacotherapy	Indication	Grade of Recommendation, Level Of Evidence
Statins	Very High and High CV Risk	I,A
	Intermediate (Moderate) and Low CV risk*	I,A
Statins + ezetimibe	Failure to achieve LDL-C goals	I,B
Statins + PCSK-9 inhibitors	Familial hypercholesterolemia	I,A
	Failure to achieve LDL-C goals	IIa,B
Statins + fibrates	Diabetic patients on maximally tolerated statins who have achieved the LDL-C target but have low HDL-C and high TG	IIb,B
Ezetimibe	Statin intolerance	IIa,C
PCSK-9 inhibitors	Very High and High CV risk with statin intolerance	IIa,B
Fibrates	Very High TG despite non-pharmacological measures	IIa,C

**After Therapeutic Lifestyle changes*

Recommendation:

- Both fasting and non-fasting samples may be used for lipid measurement
- LDL-C is the primary target of therapy
- All individuals should be risk stratified using Table 3, pg 20. The target lipid levels will depend on their CV risk (Table 15, pg 90).
- In individuals who are **Very High Risk** and **High Risk**, drug therapy should be initiated at the same time as therapeutic lifestyle changes. (Table 16, pg 90).
- Statins are the drugs of choice.
- In patients at **Low** and **Intermediate (Moderate) Risk**, the emphasis should be on therapeutic lifestyle changes. (Section 8).

9.3 Prediabetes and Diabetes Mellitus (type 2 and type 1)

9.3.1 Prediabetes

9.3.1.1 Definition

Prediabetes is a condition when blood glucose levels are higher than normal but below diabetic thresholds.

It includes any of the following categories: (Table 17, pg 93)

- Impaired fasting glucose (IFG) – FBG: 6.1-6.9 mmol/L
- Impaired glucose tolerance (IGT) – 2-hour post load glucose level following oral glucose tolerance test (OGTT) with 75 gm oral glucose between 7.8 – 11.1 mmol/L
- Prediabetes – A1c: >5.6 to <6.3%

9.3.1.2 Epidemiology

In general, the proportion of individuals with prediabetes tends to be equal or greater than that of diabetes in any studied population.[517]

Based on the Metabolic Syndrome Study of Malaysia (MSSM) 2008 the prevalence of prediabetes (based on the OGTT) among adults above the age of 18 years was 20% while that of diabetes was 22%.[518]

9.3.1.3 Prediabetes as a Risk Factor for CVD

Existing evidence indicates that:

- There is a linear relationship between blood glucose levels and CVD.[519]
- The risk of CVD is almost 2 fold in subjects with prediabetes compared to those with normal OGTT.[520]
- All-cause and CVD mortality is significantly increased in individuals with IGT but not with IFG.[520]
- At A1c values below the diabetic range (5.7 - 6.3%) there is an increased risk for CHD, stroke and death.[521]

9.3.1.4 Diagnosis

Screening can be done by measuring capillary blood glucose levels using glucometers. If the test is positive (random capillary blood glucose ≥7.8 or fasting ≥ 5.6 mmol/L), a confirmatory test can be performed by one of the following methods:

- OGTT with 75 grams of glucose
- FBG
- A1c

If A1c is used for the diagnosis of prediabetes, it is best that the test is followed by an OGTT to classify individuals into either IFG, IGT or combination of both. This has prognostic significance in terms of the risk of developing CVD and conversion to full blown diabetes.[520]

Table 17: Diagnosis of Prediabetes and Diabetes

Based on OGTT		
Category	**0 hour (fasting*)**	**2 hour**
Normal	<6.1	<7.8
IFG	6.1-6.9	-
IGT	-	7.8-11.0
Diabetes	≥7.0	≥11.1
	Based on A1c	**Based on blood glucose levels**
Normal	< 5.6%	-
Prediabetes	5.6 to <6.3%	-
Diabetes	≥6.3%	≥7.0 (fasting) ≥11.0 (random)

**fasting of at least 10 hours*

9.3.1.5 Who Should be Screened?

Table 18: Who Should be Screened for Prediabetes

A. Women with a history of gestational diabetes mellitus (GDM)
B. Adults who are overweight or obese (BMI ≥23 kg/m^2 or waist circumference ≥80 cm for women and ≥90 cm for men) with ANY of the following:
   - History of CVD
   - First-degree relative with diabetes
   - Hypertension (BP ≥140/90 mmHg or on therapy for hypertension)
   - HDL-C <0.9 mmol/L or TG >2.8 mmol/L
   - Women who delivered a baby weighing ≥4 kg
   - Those who were born from mothers with GDM
   - Other endocrine conditions associated with insulin resistance e.g:
     - Polycystic ovarian syndrome (PCOS),
     - Cushing's syndrome,
     - Acromegaly,
     - Phaeochromoytoma,
     - Presence of acanthosis nigricans etc
   - Physical inactivity & sedentary lifestyle
   - Those who are receiving long-term treatment with any of the following medications:
     - Antiretroviral therapy (Level II-1)
     - Atypical antipsychotic drugs (Level II-2)
     - Corticosteroids
     - Thiazide diuretics
     - β-blockers
     - Statins

In those without the above risk factors, testing should begin at the age of 30 years. If tests are normal, screening should be done annually (Section 9.3.1.4).

Modified from American Diabetes Association (ADA) Position Statement on Standards of Medical Care in Diabetes–2017

9.3.1.6 Management

With proper management of prediabetes, progression to diabetes can be delayed. However, this has not been shown to reduce CVD.[522-524]

Interventions that can prevent the development of diabetes include:

I,A
- **Lifestyle Measures[38]:**
  - Are the mainstay of therapy.
  - Have greater efficacy than pharmacological intervention and are practical and cost effective.
  - Have shown long-term effects on prevention of diabetes beyond the period of active intervention.
  - Consists of a modest 500 kcal reduction in total caloric intake per day resulting in a desired weight loss of 0.5 kg per week.
  - Includes moderate intensity physical activity of 150 mins a week.
  - Aims for a modest target weight loss of 5-7% of body weight over a 6-month period.
  - May include food with low GI and high in fibre to help reduce post-prandial hyperglycemia. (Appendix 5-7, pg 170-172)
  - CHO counting and meal replacement strategies are proven to help patients control their blood glucose levels as well as their weight.
- **Pharmacotherapy:**

In addition to lifestyle intervention:

I,A
- Biguanides (Metformin) can be considered for those at very high risk of developing diabetes. These include:[522,525,526]
  - Combined IFG & IGT,
  - IGT + obesity (BMI >35 kg/m^2),
  - IGT + <60 years old,
  - Previous history of GDM or for
  - Those who failed lifestyle therapy after 6 months
- The Biguanide (Metformin) is the only drug that has been endorsed widely[527,528]

I,B
- Other pharmacological interventions include:
  - Alpha-Glucosidase inhibitors (Acarbose) – this showed a 95% reduction in CVD in one study[529]
  - Lipase Inhibitors - Orlistat[476]
  - Thiazolidinediones - Rosiglitazone/Pioglitazone[530,531]
  - Glucagon-like peptide 1 Receptor Agonist - Liraglutide[479]

Other CV risk factors should also be managed appropriately in accordance with guidelines.

9.3.2 Diabetes

The diagnosis of diabetes is conventionally based on FBG, 2-hour post load/challenge with 75 gm oral glucose or A1c values that correspond to the onset of microvascular complications, namely retinopathy. However, it is known that the risk of CVD starts to increase at a much lower level of blood glucose compared to the onset of diabetic retinopathy (Section 9.3.1.3).[521]

9.3.2.1 Epidemiology

According to the NHMS 2015, the prevalence of diabetes in adults above the age of 18 years was 17.5%.[9] In addition:[9,541,533]

- The prevalence in the 20-24 year age group was 5.9%. (Table 7, pg 28)
- The prevalence was highest in the Indians (22.1%) followed by Malays (14.6%) and Chinese (12.0%).
- More than half (53%) of those with diabetes were unaware of their diagnosis.
- The percentage of undiagnosed diabetes was highest among the Malays (64%) followed by the Chinese (52%) and the Indians (42%).
- Of concern is the proportion of undiagnosed diabetes among those below the age of 30 years (88%).
- Only 23.8% of patients in primary care and 12.7% in tertiary institutions were able to achieve their A1c targets.

9.3.2.2 Diabetes & CVD

The metabolic milieu of diabetes comprises mainly of but not limited to insulin resistance, reduced insulin secretion and/or their combination. These are responsible for endothelial dysfunction, increased platelet reactivity and inflammation; factors that trigger and aggravate atherosclerotic vascular disease and thrombosis.[534]

The higher mortality and complication rates seen in diabetic patients appear to be multifactorial. Diabetes is associated with:[535]

- Severe coronary artery disease.
- Systolic left ventricular dysfunction.
- Autonomic neuropathy.
- Larger infarct size.

These result in a higher risk of death when diabetics have an acute coronary event. It also increases their risk of recurrent CV events and other long-term complications such as heart failure and sudden death.[536]

9.3.2.3 Definition, Classification and Diagnosis

Diagnosis of diabetes can be made by measurement of: (Table 17, pg 93)
- FBG
- 2-hour blood glucose level post 75-grams of oral glucose
- A1c level

For symptomatic individuals, 1 abnormal result is sufficient to make the diagnosis. In asymptomatic individuals, the abnormal test result should be repeated on a different day to confirm the diagnosis.

9.3.2.4 Specific Measures for Primary Prevention of CVD in Diabetes

Patients who have diabetes >10 years duration or above the age of 40 years:
- Should be on statin therapy regardless of their lipid level[80,81,537]
- Aspirin is not routinely recommended[538,539]
- The other CV risk factors should be treated to target (Table 7, pg 28)

9.3.2.4.1 Severe Hypoglycaemia as a Predictor of Subsequent CV Events

Hypoglycaemia is the most common acute complication of insulin secretagogues such as sulphonylureas and meglitinides and insulin therapy. It may affect daily activities and is a hindrance to tight glycaemic control. Hypoglycaemia is classified as severe when it requires a third-party assistance to correct it.

Individuals with severe hypoglycaemia are at a very high risk of developing CVD. Severe hypoglycemia:
- Has been shown to be associated with subsequent increased risk of a CV event; 9-20% in the next one year and as high as 49-80% over the next 4-7 years.[540-542]
- Could either contribute to the adverse outcomes or it may just be a marker of vulnerability to such events.[541]

Patients with more than a 10-year history of diabetes who have been hospitalised for hypoglycaemia should have the following performed:

- Anti-diabetic medications should be adjusted to reduce the risk of hypoglycaemia.
- Glycemic target if necessary should be less stringent.
- Their overall CV risk profile should be reassessed and other risk factors should be intensified. (Optimization of BP, lipid, smoking cessation etc)
- Screen for CVD and refer to a cardiologist when indicated.

9.3.2.4.2 Treatment Targets in Individuals without CVD (Table 19, pg 98)

The treatment targets in this group of patients should be individualised. In general, most patients should aim for an A1c target of < 6.5 %. Patients with proteinuria are at risk of developing chronic kidney disease and ESRD which can be prevented by strict glycaemic control.[543]

In view of the strong association between hypoglycaemia and CVD, the following patients should have an intermediate A1c target of between 6.5-7.5%:[544-546]

- High CV risk score based on FRS
- High risk of hypoglycaemia or
- Had repeated episodes of hypoglycaemia

Table 19: A1c Targets for T2DM Without Pre-existing CVD*

Tight Control (≤6.5%)	Intermediate (6.6–7.4%)	Less Tight Control (7.5–8.0%)
1. Newly diagnosed 2. On medications that do not cause hypoglycaemia 3. Low risk of hypoglycaemia 4. Proteinuria 5. Healthier (long life expectancy)	1. High CV risk based on Framingham Risk Score 2. High risk of hypoglycaemia 3. Repeated episodes of hypoglycaemia	1. Comorbidities e.g. • Chronic Renal Failure (GFR < 60 units), • Decompensated chronic liver • disease, • Chronic dementia, • Bed-bound due to CVA etc. 2. Episode of severe hypoglycaemia 3. Limited life expectancy (metastatic malignancies etc)

**Modified from the Clinical Practice Guidelines for the Management of Type 2 Diabetes Mellitus. 2015.[38]*

9.3.2.4.3 Treatment Targets in Individuals with Pre-Existing CVD (Table 20, pg 99)

The treatment targets in this group should be set initialy at a modest level (HbA1c: 6.6-7.4%). If the patient can achieve this target without any risk of hypoglycaemia within 3-6 months, then a lower target should be aimed for. If however, the patient develops new or recurrent hypoglycaemia, the target should be revised.

Table 20: A1c Targets for T2DM with Pre-Existing CVD (*"The Dynamic A1c Target"*)*

Tight Control (≤6.5%)	Intermediate (6.6–7.4%)	***Less Tight Control (7.5–8.0%)
1. Able to achieve glycaemic targets without significant hypoglycaemia 2. Posses good glycaemic control without much concern 3. On medications that do not cause hypoglycaemia	1. Initiation of insulin therapy or oral agents that can cause hypoglycaemia 2. Intensification of insulin therapy or oral agents that can cause hypoglycaemia Based on the incidence of hypoglycemia + achievable A1c target, modify the A1c target accordingly 3 months later	1. Frequent* + new episodes of hypoglycaemia 2. Severe hypoglycaemia** 3. Chronic Kidney Disease (GFR < 60 ml/min/1.73m^{2}units) 4. Symptomatic IHD or incomplete revascularisation (Suboptimal therapy of CVD) 5. Limited life expectancy (metastatic malignancies etc)

** >2 episodes of hypoglycaemia per month*
*** Episodes of hypoglycaemia that require third person's assistance*
****Caution should be exercised when intensifying treatment in diabetic patients with CVD whose baseline A1c is high (>8%) and who have never experienced an episode of hypoglycaemia.[575] A higher initial A1c target of ≥ 7.5% is preferred with gradual introduction of therapy aimed at controlling blood glucose levels. If this is achieved without significant increase in hypoglycaemia a l ower A1c target of 6.5%-7.0% may be considered.*

Modified from the Clinical Practice Guidelines for the Management of Type 2 Diabetes Mellitus. 2015.[38]

9.3.2.5 Management

9.3.2.5.1 Lifestyle Measures

This is as outlined in Section 9.3.1.6.

9.3.2.5.2 Pharmacotherapy

General guidelines on the use of anti-diabetic agents:

- The aim of treatment is to bring to target the A1c, fasting and post-prandial blood glucose levels (in that order) while avoiding the risk of hypoglycaemia and unwarranted weight gain.
- Metformin is the preferred choice as a first line therapy. However other oral anti-diabetic agents are acceptable alternatives depending on the individual patient profile. It should only be stopped completely if the GFR <30 mL/min per 1.73 m^2. It is important to reiterate that metformin does not cause or aggravate kidney disease.
- Oral agents that improve fasting hyperglycaemia more than post-prandial hyperglycaemia include metformin and thiazolidinediones (TZD).
- Sulphonylureas, meglitinides, acarbose, dipeptidyl peptidase 4 inhibitors (DPP-4i) and sodium-glucose co-transporter 2 inhibitors (SGLT2i) tend to reduce post-prandial hyperglycaemia more than fasting hyperglycaemia.
- Compliance and the manner of taking anti-diabetic agents should be ascertained before intensifying or adding other classes of anti-diabetic agents.
- Therapy should be intensified if glycaemic targets are not obtained after 3 months. Combination of up to 4 classes of oral agents are permitted as long as the patient's A1c is <10% or they are not severely symptomatic, prior to the initiation of insulin therapy.
- Triple combination therapy consisting of metformin, TZD and Glucagon-like peptide–1 (GLP-1) agonists at diagnosis has been shown to slow the progression of diabetes. However the use of TZD is contraindicated in those who are prone to cardiac failure, osteoporosis and has a history of bladder cancer (applicable for pioglitazone).
- It is important to emphasise to patients that intensive therapy that achieved targets at the beginning of diagnosis helps to improve risk of CVD in the long term.[548] (Legacy Effect/ Metabolic Memory)

For details of prescribing oral anti-diabetic agents, injectable GLIP-1 RA and insulin please refer to the CPG on the Management of Type 2 Diabetes Mellitus 2015.[38]

9.3.2.5.3 Glycemic Control for the Prevention of CVD

9.3.2.5.3.1 Primary Prevention

The trials of glycemic control in the prevention of CVD in diabetics have shown mixed results in the past.[541,547,549]

In type 1 DM, intensive glycemic control has been shown to reduce the risk of a CV event in the post-trial long term follow-up analysis.[550]

In T2DM however, intensive glycemic control has not as yet been shown to reduce CV event rates in any randomized controlled trial. However, in the long term post-trial follow up study there appears to be a reduction in CV mortality and CV event in those randomized to intensive therapy. This benefit that manifested long after the period of intervention is termed the legacy effect or metabolic memory.[548]

In the management of patients with diabetes an approach that targets multiple CV risk factors (blood glucose, BP, cholesterol, smoking cessation and weight) has clearly been shown to reduce CVD (The Steno Trial).[551]

The importance of a multifactorial approach in preventing CVD cannot be over-emphasized as more than two-third of individuals with diabetes die from CVD.[552]

9.3.2.5.3.2 Secondary Prevention

In the DIGAMI trial, patients who received intensive insulin therapy following an MI had a reduction in CV mortality at 1 year which was sustained in the 20-year post-trial analysis.[553,554] The initial result was however not reproduced in the subsequent multi-centre DIGAMI 2 trial.[555] Nevertheless DIGAMI II still supports the CVD benefit of a good glycemic control following an AMI.[555]

There are concerns of the CV safety of some anti-diabetic drugs.[556,557]

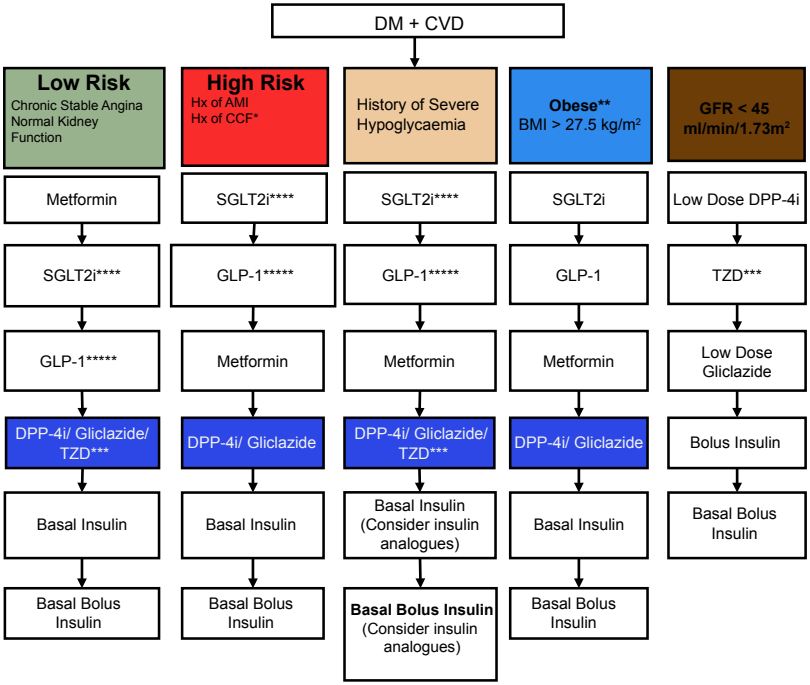
- Caution should be exercised when prescribing thiazolidinediones as they are associated with an increase incidence of heart failure and should be avoided in those in NYHA Functional class 3 & 4.
- A re-analysis of the PROACTIVE trial involving the TZD, pioglitazone, showed a significant reduction in the composite CVD end-points and a reduction in the risk of subsequent CVD in patients with a history of CVA.[558,559]

- Saxagliptin, a DPP-4i, was also shown to be associated with hospitalisation for heart failure although no increase in CVD mortality occurred in these individuals.[560] However this is not seen in the other agents of the same class, establishing the CV safety of DPP-4i.[561]

Recently, the SGLT2i (empaglifozin) and the GLP-1 agonists (liraglutide and semaglutide) have been shown to be associated with a reduction in the risk of CV composite end-points.[562-564] This benefit is only seen with CV mortality and not with the other 2 main CV end-points of non-fatal MI & strokes.

Despite the approval of FDA for empaglifozin in preventing CV mortality, several pertinent issues such as the increased trend in strokes, heterogeneity in sub-groups analysis, inappropriate CV end-points adjudication, increased drop-out rate at the end of the trial remained unanswered.[562] In the case of liraglutide and semaglutide, concerns regarding pancreatic cancers and proliferative retinopathy (HR: 1.76 with semaglutide) respectively during the trials have yet to be addressed satisfactorily.[563,564]

Figure 2: Recommendations for Glycaemic Control in Patients with Pre-Existing CVD and Specific Disease Profiles.



**Modify dose of diuretic if on SGLT2i*
***Definition of obesity is based on the M'sian CPG for the Managment of Obesity 2003.*
**** The only TZD available at present is Pioglitazone. This is contraindicated in NYHA Class 3 & 4 patients*
*****At present only Empaglifozin has CV outcome data[562]*
****** At present only Ligralitude, Semaglutide have CV outcome data[563,564]*

The recommendations in Fig 2, pg 103 are based on the following order of priority:

1. Safety profile
2. Cardio Metabolic Risk Reduction
3. Glycaemic Efficacy
4. Patient's convenience
5. Cost

However, in some situations, cost may preclude the available choices. Based on conservative price listing of Empaglifozin and Ligralitude, the estimated cost spent is:

- RM 922,560 over 3.1 years for treating 62 patients with empaglifozin to avoid one CVD composite end point.[562]
- RM 1,305,702 for 3.8 years for treating 53 patients with ligralitude to avoid 1 CVD composite end point.[563]

Key Messages:

- The risk of CVD starts to increase at much lower levels of blood glucose than that required to make a diagnosis of diabetes.
- The aim of treatment is to bring to target the A1c, fasting and post-prandial blood glucose levels (in that order) while avoiding the risk of hypoglycaemia and unwarranted weight gain.

Recommendations:

- A1c targets for patients with diabetes and low risk of CVD should be ≤6.5%
- A1c targets for patients with diabetes and CVD should be individualised. The target should be:
  - A1c ≤6.5% - for patients without any risk of hypoglycaemia
  - A1c 6.5 – 7.5 % - for patients initiated on agents with risk of hypoglycemia
  - A1c ≥7.5% - for patients assessed to be at risk of hypoglycaemia
- A1c targets for patients with diabetes and high risk of CVD should follow those with diabetes and established CVD.
- Patients who have diabetes of >10 years duration or above the age of 40 years should be on statin therapy regardless of their lipid levels
- Patients aged 40 years and above with long standing diabetes (>10 years) who experienced an episode of severe hypoglycaemia that required hospitalisation are recommended to undergo screening for CVD and be referred to a cardiologist if indicated. Treatment of all other CV risk factors should also be intensified.

9.4 Antiplatelet/ Anticoagulant Therapy

9.4.1 Antiplatelet Agents

9.4.1.1 Primary Prevention of CVD – Table 21, pg 108

9.4.1.1.1 Non-diabetics

Aspirin:

- This is the only agent investigated for the primary prevention of CVD
- The beneficial effect of aspirin in both gender is a modest reduction in non-fatal MI at a dose of ≤100mg per day.[565,566]
- There was no effect on non-fatal stroke, all-cause mortality or CV mortality.[565,566]
- Older adults seem to achieve a greater relative MI benefit.[565]
- The benefits of aspirin need to be weighed against the risk of bleeding especially gastrointestinal bleed.[565-567]

For the primary prevention of CVD, aspirin:

I,A
- Is not routinely recommended for the primary prevention of CVD.[565]

IIa,B
- May be considered in individuals with multiple CV risk factors who are not at an increased risk of bleeding.[565]

Combination therapy (aspirin + clopidogrel):

- The only study that investigated this combination versus aspirin alone in individuals at high risk of CVD (defined as either pre-existing CVD or risk factors) showed a small benefit of CV event reduction which was almost similar to the rate of bleeding.[568]

III,B
- This combination is not recommended for primary prevention of CVD.[569]

9.4.1.1.2 Type 1 and Type 2 Diabetes Mellitus

I,B In patients with diabetes, aspirin is not routinely recommended.[538,539,570]

IIa,C It may be considered in patients with diabetes >10 years duration if the bleeding risk is low.[570]

9.4.1.2 Secondary Prevention of CVD

9.4.1.2.1 Coronary Heart disease - Table 21, pg 108

In patients with established CHD (>1 year), long term treatment with:

I,A • Aspirin 75 to 100 mg daily is recommended[571,572]

I,A • Clopidogrel 75 mg daily may be an alternative in patients with aspirin intolerance[569]

In patients <1 year after an ACS who have not undergo PCI, the recommendation is dual antiplatelet therapy (DAPT) for 1 year with:[573]

I,B • Low-dose aspirin 75-100 mg + clopidogrel 75 mg daily.[570,573,574]

IIa,B • Low-dose aspirin 75-100 mg + ticagrelor 90 mg BD.[573,575,576]

In patients <1 year after an ACS who have undergone PCI (with either bare metal or drug eluting stent), the recommendation is DAPT for 1 year with:

I,B • Low-dose aspirin 75-100 mg + clopidogrel 75 mg daily.[570,573,574]

IIa,B • Low-dose aspirin 75-100 mg + ticagrelor 90 mg BD.[573,575,576]

IIa,B • Low-dose aspirin 75-100 mg + prasugrel 10 mg daily.[573,577] Prasugrel is not recommended in patients with a body weight of <60 kg, age >75 years, or with a previous stroke/TIA.[573,577]

IIa,B After the first year, to continue with either aspirin or clopidogrel (if aspirin is not tolerated).[573,578]

IIa,B In some individuals who have undergone complex PCI, a longer period of DAPT has been found to be beneficial.[579]

In patients who undergo CABG, following ACS and/or prior PCI with stent implantation DAPT can be considered for at least a year.

In patients with stable CHD who have undergone PCI, the recommendation is DAPT for:

I,B
- Bare metal stent :- 1 month with:
  - Low-dose aspirin 75-100 mg + clopidogrel 75 mg daily[573]

I,B
- Drug eluting stents :- at least 6 months with:
  - Low-dose aspirin 75-100 mg + clopidogrel 75 mg daily[573]

9.4.1.2.2 Cerebrovascular Disease

In patients with a recent non-cardio-embolic ischemic stroke or TIA, antiplatelet agents that have been investigated for secondary prevention include:[580]

I,A
- Aspirin
  - Is recommended for secondary prevention
  - Recommended dose 75 – 325 mg daily
  - For patients who use low-dose aspirin (≤325 mg) for prolonged intervals, the annual risk of serious gastrointestinal hemorrhage is about 0.4%, which is 2.5 times the risk for non-users.
  - Aspirin therapy is associated with an increased risk of hemorrhagic stroke that is smaller than the risk for ischemic stroke, resulting in a net benefit.

IIa,B
- Clopidogrel
  - Is a reasonable option in individuals who are allergic or cannot tolerate aspirin
  - Its efficacy was found to be similar to that of aspirin in a subgroup analysis of a large study.[581]

III,A
- Combination therapy
  - Aspirin + clopidogrel – when initiated days to years after a stroke or TIA has no additional benefit compared to aspirin alone.[568] This combination is associated with an increased risk of bleeding.[568] It is not recommended in routine practice.

Table 21: Antiplatelet Therapy for Primary and Secondary Prevention of CVD

				Grade of recommendation /Level of Evidence
Primary Prevention	Non-diabetics	Not routinely recommended		I,A
		May be considered in individuals with multiple CV risk factors if bleeding risks are low		IIa,B
	Diabetes	Not routinely recommended		I,C
		May be considered in individuals who are more than 40 years old or have diabetes for more than 10 years if bleeding risks are low		IIa,C
Secondary Prevention	Stable CHD (>1 year)	Established CHD>1 year: Antiplatelet monotherapy long term	Aspirin 75 to 100 mg daily	I,A
			Clopidogrel 75 mg if aspirin intolerant	I,A
			DAPT in selected cases	IIb,C
		Elective PCI with Bare metal Stents: DAPT for 1 month and then antiplatelet monotherapy long term	Aspirin 75-100 mg + clopidogrel 75 mg daily	I,B
		Elective PCI with Drug Coated Stents: DAPT for at least 6 months and then antiplatelet monotherapy long term	Aspirin 75-100 mg + clopidogrel 75 mg daily	I,B
	Following ACS <1 year	Following PCI and stenting with Bare Metal stents or Drug coated stents: DAPT for at least 1 year and then antiplatelet monotherapy long term	Aspirin 75-100 mg + clopidogrel 75 mg daily	I,B
			Aspirin 75-100 mg + ticagrelor 90 mg BD	IIa,B
			Aspirin 75-100 mg + prasugrel 10 mg daily	IIa,B
		Who have not undergone PCI: DAPT for at least 1 year and then antiplatelet monotherapy long term	Aspirin 75-100 mg + clopidogrel 75 mg daily	I,B
			Aspirin 75-100 mg + ticagrelor 90 mg BD	IIa,B

9.4.2 Anticoagulant Therapy

9.4.2.1 Non-valvular Atrial Fibrillation

Patients with non-valvular AF irrespective of whether the pattern is paroxysmal, persistent, permanent or achieved apparently successful rhythm control, should be considered for anticoagulation to reduce their stroke risk.[582,583]

The stroke risk is calculated using the CHA_2DS_2-VASc score as in Table 22, pg 109.[520,583]

The rate of stroke is 0.2%, 1.3%, and 2.2% per year for CHA_2DS_2-VASc scores of 0, 1, and 2 respectively.[582]

In patients with a CHA_2DS_2-VASc score of:

- >1 in males and >2 in females anticoagulation is recommended
- 1 in males and 2 in females anticoagulation should be individualized after a discussion with the patient.
- 0 and those with lone AF (strictly defined, irrespective of gender) have very low absolute stroke risk. It may be reasonable not to consider these group of individuals for antithrombotic treatment.[582-584]

Table 22: CHA_2DS_2-VASc Score

	CHA_2DS_2-VASc SCORE
Congestive Heart Failure	1
Hypertension	1
Age >75 years	2
Diabetes Mellitus	1
Prior Stroke or TIA or thromboembolism	2
Vascular Disease	1
Age 64-74 years	1
Female gender	1

Anticoagulation in these patients may be achieved by:[582,583]

I,A • Warfarin

IIa,B • Newer Oral Anticoagulants (NOAC)

The NOACs have been shown to cause less bleeding and are superior to warfarin in preventing stroke. They also do not require regular blood monitoring.

In patients with AF who have undergone PCI and stenting with drug eluting stents, a recent study showed that the use of NOAC with antiplatelet therapy is associated with a lower risk of bleeding than the standard triple therapy (DAPT + warfarin).[585] The following regimens are recommended:

IIa,B • Rivaroxaban 15 mg daily (10mg if eGFR: 30 to 50 ml per minute) + clopidogrel 75 mg daily (or ticagrelor at a dose of 90 mg twice daily or prasugrel at a dose of 10 mg once daily)

IIa,B • Rivaroxaban 2.5 mg BD and DAPT - aspirin 75 to 100 mg per day + clopidogrel 75 mg once daily (or ticagrelor at a dose of 90 mg twice daily or prasugrel at a dose of 10 mg once daily) - The duration of DAPT will depend on the risk of stent thrombosis versus bleeding risk. This dose of rivaroxaban is yet to be registered in Malaysia

9.4.2.2 Valvular Atrial Fibrillation and Prosthetic Heart Valves

I,C Patients with AF due to valve disease or prosthetic heart valves should be anticoagulated with warfarin.[580]

9.4.2.3 Left Ventricular Thrombus

Recent studies have shown that the incidence of mural thrombus after a large anterior MI varies 6-15% and in individuals with anterior MI and left ventricular ejection fraction (LVEF) <40% is about 27%.[586,587] The use of warfarin in the pre-thrombolytic and pre-primary PCI era, has been shown to reduce the incidence of mural thrombus and embolization.[588] However at present, most patients are already on DAPT, and the addition of warfarin has been associated with increased bleeding.[589]

III,B The use of warfarin in addition to DAPT is not recommended for the prevention of mural thrombus in patients with large anterior MI and LVEF <40%.[580]

In patients with LV thrombus demonstrated by echocardiography following a recent MI:

- Warfarin may be considered in addition to DAPT for at least 3 months in:
  - I,C Patient with non-ischaemic stroke with TIA[580]
  - IIa,C Without prior stroke or TIA
- IIb,C In patients with high risk of bleeding, warfarin plus antiplatelet monotherapy may be considered.

Recommendations:

- For the use of anti platelet therapy in the primary and secondary prevention of CVD, see Table 20, pg 99.
- In patients with a recent non-cardio-embolic ischemic stroke or TIA:
  - Aspirin is recommended
  - Clopidogrel is reasonable option in individuals who are allergic or cannot tolerate aspirin
- Patients with non-valvular AF irrespective of whether the pattern is paroxysmal, persistent, permanent or achieved apparently successful rhythm control, should be considered for anticoagulation to reduce their stroke risk.
  - The stroke risk is calculated using the CHA2DS2-VASc score. (Table 21, pg 108)
  - Anticoagulation in these patients can be achieved using either warfarin or NOACs.
- Patients with AF due to valve disease or prosthetic heart valves should be anticoagulated with warfarin.

10. Adherence to Therapy

The WHO defines adherence as the extent to which a person's behavior – taking medication, following a diet, and/or executing lifestyle changes – corresponds with agreed recommendations from a health care provider.[590]

Full adherence to medication that have been proven to prevent CVD (aspirin, BP and cholesterol lowering drugs) has been estimated to reduce the risk of a first or second CVD event by approximately 80%.[591] However, even among high risk post-MI patients, only 43% were fully adherent to treatment after six months and this declined to 34% after one year.[592] Low adherence rate leads to adverse outcomes, higher hospitalization rates and increased costs.[590,592,593]

10.1 Prevalence

Locally, only approximately 44-53% of patients on long-term therapy adhere to their medication.[594-596] This varies from 48.7% in a hospital based practice to 53.4% among hypertensive patients treated in primary care clinics.[595,596] In another study conducted in primary care, 56% were non-compliant towards antihypertensive, anti-diabetic and anti-asthmatic medication[592] These rates are similar to studies done elsewhere.[597] Generally, adherence rates to secondary prevention (66%) are better than for primary prevention (50%).[597]

10.2 Management

The reasons for decreased adherence are often multi-factorial and include the following[590] (Table 23, pg 113):

- Patient factors- especially depression[598]
- Healthcare system
- Condition
- Therapy
- Socioeconomic factors

10.2.1 Interventions to Promote Adherence

Interventions to improve medication adherence are only modestly effective.[599] Fixed-dose combination therapy (polypill) is associated with reductions in BP and lipid parameters and improved adherence.[600] However, there was modest increases in adverse events compared with placebo, single drug active component, or usual care.[600]

Other helpful clinical practice points include (Table 24, pg 115):

- Assessing adherence to medication at each visit
- Asking empathic questions, acknowledging likelihood of non-adherence and encouraging an open discussion
- Using a screening questionnaire
- Reviewing refill frequency[601,602]
- Identifying reasons (non-judgmentally) for non-adherence[601,602]

To promote adherence:

- Provide clear instructions on the benefits and possible adverse effects of medications, duration and timing of dose[602]
- Consider patients' perspective[602]
- Simplify regimen[593,602,603]
- Practice regular monitoring (including self-monitoring) and feedback, reinforcement and reminders[604,605]
- Involve allied health care providers, such as pharmacists and nurses
- Refer to medication therapy adherence clinics and for cardiac rehabilitation[599,606]

Table 23: Reasons for Non-adherence to Medications*

Categories of non-adherence	Examples
Patient	Lack of understanding, lack of involvement in decision making, health beliefs and attitudes concerning effectiveness of treatment, high medication cost, lack of transportation, long wait, poor social support, psychological stress, forgetfulness, anxiety about side effect, low motivation
Health-care system	Failure to recognize non-adherence, complex regimen, lack of continuity of care, large volume of patients, poor communication, benefits and adverse outcomes not explained, short consultation, weak capacity to educate patients and provide follow up, lack of knowledge on adherence and of effective interventions to improve it
Social/economic factor	Unemployment, low literacy, high cost of medication and transport, poor social support, unstable living conditions, family dysfunction
Condition-related	Asymptomatic chronic disease, depression
Therapy-related	Complexity of treatment regimen and duration, side effects, immediacy of beneficial effects

**Sabate E. Adherance to Long-Term Therapies: Evidence for action. Geneva, Switzerland: 2003*[590]

Key Message:

- Full adherence to therapy that reduces CVD (aspirin, blood pressure and cholesterol lowering drugs) has been estimated to reduce the risk of a first or second CVD event by approximately 80%.

Recommendations:

- At every visit, attempts should be made to identify and manage non adherence to therapy. (Table 23, pg 113, Table 24, pg 115)

Table 24: Strategies to Improve Medication Adherence

Categories	Strategies	Example
Patient-related factors	Patient education	
	Involvement in treatment decision when possible	Ask what time of day they would prefer to take their medications
		How quickly they would like to achieve desired outcomes
		Avoid prescribing numerous medications and behavioural modifications at any one visit. If it is necessary, a rationale should be provided
	Inadequate health literacy	Create a 'shame free' environment
		Provide pictorial and audio-visual educational material instead of written instruction
	Mental illness	Recognise and treat mental illness when treating for other chronic conditions
	Economic status	
Physician-related factors	Effective communication	Consider patients' cultural beliefs and attitudes (eg. Preference for herbal remedies)
	Create blame free environment	
	Assess Adherence	Ask in a non-judgemental way. E.g.: 1) I know it must be difficult to take all your medications regularly. How often do you miss taking them? 2) Of the medications prescribed to you, which ones are you taking? 3) Have you had to stop any of your medications for any reasons?
	Prescribing	Simplify regimen, use of pill boxes, cues to remind patients to take medications
		When prescribing new medication, provide all important information-name, purpose, rationale, frequency, duration, potential adverse effects
		Use Teach back approach
Health-care related factor	Appointment visits	Reminder for patients to bring all their medications
		Team-based approached, assessment of adherence by pharmacists/nurses
		Make follow up visits more convenient and efficient for the patients
	Medication reconciliation	Review medication list at every visit

Adapted from:

- *Brown, Marie T. et al. Medication Adherence: WHO Cares Mayo Clinic Proceedings; 2011:86: 4: 304 - 314*[602]
- *Osterberg et al 2005 NEJM. Adherence to medication. N Engl J Med. 2005 Aug 4;353(5):487-97*[607]

11. Community, Population and Governmental Level

Non-communicable diseases (NCDs) are a major health burden to the country. Preventive care ensures a healthy population leading to a reduction in the expenditure for curative care. This is the focus of the healthcare sector in the current 11th Malaysia Plan. Health education and promotion (including media campaigns) are important in raising awareness and knowledge. However, by themselves, these are inadequate in achieving behavioural change. Essentially, we need "pro-health" national policies to achieve positive behavioural changes.

In accordance with the recommendations of WHO.[608] Malaysia has adopted a "whole-of-government" approach to effectively prevent NCDs with strong and proactive involvement of many ministries and stakeholders. The 3 main modifiable CV risk factors – unhealthy diet, physical inactivity and smoking – have to be tackled simultaneously. This involves individual behavioural modification, as well as policy and regulatory interventions.

Malaysians need to take on more responsibility for their own health. As such, the MOH puts a high priority on empowering individuals and communities to take on self-care responsibilities and becoming a resource for themselves and others in disease prevention and management. This is done through the KOmuniti Sihat, Perkasa Negara (KOSPEN) Program (Section 11.4, pg 122).

National policies for the prevention of CVD has focused on the following main areas:
- Tobacco control
- Salt reduction
- Modifying the obesogenic environment
- Others: KOSPEN

11.1 Tobacco Control

11.1.1 Legislation for Tobacco Control in Malaysia

Tobacco control in Malaysia is regulated under the Control for Tobacco Products Regulations (CPTR) 2004, a component of the Food Act 1983. CPTR 2004 replaced the old CPTR 1993, and was developed based on the WHO Framework Convention for Tobacco Control (FCTC). Malaysia became a signatory to this convention on 23 September 2003, ratified it on 16 September 2005, and officially became a party 90 days later on 15 December 2005.

At the ministry level, the Tobacco Control and FCTC Sector under the NCD Section, Disease Control Division, serves as the country's focal point for WHO FCTC and all issues related to tobacco control. A National FCTC Driving Committee comprising of various governmental ministries and non-governmental organizations (NGOs) was also formed to ensure better implementation of the FCTC requirements in Malaysia.

11.1.2 The National Strategic Plan for Tobacco Control 2015-2020

Malaysia developed the National Strategic Plan for Tobacco Control 2015-2020 in line with FCTC.[609] The global NCD target is a smoking prevalence of <15% by 2025. The eventual goal is a smoking prevalence of <5% and this is called the end game for tobacco consumption (The End Game).

There are four strategies outlined in this national plan in accordance with the WHO **MPOWER** Strategy as listed below:

- To strengthen tobacco control capacity
- To strengthen tobacco control enforcement and legislation
- To empower community and to increase multi-sectoral collaboration
- To strengthen tobacco control activities through **MPOWER** strategies (Table 25, pg 117)

A selected list of current activities under the National Strategic Plan is shown in Table 26, pg 119.

Table 25: The MPOWER Strategy

M	**M**onitor tobacco use and prevention policies
P	**P**rotect people from tobacco smoke
O	**O**ffer help to quit tobacco use
W	**W**arn about the dangers of tobacco
E	**E**nforce bans on tobacco advertising, promotion and sponsorship
R	**R**aise taxes on tobacco

11.2 Salt Reduction

Salt reduction is the simplest and most cost-effective measure for reducing CVD because of its high impact on health, high feasibility and low implementation costs.[610] Based on Malaysia's latest burden of disease study, high BP is estimated to contribute to 42.2% of deaths and 21.6% of disability adjusted life year (DALY), the largest contributor for both men and women.[611]

A 24-hour urine analysis is considered as the gold standard method to estimate salt intake in the population as compared to data obtained through dietary surveys which generally tend to underestimate salt/sodium intake. A study conducted in a sub-population in Malaysia in 2012 showed an average salt intake of 8.7 g/day (or 3.4 g/day sodium), about 1.7 times higher than WHO's recommendation.[612] (Appendix 9, pg 174, for salt content of common Malaysian food)

11.2.1 Salt Reduction Strategy 2015-2020

The general objective of the Salt Reduction Strategy is to promote, educate and collaborate with all related stakeholders to reduce salt intake among the Malaysian population, working towards achieving a 30% reduction in the average daily salt intake (from 8.7 g/day to 6.0 g/day) of the adult population by year 2025.[613] Based on the major sources of dietary salt/sodium in Malaysia (non-processed food), modification of the population's behaviour would have the biggest impact, but unfortunately the interventions would be the most challenging.

Table 26: Selected List of Tobacco Control Activities in Malaysia

	Activities
1.	**Strengthening the Smoking Cessation Services** The **mQuit services**[614] is a public-private initiative that aims to improve access to smoking cessation services. This was introduced in 2016 to give smokers to obtain three levels of support, namely professional advice, materials to help quit smoking and enlisting the smoker's own willpower. Smokers will have the ease to get professional help from either the government health clinics or hospital, or from the private sector such as the community pharmacies. The delivery of the services is standardised through the national Clinical Practice Guidelines on Treatment of Tobacco Dependence[615]. On top of that, a national Quitline was established to help and guide smokers to quit through behavioural intervention through telephone calls.
2.	**School programs to develop a Smokefree Malaysian Generation** Preventative programme: Implementation of the **IMFree Program**[616] This is an educational program for smoking prevention among primary school children age 7 to 12 years. Some components of the IMFree Program are also implemented in pre schools under the *Tunas Doktor Muda* Program throughout the country. Intervention programme: The majority of smokers had their first cigarette before the age of 14 years old. Therefore, intervention programmes for school children are deemed essential. • The **Kesihatan Oral Tanpa Asap Rokok (KOTAK)** is a new initiative but as an extension to the existing Incremental School Dental Care programme. In this programme school children who are detected as smokers will be given interventions to help them beat smoking. • A new Guidance for Helping School Children Who Smoke was developed to give guidance to school counsellors on how to manage school children who smoke. This approach is a curative approach rather than punitive. Smokers will be coached on how to quit smoking properly.
3.	**Empowering the community** To empower the communities to stop smoking and creating smoke-free environments through the **KOSPEN Program**. KOSPEN is currently a flagship program led by the MOH for community-based NCD risk factor screening and intervention. (more information on KOSPEN in Section 11.4) Specifically, for smoking, smokers identified through the screening are referred for quit smoking services available in their area. The KOSPEN volunteers could have a great influence in encouraging their fellow community members to quit smoking properly through professional smoking cessation in their local area.
4.	**Protecting the public from the dangers of tobacco smoke** • **Through volunteerism**: To reduce exposure to second-hand smoke, houses in the KOSPEN area are encouraged to commit to "**My Smokefree Home**" declaration and all community events declared "Smoke-free". On the other hand, the **Blue Ribbon**[5] programme is a voluntarily smoke free declaration in public places such as businesses, eateries and other community places. • **Gazettement of Smoke-Free Places by law**: Smoking is generally prohibited on public transportation. Smoking is prohibited in specified public places and workplaces listed in the regulations including, among others, in workplaces with a centralized air-conditioning system; health, education, government and cultural facilities; and indoor stadiums. Smoking is also prohibited on floors with a service counter in banks, financial institutions, national telecom company, national energy company and post offices. Expansion of places to be gazetted as smoke-free place is being undertaken; most recently the rest & respite areas of the federal highways – and will include all hotels, public parks and all restaurants.
5.	**Other Tobacco Control Activities** • **Tobacco Packaging and Labeling**: Rotating combined picture and text health warnings are required to occupy 50% of the front and 60% of the back of the package. The text of the warning is in Malay on the front panel and English on the back panel. Misleading packaging and labeling, including terms such as "light" and "low tar" and other signs, is prohibited. Efforts are currently being undertaken to move towards "plain packaging". • **Increase in tobacco excise tax:** Fiscal measure is one of the best option for reducing demand for cigarettes. It is also a great deterrent for non-smoker to take up smoking. WHO FCTC encourages countries to raise their tobacco taxes to at least 75% of the retail price.

Through **M**onitoring-**A**wareness-**P**roduct (**M-A-P**) strategies, Malaysia hopes to build upon the existing framework to strengthen current interventions. A selected list of activities under the Salt Reduction Strategy is shown in Table 27, pg 120.

Table 27: Selected List of Salt Reduction Activities in Malaysia

	Activities
1.	**Strategy 1: Monitoring** A database on the salt content of processed foods with data available to the public is being planned for 2018. This will assist the public in their decision during purchasing and enables monitoring the trends of salt content of the processed foods over time.
2.	**Strategy 2: Awareness** Mass media and social marketing (using alternative media) are very important methodologies to educate on the relationship between salt, hypertension and heart attacks and strokes to the general population. The public also needs to be educated on salt content of foods, how to reduce salt intake and understand salt/sodium labelling. Within specific settings, for example, school canteens, catering in the public services sector, hospital foods or food outlets in hospitals and health facilities, administrative guidelines are being introduce in a step-wise manner to reduce salt content in food preparations.
3.	**Strategy 3: Product** MOH will continue the current partnership with food industries on food reformulation. This is currently being undertaken by focusing on selected food categories, setting targets for reduction. MOH is also in the process of making salt content labeling as mandatory for all processed food (target date: 2018). This is important for educating the population to identify healthier choices, and also to inform MOH to engage with food industries to reduce the salt content in their products.

11.3 Modifying the Obesogenic Environment

In July 2014, the MOH requested the formation of a national level task force to tackle obesity in Malaysia. This comprised experts from the government, academia, professional organizations and NGOs. The final recommendations was presented and approved by the MOH in 2016.

It was based on the current scientific evidence of cost-effectiveness. In addition to cost-effectiveness, considerations were also given on affordability, implementation capacity, feasibility and perceived acceptability by the population. A selected list of hard policy interventions currently being pursued by the government is shown in Table 28, pg 121.

Table 28: Selected List of Hard Policy Interventions in Malaysia

	Activities
1.	"**Healthy schools**": Policy options for school setting. This includes: • Revision of list of food and beverages allowed to be sold in school canteens. • Ban of selling of food and beverages within 40 meters outside of school perimeter (except for licensed vendor complying with the list of food and beverages allowed). • Ban of marketing of unhealthy food and beverages to children in print and fixed outdoor advertising within 300 metres of schools (media, bus stops, billboards). • Mandatory to provide free, clean and safe water (water fountain/ dispenser) in schools.
2.	**General setting** • Increase consumption and access to affordable and fresh vegetables (including *ulam*) and fruits by increasing the number of *Pasar Tani* outlets. • Banning television advertising of foods and beverages high in fat and/or high in sugar that is appealing to children. • Excise and/or GST on unhealthy foods (foods high in fats, salt and sugars) e.g. sweetened creamer, condensed milk, sugar sweetened beverages, carbonated drinks, juices and processed foods. • Increase availability of facilities in the community to promote PA and exercise in a safe environment (e.g. public parks, public sport complexes, jogging and cycling paths and public gymnasium). • Mandatory for local authorities to provide cyclists and pedestrians safe and accessible sidewalks, walking paths and cycling paths. • Mandatory for local media to allocate more airtime and advertisement space during appropriate time slot for promotion of PA. • Mandatory to relocate street stalls to hawker centres for the purpose of ensuring opening time, food safety and healthier choices. • Reduce cooking oil subsidies. • Restrict the number of new food outlets including 24-hours food outlets within 400 metres radius of new residential areas.

11.4 KOSPEN: For the Community, by the Community

This is an NCD risk factor community-based intervention program developed in response to the increasing prevalence of NCD risk factors, as well as to empower the population to take more responsibility on their own health status. It is known as Komuniti Sihat Perkasa Negara (**KOSPEN**). The program aims at bringing the NCD risk factor related activities to the community by creating trained health volunteers, who will function as "agents of change" or health enablers who will introduce and facilitate healthy living practices amongst their respective community.

The main objectives of KOSPEN are to:

- Empower the community in adopting and practicing healthy lifestyles and
- Enhance their participation and involvement in programs aiming at preventing and controlling NCD in Malaysia.

This program was launched in 2014. Its main scope is promoting a healthy diet, active living, non-smoking, weight management and routine community NCD risk factor screening.

The MOH is currently collaborating with the Ministry of Rural and Regional Development (through the Department of Community Development or KEMAS) in implementing KOSPEN in rural areas, and collaborating with the Department of National Unity and Integration (through *Rukun Tetangga*) for urban and sub-urban areas.

A group of health volunteers within the identified residences or community registered under both collaborating agencies are provided with training that will enable them to promote healthy behaviours, advocate for healthy policy adoption and facilitate environmental changes within the local community. These trained volunteers are also capable of conducting basic health screening consisting of measuring blood pressure, blood glucose levels and BMI. They also conduct semi-structured interventions, and those at high risk would be referred to nearby health clinics for further investigation and management.

11.4.1 Status of Implementation

As of December 2016, 5,900 KOSPEN localities or sites have been established throughout Malaysia, with more than 36,000 volunteers trained. Within the localities, almost 400,000 adult residents have been screened for NCD risk factors; about 75% have been referred for diabetes confirmatory tests, 35% for hypertension and 9% for obesity class 2 (BMI ≥35 kg/m²).

To date, KOSPEN volunteers have conducted weight management programs in 200 KOSPEN localities. Initial analysis indicates that 90% of the programs have successfully achieved their targets.

In 2017, further work will be done to further strengthen the NCD risk factor intervention components as well as exploring options in ensuring the sustainability of the KOSPEN program. In addition, 2017 will see the implementation of KOSPEN+, a workplace-based NCD risk factor intervention program to be implemented in a stepwise manner. This is to be done in collaboration with both public and the private sectors.

12. Traditional and Complimentary Medicine

12.1 Definition of Terms and Concepts

Traditional medicine, by WHO definition,[617] is the sum total of the knowledge, skills, and practices based on the theories, beliefs, and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness. In Malaysia, it identifies strongly with the respective ethnic cultures and is often considered as an important part of their cultural heritage.

Complementary medicine refers to a broad set of healthcare practices that are not part of that country's own traditional or conventional medicine and are not fully integrated into the dominant healthcare system.[618] It is often used together with conventional medicine.

Alternative medicine, on the other hand, is used in place of conventional medicine.

In Malaysia, the Traditional and Complementary Medicine ACT 775, (2016)[619] defines the practice of T&CM as a form of health-related practice designated to prevent, treat or manage ailment or illness or preserve the mental and physical well-being of an individual. The handbook on T&CM outlines the program in Malaysia.[618]

According to the Act 775, T&CM practices includes:
- Traditional Malay medicine
- Traditional Chinese medicine
- Traditional Indian medicine
- Islamic medical practice
- Homeopathy and
- Complementary therapies

It excludes medical and dental practices used by medical and dental practitioners respectively. (Appendix 12, pg 177-178)

TCM stands for Traditional Chinese Medicine whereas T&CM is abbreviation for Traditional and Complementary Medicine. There are many more abbreviations and terms which appear frequently in many T&CM related literatures and documents which at time may cause confusion without knowing the context of source document. Visit web site Globinmed for further detail. (http://www.globinmed.com/)

12.2 Utilisation of T&CM

According to data from NHMS 2015, about 29.25% of the population had ever used any form of T&CM with consultation.[620] For use within the last 12 months, females showed significantly higher usage (23.98%) compared to males (19.33%).[620] A higher percentage of the urban population (22.64%) were more likely to use T&CM compared to the rural population (18.23%).[620]

The survey showed that T&CM practices were mainly used to maintain wellness. When T&CM was used as treatment, the intended use was for primary healthcare and complementary treatment. About 18.3% of those surveyed intended to use of T&CM as an alternative treatment.[620]

In a survey conducted in a rural setting, 31.7% (about 1 in 3) of about 2,800 respondents with CV risk factors were using T&CM, and 20-30% of these were using this as a substitute to their conventional medicine.[621]

There has been no specific research conducted locally on the use of T&CM by patients with CVD. Research from Australia and the USA show the following trends:[622-627]

- The prevalence of T&CM use is high and fast growing.
- There is lack of sound, evidence-based professional resources for reliable information about the safety and efficacy of T&CM treatments on CVD.
- There exists a patient-doctor communication gap.
- Patients' reluctance to communicate about T&CM use with medical doctors out of fear of disapproval is just as significant a problem as health professionals' hesitancy to discuss this topic with their patients.
- Most medical doctor and pharmacists believe that they lack the resources and training to respond to patients' inquiries about T&CM use.

The areas of concern mentioned above require long term efforts in education and research by all the stakeholders.

In short term, frequent interaction, exchange of idea as well as information with credible T&CM practitioners specialised in CVD through periodic seminar, workshop and conference may be helpful in promoting mutual understanding. Malaysia Medical Association organises evidence based T&CM seminars on a yearly basis. Other available information may be obtained at Globinmed (http://www.globinmed.com/). This is a website administered by the Institute of Medical Research, MOH Malaysia

12.3 T&CM and CVD

Many forms of T&CM base their information on traditional philosophy or belief system rather than relying on existing scientific research.

12.3.1 Acupuncture & Qi Gong for Hypertension

Two randomized controlled trials have produced conflicting results on the effectiveness of acupuncture in reducing BP.[628, 629]

Meta-analysis have found that it does not reduce BP on its own. However it is a useful adjunct to drug therapy.[630,631]

Acupuncture, although generally safe, has been associated with a small risk of infection from the use of contaminated needles and rarely, damage to major organs.[632]

III,B The committee does not recommend acupuncture as a form of blood pressure lowering therapy.

There is some evidence that qi gong lowers diastolic BP, but the conclusiveness of these findings is limited.[633,634]

12.3.2 Mind Body Practices (Appendix 13, pg 179)

Meditation and spiritual healing are mind based therapies that are relatively safe and influence physical health through psychosocial and behavioural pathways.[635] They help to cope with stress, improve emotional health and general well-being.[635]

IIa,B Mind body practices have a positive impact on CV health.[636]

12.3.3 Herbal Medicine

Herbal medicine does not belong to the traditional system of medicine. The National Pharmaceutical Regulatory Agency has categorised natural products into:

- traditional products
- herbal products and
- health supplement products

Herbal medicines have herbal ingredients but are not traditional products. They are different from herbal preparations used in the various T&CM practices and are not based on the philosophy of the respective traditional medicine and documented traditional history of use.

Many of these herbal medicines appear to have pharmacological effects in vitro and in animal studies.[637] However, the evidence from properly conducted clinical trials is generally insufficient to draw definitive conclusions.[637]

In addition, there are several issues regarding the characterization of botanical products.[637] This includes whether the whole extract or a specific fraction was used, the method of extraction (e.g. alcoholic, tea, pressed juice), and the chemical and genetic standardization of the product.[637]

Some herbal medicines that have been used to treat CVD include:[638-640]

- Plant sources of cardiac glycosides - digitoxin, derived from either *D purpurea* (foxglove) or *Digitalis lanata*, and digoxin, derived from *D. lanata* alone. These have been used for the treatment of heart failure.
- Reserpine from *Rauwolfia serpentina* (snakeroot), *Evodia rutaecarpa* (wu-chu-yu) and *Stephania tetrandra* have been used in traditional Chinese medicine to treat hypertension.
- Garlic and guggulipid have been used in Ayurvedic medicine to treat hyperlipidemia.
- Extracts of Chinese red yeast rice (*Monascus purpureus*) containing several active ingredients, including monacolin K, which has the same chemical structure as lovastatin, can lower LDL-C.
- The fruit of the hawthorn (usually *Crataegus pinnatifida*; known as *shanzha*) is widely used for many indications, including digestive disorders and for lowering cholesterol and blood pressure.
- The dried root of *S. miltiorrhiza*, known as danshen in TCM, is widely used in China for the treatment of angina pectoris, hyperlipidemia, and acute ischemic stroke
- *G. biloba* extract (GBE) has been used for treating cerebral insufficiency and its symptoms of vertigo, tinnitus, memory loss, and mood disorder. A placebo-controlled study of GBE administered at 120 mg twice daily found no effect on cognitive decline in older adults with normal cognition or with mild cognitive impairment.[641]
- The root of P. notoginseng is also often used in the treatment of patients with angina and CAD.
- Oral aloe vera has been shown to reduce FBG and HbA1c (by as much as 1.05%).[642]

Herbal medicine has no strong quantitative scientific evidence of its efficacy in CV risk and event reduction.

It however has the possibility of potential harm in view of the narrow therapeutic index of some preparations and also due to interaction with allopathic medications.[637-639]

Some examples include but not limited to the following:

- The concomitant use of hawthorn with cardiac glycosides can markedly enhance their activity and cause digoxin toxicity.
- Aristolochia fangchi has been implicated in an outbreak of rapidly progressive renal failure, termed *Chinese herb nephropathy*. It is also associated with urothelial cancer.[643,644]
- Interaction between *S. miltiorrhiza* and warfarin. There have been several case reports of increased anticoagulation or haemorrhage.
- Aloe vera may interact with oral hypoglycemics and insulin and cause hypoglycaemia.[642]

IIb,C Herbal medicine should be used with caution in the prevention and treatment of CVD.[645]

12.4. Role of T&CM in the prevention of CVD

There are unique features of T&CM as practised in Malaysia that can be harnessed to contribute to the nationwide CVD prevention strategy.[646]

- The practice is strongly identified with the respective ethnic cultures and is considered as important cultural heritages.
- Almost all the 14,000 or so T&CM practitioners establish their practice at the primary health care level. They stay close to the grass roots and establish symbiotic relationships with local cultural institutions such as temples, mosques, schools and other NGOs. They can become strong opinion leaders among the grass roots that can influence individual and community behavior and participation in health strategies.
- The practice is multi-cultural and highly diversified. These rich cultural resources provide us with plenty of ready-made inputs that increase the attractiveness of our health related initiatives and activities. For example, in addition to the common sporting events, Qigong, Tai Chi, Yoga and Senaman Melayu Tua can be used to encourage more physical activities.
- Many of the practices are rich in the area of health maintenance especially lifestyle modification, physical activities, appropriate diet and maintaining a healthy environment leading to emotional, psychological and spiritual well being of the individual. The government agencies and NGOs can galvanize the T&CM groups to work together towards the achievement of health promotion efforts.

However, there are also weaknesses in the T&CM industry. While there are a small number of credible practitioners, most of them require further training and upgrading of their knowledge before they can contribute positively to the prevention strategy.

I,C These practitioners should not replace conventional mainstream health professionals as sources of medical advice for the prevention of CVD.

The practice of TCM is based on TCM evidence rather than scientific evidence. Even the terminology CVD is being interpreted based on pathology and physiology of conventional medicine and not based on the TCM philosophy. While they make a lot of reference to scientific investigations such as laboratory and imaging investigation, they draw on TCM's profound and unique philosophy of Yin Yang and Five Element theories for diagnosis, treatment, rehabilitation and prevention. The object of TCM treatment is not CVD itself but to restore the disharmony of Yin Yang. TCM has it unique, complete and time tested body of knowledge and theories which follow a pathway different from conventional medicine and which existed long before the birth of modern science.

A meta-analysis found insufficient or conflicting evidence for the use of TCM in CVD prevention.[645]

T&CM practices such as Traditional Indian Medicine and Homeopathy have claimed benefits in the prevention and treatment of CVD. However, there is no good scientific data in the form of randomized controlled trial or systemic reviews. This is because it involves different philosophical systems and methodologies.

Currently, only TCM offers professionalized and specialized services to patients with CVD. Patients are given outpatient consultations in the area of life style modification, Chinese medicine concoction for maintenance of health, dietary advice and management of CV risk factors. More information, may be obtained via Globinmed (http://www.globinmed.com/).

Recommendations:

- Herbal medicine, acupuncture and other forms of T&CM should be used with caution in the prevention and treatment of CVD.
- TCM practitioners should not replace conventional mainstream health professionals as sources of medical advice for the prevention of CVD.

13. Miscellaneous Frequently Asked Questions and Myths

13.1 Chelation Therapy

Chelation therapy (CT) is defined as the use of repeated administration of ethylenediamine tetraacetic acid (EDTA) with or without the combination of vitamins, trace elements and iron supplements as an alternative treatment option for vascular diseases. It is given via an intravenous concoction of infusions, often several days apart for 20 to 30 sessions. It is proven therapy and is efficacious in heavy metal poisoning involving lead, iron and other metals.[647]

The evidence to support the use of CT in prevention of CVD is extremely weak and should be avoided.[648-653]

There are risks associated with CT. Renal failure, arrhythmias, tetany, hypocalcemia, hypoglycemia, hypotension, bone marrow depression, prolonged bleeding time, convulsions, respiratory arrest, and autoimmune diseases have all been described.

III,B Until further data is available, CT cannot be recommended as an option for the treatment or prevention of CVD.[648-653]

13.2 Ozone

Ozone is an inorganic molecule with the chemical formula O_3. It is a controversial gas because, owing to its potent oxidant properties, it exerts damaging effects on the respiratory tract and yet it has been used for decades as researchers believes it has many therapeutic effects.[654-656] Hence, due to its toxic effects on the respiratory tract, it should never be given via inhalation.[657] Medical O_3 is used to disinfect equipment by inactivation of bacteria, viruses, fungi, yeast and protozoa.[658] It is also used in dental practice.[658,659] There have been claims that it activates the immune system but there is no scientific evidence to support this.[658]

The gas produced from medical grade oxygen is administered in precise therapeutic doses.

13.2.1 Effects of Ozone Therapy

Ozone has not been established scientifically as an antioxidant and/ or immunomodulant. Clinical trials have not shown ozone to be beneficial in patients with CVD (CHD, limb ischaemia and/ or stroke)[660,661]

Ozone therapy has the potential for harm. During administration, it may result in air embolism,[662] myocardial infarction,[663] stroke[664], visual loss[665] and blood borne infections such as hepatitis, HIV.[666,667]

Current data on the usage of ozone therapy as therapeutic options for CVD are insufficient in regards to safety and therapeutic advantage over available treatment currently.[668]

III,B There is a lack of clinical evidence for ozone therapy as a form of complementary or alternative treatment. It is not recommended.

The Malaysian Medical Council prohibits any registered medical doctor from practicing ozone therapy.[669]

13.3 Stem Cells

IIb,B Stem cells is being promoted as a form of regenerative therapy. However, currently there is little evidence to support the use of stem cells in the prevention or treatment of CVD.[670,671]

13.4 Anti-aging (vascular aging)

Telomeres are essential parts of human cells (chromosomes) that affect how our cells age. The length of telomeres is a biomarker of age, a shorter telomere length is associated with older age, atherosclerosis and other CV risk factors such as hypertension, adiposity, diabetes, smoking and physical inactivity.

A healthy lifestyle, increased physical activity and appropriate drug use (e.g. statins for hypercholesterolemia) prevent shortening of the telomere, reduces the risk of atherosclerosis and also improves life expectancy by anti-aging effects.[672]

Several agents such as metformin and reserveterol have been thought to slow the ageing process. At present, there is insufficient evidence that they do so.[673,674]

The use of hormones (growth hormones, TRT, placental hormone, stem cells etc) has not been proven to have any anti-aging effects and has the potential for harm.

III,C The committee does not recommend the use of hormones as anti-aging agents.

Recommendations:

- There is no role for chelation therapy, ozone therapy, stem cells or anti aging therapy in the prevention or treatment of CVD.

14. Monitoring of Activity and Quality Assurance

Implementation of the recommendations listed in this CPG can be accomplished by:

- Continuous medical education via regular seminars, lectures and roadshows particularly at the district hospital and family medicine clinics. Education and training is the most important aspect of the implementation of this CPG.
- Widespread availability of this CPG to healthcare providers via printed copies, electronic websites, etc.

The national NCD targets for Malaysia by year 2025 are shown in Table 29, pg 133. This was developed based on the comprehensive global monitoring framework, including 25 indicators, and a set of nine voluntary global targets for the prevention and control of NCDs.

Table 29: NCD Targets for Malaysia 2025

	Indicator	Global target	Malaysia	
			Baseline (2010*)	Target (2025)
1.	Risk of premature mortality from CVD, cancer, diabetes, or chronic respiratory diseases.	25% relative reduction	20%	15%
2.	Prevalence of current tobacco use in person aged 15+ years	30% relative reduction	23%	15%
3.	Mean population intake of sodium	30% relative reduction	8.7 gm	6.0 gm
4.	Prevalence of insufficient physical activity	10% relative reduction	35.2%	30.0%
5.	Harmful use of alcohol (prevalence of Heavy Episodic Drinking – HED)	10% relative reduction	≤1.2%	≤1.2%
6.	Prevalence of raised blood pressure	25% relative reduction	32.2%	26.0%
7	Prevalence diabetes and obesity	Halt the rise	≤15%	≤15%

**Note: The baseline data was determined through estimates from WHO, the National Health and Morbidity Survey (NHMS) and sub-population-based studies.*

In addition, other performance measures include:

- Hospital admissions and discharges
- Periodic national health surveys
- Mortality statistics
- Burden of disease studies conducted every 10 years

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APPENDIX

APPENDIX 1: COMPARISON OF GLOBAL CORONARY AND CV RISK SCORES

	Framingham CHD Risk Score	Framingham General CVD Risk Score	SCORE	ACC/AHA Pooled Cohort	Q-Risk2 Score
Sample size	5,345	8,491	205,178 (12 cohorts -Europe)	Based on 13 systematic reviews and meta analysis (includes CARDIA, Framing-ham, ARIC, CHS,USA	2.3 million patients (QRESEARCH database)
Age (y)	30 to 74; Mean: 49	30-74 Mean: 49	19 to 80; Mean : 46	40-79	35-74
Mean follow-up, y	12	12	13	At least 12 years	15
Risk factors considered	Age, sex, total cholesterol, HDL cholesterol, smoking, systolic blood pressure, antihypertensive medications	Age, total and HDL cholesterol, systolic blood pressure, treatment for hypertension, smoking, and diabetes status	Age, sex, total-HDL cholesterol ratio, smoking, systolic blood pressure	Age, total and HDL-cholester-ol, systolic BP (including treated or untreated status), diabetes, and current smoking status.	Ethnicity, age, sex, smoking status, SBP, ratio of TC: HDL-C, BMI, family history of CHD in first degree relative under 60 years, Townsend deprivation score, treated hypertension, T2DM, renal disease, AF, rheumatoid arthritis.
Endpoints	CHD (MI and CHD death)	CVD events (CHD, stroke, peripheral artery disease, or heart failure	Fatal CHD	First ASCVD event (nonfatal MI or CHD, death, or fatal or nonfatal stroke	First CVD event (CHD,stroke, TIA)
URLs for risk calculators	http://hp2010.nhl-bihin.net/atpiii/cal-culator.asp?user-type=prof	https://www.-framingham-heart-study.org/risk-functions/cardi-ovas-cular-disease/10-year-risk.php type=prof	http://ww-w.heartscore.org/pages/wel-come.aspx	www.cvriskcal-culator.com.	https://qrisk.org /2016/

APPENDIX 2: HOW TO USE THE FRAMINGHAM CARDIOVASCULAR RISK PREDICTION MODELS ONLINE?

For men and women

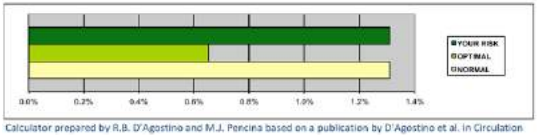
Example of the Framingham Cardiovascular Disease 10-year risk prediction model (cholesterol model)

If the patient is female, aged 30 years, has a systolic blood pressure of 125 mmHg, HDL cholesterol levels of 45 mg/dL and a total cholesterol level of 180 mg/dL, her 10-year cardiovascular risk is 1.3%. She falls into the low cardiovascular risk category.

From The Framingham Heart Study — **Enter Values Here**

General CVD Risk Prediction

Risk Factor	Units	(Type Over Placeholder Values in Each Cell)	Notes
Sex	male (m) or female (f)	f	
Age	years	30	
Systolic Blood Pressure	mmHg	125.0	
Treatment for Hypertension	yes (y) or no (n)	n	
Smoking	yes (y) or no (n)	n	
Diabetes	yes (y) or no (n)	n	
HDL	mg/dL	45	
Total Cholesterol	mg/dL	180	
Your 10-Year Risk (The risk score shown is derived on the basis of an equation. Other print products, use a point-based system to calculate a risk score that approximates the equation-based one.)		1.3%	*If value is < the minimum for the field, enter the minimum value. If value is > the maximum for the field, enter the maximum value.*
Your Heart/Vascular Age		30	

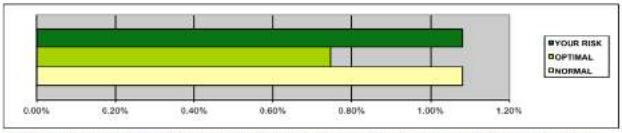


Calculator prepared by R.B. D'Agostino and M.J. Pencina based on a publication by D'Agostino et al. in Circulation

Example of the Framingham Cardiovascular Disease 10-year risk prediction model (BMI model)

If the patient is female, aged 30 years, has a systolic blood pressure of 125 mmHg, with a BMI of 22.5, kg/m^2, her 10-year cardiovascular risk is 1.1%. She falls into the low cardiovascular risk category.

From The Framingham Heart Study		Enter Values Here	
General CVD Risk Prediction			
Risk Factor	**Units**	**(Type Over Placeholder Values in Each Cell)**	**Notes**
Sex	male (m) or female (f)	f	
Age	years	30	
Systolic Blood Pressure	mmHg	125.0	
Treatment for Hypertension	yes (y) or no (n)	n	
Smoking	yes (y) or no (n)	n	
Diabetes	yes (y) or no (n)	n	
Body Mass Index	kg/m²	22.5	
Your 10-Year Risk (The risk score shown is derived on the basis of an equation. Other print products, use a point-based system to calculate a risk score that approximates the equation-based one.)		1.1%	*If value is < the minimum for the field, enter the minimum value. If value is > the maximum for the field, enter the maximum value.*
Your Heart/Vascular Age		30	



Calculator prepared by R.B. D'Agostino and M.J. Pencina based on a publication by D'Agostino et al. in Circulation

APPENDIX 3: STOP- BANG SLEEP APNEA QUESTIONNAIRE

STOP		
Do you SNORE loudly (louder than talking or loud enough to be heard through closed doors)?	Yes	No
Do you often feel TIRED, fatigued, or sleepy during daytime?	Yes	No
Has anyone OBSERVED you stop breathing during your sleep?	Yes	No
Do you have or are you being treated for high blood PRESSURE?	Yes	No

BANG		
BMI more than 35kg/m^2	Yes	No
AGE over 50 years old?	Yes	No
NECK circumference >16 inches (40cm)?	Yes	No
GENDER: Male?	Yes	No

TOTAL SCORE		

High risk of OSA: Yes 5-8

Intermediate risk of OSA: Yes 3-4

Low Risk of OSA: Yes 0-2

From: Chung F, Abdullah HR, Liao P. STOP-Bang Questionnaire: A Practical Approach to Screen for Obstructive Sleep Apnea. Chest. 2016 Mar;149(3):631-8

APPENDIX 4: FAT CONTENT OF COMMON MALAYSIAN FOOD*

Food	Portion	Calorie content
Nasi lemak with fried chicken	1 plate	640 kcal
Fried *kuey teow*	1 plate	320 kcal
Roti canai	1 piece	300 kcal
Fried chicken	1 piece	260 kcal
Curry noodle	1 bowl	530 kcal
Teh tarik	1 glass	140 kcal
Banana fritters	3 pieces	390 kcal
Curry puff	2 pieces	260 kcal
Briyani rice with chicken curry and *dhal* gravy	1 set	630 kcal
Idli with *dhal* gravy and coconut chutney	1 set	240 kcal
Capati with mungbean gravy	1 piece	380 kcal
Kuey teow soup	1 bowl	180 kcal
Vegetable soup	1 bowl	30 kcal
Kuih apam	1 piece	50 kcal
Putu mayam	1 piece	100 kcal
Noodle soup	1 bowl	380 kcal

**Nutrition Month Malaysia. Eat right. Move More. Fight Obesity. Available at http://nutritionmonthmalaysia.org.my/wp-content /uploads/ 2015/08 /nmm _ 2014_fight_obesity_ guidebook.pdf. Accessed April, 2016. & Bahagian Pemakanan Kementerian Kesihatan Malaysia. Panduan Nilai Kalori 200 Jenis Makanan.*

APPENDIX 5: CARBOHYDRATE CONTENT OF COMMON MALAYSIAN FOOD*

Food	Serving	Calories (kcal)	CHO content (g)	Glycaemic Index(GI)**
Added sugar	6 teaspoonfuls	100		High GI (>70)
Cooked White Rice	1 bowl (159g)	207	48	High GI (>70)
Roti Canai	1 piece (95g)	301	46	High GI (>70)
Capatti	1 piece (100g)	300	47	Intermediate GI (56-70)
Curry Mee	1 bowl (450g)	549	55	
Fried noodles (mee/meehoon)	1 plate (30g)	281	41	High GI (>70)
Bread (white/wholemeal)	1 slice (30g)	70	15	High GI (>70)
Biscuits, unsweetened	2 pieces (18g)	80	14	
Curry Puff	1 piece (40g)	128	17	
Potato	1 medium *90g)	90	16	High GI (>70)
Dhal (raw)	½ cup (96g)	96	64	
Full Cream Milk	1 cup (250ml)	187	18	Low GI (<55)
Low fat milk	1 cup (250ml)	131	12	Low GI (<55)
Skim Milk Powder	4 tablespoon (26g)	100	16	Low GI (<55)
Condensed milk,sweetened	1 tablespoon (40g)	126	21	Intermediate GI (56-70)
Apple/orange	1 medium (114g)	40	9	Low GI (<55)
Banana (pisang mas)	1 small (50g)	40	9	Intermediate GI (56-70)
Star fruit	1 medium (260g)	56	11	-
Durian (local)	5 small seeds(189g)	64	12	-
Langsat/grapes/longans	8 small (233g)	52	12	-
Guava	½ fruit (100g)	50	11	-
Papaya /pineapple	1 slice (160g)	56	11	Intermediate GI (56-70)
Watermelon	1 slice (160g)	56	11	Low GI (<55
Mango	1 small (100g)	50	11	Low GI (<55)

** Adapted from:Tee ES, Mohd Ismail N, Mohd Nasir A, et al. Nutrient Composition of Malaysian Foods. Institute for Medical Research (IMR). Kuala Lumpur, 1997*
***Food with Low GI is preferred.*

APPENDIX 6: GLYCAEMIC INDEX OF FOODS*

Food category	Low GI (<55)	Intermediate GI (56-70)	High GI (>70)
Rice	Barley	Basmati Rice Brown rice Parboiled rice Red rice	Glutinous rice Jasmine rice Instant porridge White rice Sago
Bread and cereals products	All bran breakfast cereals, Muesli, Wholegrain bread varieties	Capati Idli Oatmeal Pita bread, wholemeal Wholemeal barley flour bread	Cornflakes Rice crackers Roti canai White flour bread Wholemeal (whole wheat) Wheat flour bread.
Noodle and pasta	Lasagna pasta sheets, Spaghetti, white, boiled Spaghetti, wholemeal, boiled	Spaghetti, white, durum Wheat semolina, Udon noodles, plain Wheat noodles	Fried macaroni Fried meehoon Fried rice noodles Rice noodle (kuey teow)
Milk	Full fat milk Low fat milk Skim milk Soy milk (without added sugar) Yogurt	Ice cream Sweetened condensed milk	Teh Tarik
Fruits	Apple Mango Oranges Plum	Banana Dates Papaya Pineapples Raisin	Lychee Watermelon
Legumes	Baked beans Chickpeas Lentils Mung bean	-	-
Tubers	Cassava, boiled Sweet potato, boiled	Pumpkins, boiled Sweet corn, boiled	Potato, boiled

**Adapted from CPG, Management of Type2 Diabetes Mellitus 2015*
***It is important to consider both GL and GI:*
GL = GI x CHO (g)/100

APPENDIX 7: DIETARY FIBRE CONTENT OF COMMON FOOD*

	High Fibre (5+ g)	Medium Fibre (2-4 g)	Low Fibre (< 2 g)
Grains	Barley, cooked,1/2 cup	Bran, natural 1 tbsp Brown rice, cooked, ½ cup Wheat germ. 1 tbsp Basmathi rice uncooked ¼ cup	White rice, cooked, ½ cup
Noodles/ Pastas	Wole-wheat pasta, 1 cup	-	Noodles (Kuey tiaw, meehoon and mee), Spaghetti, cooked,1/2 cup
Starchy foods & cereals	Multiwholegrain fibremeal Bread, 1 slice	Rye bread, 1 slice Whole-wheat, 1 slice Whole-wheat pasta, ½ cup	Hamburger/hot dog bun ½, Plain dinner roll, 1 small White bread, 1 slice
Cereals (ready to eat)	bran, ½ cup	Shredded Wheat, 1 biscuit	Rice Krispies, 2/3 cup Corn flakes, ¾ cup
Starchy vegetables	Dried beans, peas, legumes, cooked, ½ cup	Potato, whole, cooked, with skin, ½ cup Sweet potato with skin, ½ cup Yam, cooked, ½ cup cubes Miso, paste, 3 tbsp Corn, canned, whole kernel,1/2cup Corn on the cob, 1 small	Potato, whipped, no skin, ½ cup Potato, whole, no skin, ½ cup Corn, canned creamed, ½ cup
Fruits	Apple, raw with skin, 1 medium, Figs/dates,10 Kiwi fruit, 2 medium Mango, 1 medium Pear, raw,1 medium Prunes, dried, 5	Apple, raw, no skin, 1 medium Orange, raw, 1 small Raisins, 2 tbsp Prune juice, 1 cup.	Grapes, 8 Honeydew melon, 1 slice, Pineapple, raw, 1 slice, Watermelon, 5 " triangle Most fruits and vegetables-based juice (apple, orange) – 1 cup
Vegetables	Green peas, fresh, frozen or canned, ½ cup, snowpeas, 10 pods	Bean sprouts, ½ cup Beans, string, ½ cup Brocolli,1/2 cup Carrots, raw,1/2 cup Eggplant, ½ cup Ladies fingers, ½ cup Vegetables, mixed, ½ cup	Asparagus, cooked, 6 spears Cabbage, raw, 1 cup Lettuce iceberg, 1 cup Cauliflower, raw, ½ cup Celery, raw, ½ cup Cucumber, raw,1/2 cup Mushrooms, raw,1/2 cup Mustard greens, fresh Cooked, ½ cup Spinach, raw,1 cup
Nuts & seeds	Almonds ,1 oz	Peanut butter, smooth, crunchy, 2 tbsp Peanuts (15),1 oz Sunflower seeds, with kernels, 2 tbsp Watermelon seeds, 2 tbsp Sesame seeds, 2 tbsp	Coconut, 2 tbsp Walnut, 2 tbsp

**Medical Nutrition Therapy Guideline for Type 2 Diabetes Mellitus 2nd Edition, adapted from American Dietetic Association, 2000*

APPENDIX 8: SERVING SIZE AND WEIGHT OF SELECTED FRUITS AND VEGETABLES*

Fruits	One serving	Weight (g)
Apple (red)	1 medium	128
Banana (*Pisang berangan*)	1 medium	93
Grape	8 fruits, whole	93
Guava (*Jambu batu*)	1 slice, big, without skin and seeds	111
Mandarin orange	2 whole medium	232
Mango	1 whole	232
Oranges	2 whole, medium	268
Papaya	1 slice without skins and seeds	159
Pear (yellow, lai)	1 whole medium	169
Pear (green)	½ whole medium	104
Pineapple	1 slice without skin and core	130
Prune	4 whole	26
Starfruit (*Belimbing manis/besi*)	1 whole, medium	261
Watermelon	1 big slice, without skin	311

Vegetables	One serving	Weight (g)
Bell paper (green), (*Lada hijau besar*)	1 cup raw (chopped)	129
Bittergourd (*peria*)	1 cup raw (diced)	125
Brinjal (*terung*)	1 cup raw (diced)	86
Cabbage	1 cup raw (shredded)	69
Carrot	1 cup raw (diced)	129
Cashew leaves (*Pucuk gajus*)	1 cup raw (chopped)	45
Cekor manis	1 cup raw (chopped)	34
Daun kelor	1 cup raw	26
Daun selom	1 cup raw (chopped)	42
Daun turi	1 cup raw (chopped)	34
Kailan (chinese kale)	1 cup raw (chopped)	63
Kangkung	1 cup raw (chopped)	78
Long beans (dark geen- kacang panjang)	1 cup raw (diced)	118
Petola	1 cup raw (chopped)	141
Pegaga (Indian Pennywort)	1 cup raw (chopped)	42
Pucuk Paku	1 cup raw (chopped)	84
Sawi (Choy sum)	1 cup raw (chopped)	86
Spinach (red)	1 cup raw (chopped)	47
Tapioca shoots (*Pucuk ubi kayu*)	1 cup raw (chopped)	40
Tomato	2 whole medium	110
Ulam raja	1 cup raw (chopped)	34

**Adapted from Malaysian Dietary Guideline (MDG), NCCFN, MOH, 2010*
***1 cup= 200ml*

APPENDIX 9: SODIUM CONTENT OF COMMON FOOD

No.	Foods	Serving size	Sodium/ Na (mg)
1.	Chicken curry	1 can (405g)	2036
2.	Chicken stock, cube	1 piece (10g)	1800
3.	Instant noodle	1 packet (80g)	1560
4.	Mono sodium glutamate	1 dessert spoon (10g)	1374
5.	Ham	3 slices (90g)	1098
6.	Salted fish	1 whole small sized (25g)	1022
7.	Belacan	1 slices (10g)	948
8.	Soy sauce	1 dessert spoon (10g)	880
9.	Bean paste	1 dessert spoon (10g)	780
10.	Fish oil	1 dessert spoon (10g)	726
11.	Tomato soup	1 can (250g)	712
12.	Fried chicken	2 pieces (240g)	660
13.	Salted vegetable	1 dessert spoon (8g)	624
14.	Chips	1 packet (large, 75g)	618
15.	Fish ball	2 pieces (large, 60g)	588
16.	Oyster sauce	1 dessert spoon (10g)	450
17.	Snack noodle	1 packet (medium, 35g)	430
18.	Fruit pickles	1 dessert spoon (10g)	428

Source:

1. *CCHRC. 2007. Sodium (Na*) Content of Seasoning and Common Foods.USA: Chinese Community Health Resource Center*
2. *CFS. 2012. Risk Assessment Studies, Report No. 49: Study on Sodium Content in Local Foods. Center for Food Safety Food and Environmental Hygiene Department. The Government of the Hong Kong Special Administrative Region.*

APPENDIX 10: ALCOHOL CONTENT OF COMMON DRINKS*

Low Alcohol Beer, Lager & Cider	Bottle (330ml)	Can (440ml)	Pint (568ml)	Litre
2%	0.7 units	0.9 units	1.1 units	2 units
Beer Lager & Cider				
4%	1.3 units	1.8 units	2.3 units	4 units
5%	1.7 units	2.2 units	2.8 units	5 unit
6%	2 units	2.6 units	3.4 units	6 units
Wine & Champagne (red, white, rose or sparkling)	Small Glass (125ml)	Standard Glass (175ml)	Large Glass (250ml)	Bottle (750ml)
10%	1.25 units	1.75 units	2.5 units	7.5 units
11%	1.4 units	1.9 units	2.8 units	8.3 units
12%	1.5 units	2.1 units	3 units	9 units
12.5%	1.6 units	2.2 units	3.1 units	9.4 units
13%	1.6 units	2.3 units	3.3 units	9.8 units
13.5%	1.7 units	2.4 units	3.4 units	10.1 units
14%	1.75 units	2.5 units	3.5 units	10.5 units
Fortified Wine (Sherry & Port)	Standard measure (50ml)			
17.5-20%	0.9-1 unit			
Spirits (Gin, Rum, Vodka & Whisky)	Single Measure (25ml)	Large Single Measure (35ml)	Double Measure (50ml)	Large Double Measure (70ml)
38 - 40%	1 unit	1.4 units	1.9-2 units	2.7-2.8 units
Shots (Tequila, Sambuca)	Single Measure (25ml)	Large Single Measure (35ml)		
38 – 40%	1 unit	1.3 units		

**Department of Health. Alcohol know your limits. Alcohol units: A brief guide, National Health Service. Crown Copyright 2008. Accessed from www.nhs.uk/units)*

APPENDIX 11: TIPS ON LOSING WEIGHT

Good Eating Habits

- Eat slowly.
- Eat when only feel hungry
- Stop before you feel full
- Eat three times a day.
- Snacks whenever needed and eat healthy snacks such as fruits.
- Eat slowly and enjoy each mouthful.
- Put down fork/Spoon between bites.
- Delay eating for 2 – 3 min and converse with others
- Postpone a desired snack for 10 min
- Serve food on a smaller plate
- Leave 1 – 2 bites on the plate

Elimination of eating cues.

- Plan meal/ snack - eat only at one designated place
- Plan for special events, parties, dinners
- Leave the table as soon as eating is done
- Do not combine eating with other activities such as reading/ watch TV
- Do not put bowls of food on table
- Stock home with healthier food choices
- Keep all food in cupboards where it cannot be seen
- Shop for groceries from a list after a full meal
- Immediately place leftovers in storage containers and refrigerate or freeze them for another meal
- Negotiate with the family to eat healthier foods
- Ask others to monitor eating patterns and provide positive feedback
- Substitute other activities for snacking
- Snack on fresh vegetables and fruits

See Physical Activity Tips – Table 10, pg 73

APPENDIX 12: FORMS OF TRADITIONAL MEDICINE

Traditional Malay Medicine (TMM):

- Is based on knowledge inherited from generation to generation among the Malay community.
- Has the largest user group.

There are four major practice areas in TMM:

- Traditional Malay Massage (Urut Melayu)- This is a massage technique comprising of kneading, stroking and pressing with hands and application of herbal oils to ease the massage. The practitioner uses his/her thumbs, palms, elbows and/or feet in applying a sustained mechanical pressure during massage. Sometime massage tool such as wooden stick, comb, and horn may be used as an aid during the massage. Traditional Malay massage may involve recitation of prayers.
- Malay Herbs- Herbs are used as a complement therapy in TMM in the treatment of a disease or enhancement of wellness. It may consist of any part of a plant such as root, leaf or stem, either dry or fresh.
- Cupping- This is a form of traditional medicine found in many cultures world-wide. TMM practitioners do not combine other forms of practices (such as herbal prescription) during or after cupping
- Postnatal care- There are three unique features in Malay postnatal care: the use of herbs, the use of heat and Malay postnatal massage. Malays are the main users.

Traditional Chinese medicine (TCM)

- Is based on knowledge inherited from generation to generation among the Chinese community grounded on a profound philosophy of Yin Yang and Five Element.

TCM uses many forms of treatment methods, the major methods being:

- Chinese herbs and material medica that involve mineral substance and animal components may be combined to form concoction. This is the most important method used to treat various diseases and manage the health of individual.
- Acupuncture, acupressure, Tuina, moxibustion, cupping and Guasa- These are the physical or mechanical treatment methods often use together under the guidance of the Meridian Theory, Yin Yang and Five Element Theory.
  - Acupuncture needles are suitable for deep but small area stimulation of human body.
  - Cupping and Guasa are suitable for large but superficial stimulation of skin area.
  - Acupressure is method of the choice when relatively mild stimulation is indicated or when there is no suitable equipment available.
  - Moxibustion provides stimulation of acupuncture points and heat therapy simultaneously.
  - Tuina is a form of manipulative treatment method use for treatment of certain disease and health condition. The practitioner can use a range of motion, traction, and massage with the stimulation of acupuncture points.
- Qigong- This is a practice of aligning body, breath and mind to cultivate and balance qi or what has been translated as “life energy”.

APPENDIX 12: FORMS OF TRADITIONAL MEDICINE (*cont'd*)

Traditional Indian medicine (TIM)
Has 5 major forms:

- Ayurveda means "science of life". The principal objectives of Ayurveda are maintenance and promotion of health, prevention of disease and cure of sickness. It is a famous practice in North India. It is a system based on 5 elements-space, air, fire, water and earth; and treatment concept based on balance of the three elemental substances. These elemental substances combine in the human body to form three life forces or energies, the Doshas. The Doshas consist of Vata (kinetic energy), Pitta (thermal energy), Kapha (potential energy) that governs physiological and psychological functions of the body. An equal balance of the 3 doshas leads to health, while imbalance in them leads to disease. Ayurveda emphasizes on Dietary Principles (Ahara Niyma), Daily regimen (Ritucharya), Good conduct/social behaviour (Sadavritta), the use of plant based medicines and treatments.
- Siddha came from the word siddhi, which means perfection of heavenly bliss. Siddha system gained popularity in South India especially in Tamil Nadu. Siddha medicine is a form of the TIM that uses a therapeutic concept. It is assumed that when the normal equilibrium of the three humors (Vaadham, Pittham and Kabam) is disturbed, disease is caused. The factors, assumed to affect this equilibrium, are environment, climatic condition, diet, physical activities, and stress. According to the siddha medical system, diet and life style play a major role, not only in health but also in curing disease.
- Unani is a form of TIM practiced mostly by Indian Muslim. According to its teachings, the body is comprised of four basic elements (earth, air, water and fire) and four humors (blood, phlegm, yellow bile, and black bile). Equilibrium in the humor indicates good health while a disturbance in this equilibrium results in disease.
- Yoga is a practice that involves physical movement, mental focus and spiritual strength. It originates from ancient India. The aim is to achieve a peaceful state of mind. Yoga also has been popularly defined as "union with the divine" in the context of other traditions. It has eight folds or paths that advocate certain restraints and observances, physical discipline, breath regulations, contemplation, meditation and Samadhi.
- Naturopathy- Practitioners often recommend the use of natural materials, such as sunlight, herbs and certain foods, as well as the activities that are supposed to be natural, such as exercise, meditation and relaxation. They claim that natural treatment helps restore the body's natural ability to heal itself without the adverse effects of conventional drugs. This treatment is offered through consultations.

Homeopathy
This is a system based on Samuel Hahneman's doctrine of "like cures like", according to which a substance that causes the symptoms of disease in healthy people will cure similar symptoms in sick people. Hahneman believed that the underlying causes of disease were phenomena that he termed miasms and homeopathic remedies addressed these. Homeopathy remedies are based on plant, mineral and animal substances.

Islamic medical practice
Islamic medical practice is used in the treatment of physical and spiritual ailments. It is performed by a Muslim who is knowledgeable and skilled in treatment methods or materials permitted by the Islamic law. The practitioner uses Quranic verses, Hadith, the practices of the pious and righteous scholars and venerated religious teachers.

APPENDIX 13: CATEGORIES OF COMPLEMENTARY AND TRADITIONAL MEDICINE*

The National Centre for Complementary and Alternative Medicine (NCCAM) has identified 5 major domains of Complementary and Alternative Medicines:

- Whole medical systems -This includes Traditional Oriental medicine, Ayurvedic medicine, Homeopathy, Naturopathy and other culturally based or indigenous healing practices.
- Mind-body Medicine- This includes clinical hypnosis, guided imagery, biofeedback, meditation, dance, music and art therapies, prayer, and spiritual healing.
- Biologically based therapies -This encompasses herbal medicine, the use of essential oils (clinical aromatherapy), special diets, orthomolecular therapies (high-dose vitamins and use of minerals, such as magnesium), and the use of biologic substances, such as shark cartilage and bee pollen.
- Manipulative and body-based Practices- This includes chiropractic medicine, osteopathy, massage, rolfing (structural integration), and cranial-sacral therapy. Each of these approaches is based on manipulation and/or movement of the body.
- Energy therapies -This includes biofield therapy and electromagnetic therapy. Biofield therapies, such as therapeutic touch, healing touch, reiki, and qi gong, are intended to affect the energy fields that are believed to surround and penetrate the body.

**National Centre for Complementary and Alternative Medicine (NCCAM),USA 2007*

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