

Your guide to understanding

Screening for Heart Disease



MINISTRY OF HEALTH
SINGAPORE



Contents

- 02 Heart (cardiovascular) screening
- 03 Why is cardiovascular screening important?
Who should go for screening for cardiovascular risk factors?
- 04 What is global cardiovascular risk assessment?
- 05 When should global risk assessment screening start?
How is the ten-year coronary artery disease risk in the Framingham Risk Score (FRS) calculated?
- 10 What additional screening tests may be needed following global cardiovascular risk screening?
- 11 When should general screening for body mass index, waist circumference, high blood pressure and high cholesterol be done?
- 12 What is pre-participative exercise screening?
- 14 Follow-up on the results of screening for cardiovascular disease and risk factors
- 18 Putting it all together – recommended guidelines for cardiovascular screening – men and women

This brochure is developed together with the Ministry of Health's Clinical Practice Guidelines on Screening for Cardiovascular Disease and Risk Factors. Clinical Practice Guidelines are recommendations to help doctors and patients make appropriate choices about patient care based on the best scientific evidence currently available. These guidelines do not replace the judgment of the attending doctor. It is important to remember that each person is different, and the Clinical Practice Guidelines may not always apply to everyone.



Heart (cardiovascular) screening

Heart disease is a broad term used to describe a range of diseases that affect one's heart and blood vessels. The term "heart disease" is often used interchangeably with "cardiovascular disease".

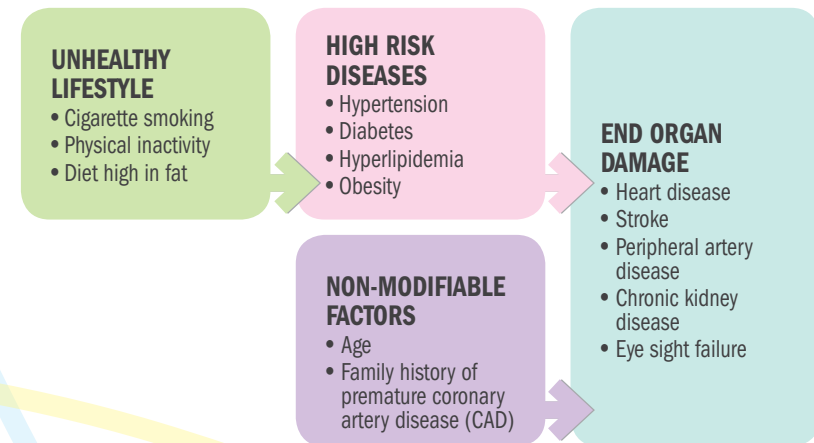
Cardiovascular disease is a leading cause of deaths worldwide and refers to disorders of the blood vessels supplying the heart and other major parts of the body such as the brain, kidneys, eyes, the arms and legs. Early detection of cardiovascular risks reduces the suffering from cardiovascular disease and prevents its complications such as heart failure, heart attack, stroke, kidney disease and peripheral artery disease through early treatment.

Why is cardiovascular screening important?

Cardiovascular disease is a process that begins with damage to the body from lifestyle factors of smoking, physical inactivity and unhealthy diet. This damage progresses to the development of high-risk diseases such as obesity, high blood pressure, diabetes and high lipids. If still left unchecked, these diseases progress to vascular disease resulting in damage to and failure of various organs and eventually death.

Cardiovascular screening identifies those at risk of future cardiovascular events of the heart and other major body organs. Cardiovascular screening also identifies those with modifiable risk factors. These factors are reversible and reduce one's risk of developing cardiovascular disease.

Major risk factors for cardiovascular disease



Who should go for screening of cardiovascular risk factors?

Every adult aged 18 years and above should go for screening of cardiovascular risk factors and cardiovascular diseases as part of disease prevention and health promotion. Patients with diabetes, high blood pressure and long-standing kidney disease have a higher risk for cardiovascular disease and should be screened regularly based on their doctor's advice.

What is global cardiovascular risk assessment?

Since many cardiovascular events such as heart attack, stroke, kidney failure and peripheral artery disease share the same causes and risk factors, assessing a patient's total cardiovascular risk should be done rather than just assessing risk factors (high cholesterol, blood pressure, diabetes or obesity) in isolation. This is known as global cardiovascular risk assessment.

The best known global cardiovascular risk assessment tool is the Framingham Risk Score (FRS). Based on the FRS adapted for local use, the risk for an asymptomatic individual is classified as:

- **Low-risk** – corresponding to <10% risk of vascular events* over a ten-year period
- **Intermediate-risk** – corresponding to 10-20% risk of vascular events over a ten-year period
- **High-risk** – corresponding to >20% risk of vascular events over a ten-year period

**These vascular events include heart attack and coronary death.*

For individuals at risk but who have no symptoms of cardiovascular disease, the assessment is followed by advice on making certain lifestyle changes to improve their heart health such as cutting back on cigarettes, eating healthy foods and exercising regularly and, where appropriate, medicines are given to treat high blood pressure, high lipids and diabetes. Individuals at low risk should continue to lead a healthy lifestyle.

When should global cardiovascular risk assessment screening start?

Global cardiovascular risk assessment should be done once every five years starting from the age of 18 years. More frequent assessment is recommended for those with increased risk for cardiovascular diseases such as those who are diabetic, chronic smokers or obese.

How is the ten-year coronary artery disease risk in the Framingham Risk Score (FRS) calculated?

The ten-year coronary artery disease risk in the FRS is calculated based on:

- Age
- Sex
- Ethnicity
- Smoking status
- Total and High Density Lipoprotein (HDL) or good cholesterol level
- Systolic blood pressure

Individuals who have diabetes are considered to be already at high risk for cardiovascular disease and are therefore not included in the FRS score.

(Refer to pages 6 and 7 for men, and pages 8 and 9 for women)



How to calculate ten-year Coronary Heart Disease (CHD) risk for men in Singapore

Allocate points based on person's age, total and HDL cholesterol levels, smoking status and systolic blood pressure as indicated in the tables below.

Check the total points against Table 1 to estimate the person's ten-year CHD risk.

Age	Points
20 - 34	-9
35 - 39	-4
40 - 44	0
45 - 49	3
50 - 54	6
55 - 59	8
60 - 64	10
65 - 69	11
70 - 74	12
75 - 79	13

Smoker	Points				
	Age 20 - 39	Age 40 - 49	Age 50 - 59	Age 60 - 69	Age 70 - 79
No	0	0	0	0	0
Yes	8	5	3	1	0

Total cholesterol mmol/L (mg/dL)	Points				
	Age 20 - 39	Age 40 - 49	Age 50 - 59	Age 60 - 69	Age 70 - 79
< 4.1 (160)	0	0	0	0	0
4.1 - 5.1 (160 - 199)	4	3	2	1	0
5.2 - 6.1 (200 - 239)	7	5	3	1	0
6.2 - 7.2 (240 - 279)	9	6	4	2	1
≥ 7.3 (280)	11	8	5	3	1

For example, if you are a 45-year-old Chinese male who smokes every day with a total cholesterol of 7.5 mmol/L, a HDL cholesterol of 1.1 mmol/L and a systolic BP of 135 mmHg, then your total score is >20. You are estimated to have a 'high' risk of heart attack or coronary death within the next ten years.

This would mean that more than 20 out of 100 persons in your risk category would experience a heart attack or coronary death within the next ten years.

You can also refer to the Heart Disease Assessment Tool available online to calculate your heart disease risk. This calculator estimates your risk of developing a heart attack or death due to heart disease in the next ten years and is available on <http://www.hpb.gov.sg/hpb/healthjournal/jou06b.asp?id=461>

HDL cholesterol mmol/L (mg/dL)	Points
≥ 1.6 (60)	-1
1.3 - 1.5 (50 - 59)	0
1.0 - 1.2 (40 - 49)	1
< 1.0 (40)	2

Systolic BP (mmHg)	Points	
	If untreated	If treated
< 120	0	0
120 - 129	0	1
130 - 139	1	2
140 - 159	1	2
≥ 160	2	3

Table 1. Estimation of ten-year CHD risk for men in Singapore

Total points	Ten-Year Risk (%)		
	Chinese	Malay	Indian
-1	< 1	< 1	1
0	< 1	< 1	1
1	< 1	1	1
2	1	1	1
3	1	1	2
4	1	1	2
5	1	1	3
6	1	2	3
7	2	2	4
8	2	3	5
9	3	4	7
10	4	5	9
11	5	6	11
12	6	8	14
13	8	11	18
14	11	13	> 20
15	13	17	> 20
16	17	> 20	> 20
≥17	> 20	> 20	> 20

How to calculate ten-year Coronary Heart Disease (CHD) risk for women in Singapore

Allocate points based on person's age, total and HDL cholesterol levels, smoking status and systolic blood pressure as indicated in the tables below.

Check the total points against Table 2 to estimate the person's ten-year CHD risk.

Age	Points
20 - 34	- 7
35 - 39	- 3
40 - 44	0
45 - 49	3
50 - 54	6
55 - 59	8
60 - 64	10
65 - 69	12
70 - 74	14
75 - 79	16

Smoker	Points				
	Age 20 - 39	Age 40 - 49	Age 50 - 59	Age 60 - 69	Age 70 - 79
No	0	0	0	0	0
Yes	9	7	4	2	1

Total cholesterol mmol/L (mg/dL)	Points				
	Age 20 - 39	Age 40 - 49	Age 50 - 59	Age 60 - 69	Age 70 - 79
< 4.1 (160)	0	0	0	0	0
4.1 - 5.1 (160 - 199)	4	3	2	1	1
5.2 - 6.1 (200 - 239)	8	6	4	2	1
6.2 - 7.2 (240 - 279)	11	8	5	3	2
≥ 7.3 (280)	13	10	6	4	2

For example, if you are a 40-year-old Chinese non-smoker female with a total cholesterol of < 4.1 mmol/L, a HDL cholesterol of 1.3 mmol/L and a systolic BP of <120 mmHg, then your total score is 0. You are estimated to have a 'low' risk of heart attack or coronary death within the next ten years.

This would mean that less than one out of 100 persons in your risk category would experience a heart attack or coronary death within the next ten years.

You can also refer to the Heart Disease Assessment Tool available online to calculate your heart disease risk. This calculator estimates your risk of developing a heart attack or death due to heart disease in the next ten years and is available on <http://www.hpb.gov.sg/hpb/healthjournal/jou06b.asp?id=461>

HDL cholesterol mmol/L (mg/dL)	Points
≥ 1.6 (60)	-1
1.3 - 1.5 (50 - 59)	0
1.0 - 1.2 (40 - 49)	1
< 1.0 (40)	2

Systolic BP (mmHg)	Points	
	If untreated	If treated
< 120	0	0
120 - 129	1	3
130 - 139	2	4
140 - 159	3	5
≥ 160	4	6

Table 2. Estimation of ten-year CHD risk for women in Singapore

Total points	Ten-Year Risk (%)		
	Chinese	Malay	Indian
5	< 1	< 1	1
6	< 1	< 1	1
7	< 1	1	1
8	< 1	1	1
9	1	1	2
10	1	1	2
11	1	2	3
12	1	2	3
13	1	3	4
14	2	4	6
15	3	5	7
16	3	6	10
17	4	8	12
18	5	10	16
19	7	13	20
20	9	16	> 20
21	12	20	> 20
22	15	> 20	> 20
23	19	> 20	> 20
> 24	> 20	> 20	> 20

What additional screening tests may be needed following global cardiovascular risk screening?

Table 3 lists the additional screening tests that may be needed for cardiovascular evaluation of individuals at moderate and high risk without any symptoms.

Your doctor will recommend which additional tests are needed based on your risk factors.

Table 3

Additional Screening Tests	Remarks
Resting electrocardiogram (ECG)	Indicated only in selected individuals e.g., cardiovascular screening in asymptomatic people with high blood pressure
Exercise treadmill test	Recommended in individuals without symptoms: <ul style="list-style-type: none"> • Older than 45 years in males and 55 years in females who plan to start vigorous exercise • Older than 45 years in males and 55 years in females who are at high-risk due to concurrent diseases • With diabetes who plan to start vigorous exercise
Coronary artery calcium score	Recommended in patients who have atypical chest pain to rule out ischaemic heart disease (These patients are otherwise considered to be at low-risk of coronary disease)
Cardiac stress imaging (stress echocardiography)	Reserved for individuals with an abnormal exercise ECG
CT coronary angiography	Uncertain value as a screening test even in high-risk individuals. The risks of the test and the possibility that it may lead to further unnecessary tests need to be considered
Carotid intima-media thickness	Not recommended for routine cardiovascular screening

When should general screening for body mass index (BMI), waist circumference, high blood pressure and high cholesterol be done?

The recommended age to screen for BMI, waist circumference, high blood pressure and high cholesterol is shown below in Table 4:

Table 4

Recommended for	To screen for	Screening test	Screening frequency
Individuals aged 18 years and above	Obesity	Body Mass Index (BMI)	Once a year
	Obesity	Waist circumference	
Individuals aged 18 years and above	High blood pressure	Blood pressure measurement	Once every two years or more frequently as advised by your health care provider
	Diabetes mellitus	Fasting venous blood glucose	
Individuals aged 40 years and above (Younger age group e.g. 30 years if other risk factors for diabetes or high lipids are present)	High blood lipids	Fasting venous blood lipids	Once every three years or more frequently as advised by your health care provider



What is pre-participative exercise screening?

Pre-participative screening helps identify those at risk for a cardiovascular event during exercise. A self-administered questionnaire (Table 5) is recommended for safety reasons before participating in any physical activity.

Table 5. Physical Activity Readiness Questionnaire (PAR-Q)

Before you exercise, please read each question carefully and answer Yes or No to your best knowledge:

1) Has anyone in your immediate family (mother, father, sister or brother) had a heart attack or died suddenly of a heart related disorder before age 55 (men) or 65 (women)?	Yes	No
2) Has your doctor informed you that you have any of these conditions? (check all that apply) <input type="checkbox"/> Heart condition or disease (also includes any type of heart surgery) <input type="checkbox"/> Stroke <input type="checkbox"/> Lung disease (e.g. chronic obstructive pulmonary disease/COPD or asthma) <input type="checkbox"/> Diabetes	Yes	No
3) Do you feel pain or discomfort in your chest when you engage in physical activity?	Yes	No
4) In the past one year, have you had chest pain when you were NOT engaging in physical activity?	Yes	No
5) Do you ever experience dizziness or even lose consciousness?	Yes	No
6) Do you have any bone, joint or muscle problem (e.g. back, knee, hip, shoulder or ankle) that could be made worse by participating in exercise?	Yes	No
7) Are you taking medication for high blood pressure or a heart condition?	Yes	No
8) Are you currently pregnant? (Female participants if you are currently pregnant please speak with your doctor about an appropriate exercise programme)	Yes	No
9) Do you know of any reason why participating in any other physical activity might be harmful to your health?	Yes	No
If you answered YES to one or more questions: Talk with your doctor in person before you proceed with any exercise programme.		

Physical activities are categorised into Category 1 and Category 2 (Table 6) based on the requirement of cardiovascular fitness.

- For Category 2 activities, greater cardiovascular fitness is needed along with a physical fitness clearance by a doctor
- For Category 1 activities, physical fitness is still an important consideration

For example, in a physically fit 55-year-old adult, Category 1 activities will pose no problem whereas an unfit person with congestive heart failure may not be able to tolerate such activities.

Table 6. Categorisation of sports based on cardiovascular activity

	Category			
	1	2		
Sport	Bowling	Archery	Field events	Sailing
	Bowls	Badminton	Floorball	Sepak takraw
	Chess	Baseball/	Gymnastics	Soccer
	Contract bridge	Softball	Hockey	Squash
	Cuesports	Basketball	Ice skating	Swimming
	Darts	Bodybuilding	Kayaking	Table tennis
	Gateball	*Boxing/	Lifesaving	Tennis
	Golf	wrestling (not	Martial arts	Triathlon
	Shooting	an NSA sport)	Motor sports	Underwater
	Sport boules	Canoeing	Mountaineering	activities
	Weiqi	Cricket	Netball	Volleyball
	Woodball	Cycling	Pickleball	Waterski/
	Xiangqi	Dancesport	Powerboat	wakeboard
		Dragonboat	Roller sports	Weightlifting
	Equestrian	Rowing		
	Fencing	Running		

Source: Maron et al. 36th Bethesda Conference: Eligibility Recommendations for Competitive Athletes with Cardiovascular Abnormalities.

Follow-up on the results of screening for cardiovascular disease and risk factors

Talk about the results of your screening with your doctor and know what you can do to live a healthy lifestyle (Table 7) as well as ways to prevent and treat your medical conditions (Table 8).

Table 7. Live a healthy lifestyle

What you can do	Recommendations
Healthy eating	<ul style="list-style-type: none"> • Eat five to seven servings of rice and alternatives daily (of which two to three servings should be whole-grain products) • Eat two servings of fruits and two servings of vegetables daily • Eat two to three servings of meat and alternatives daily (of which half a serving should come from dairy or other high calcium products) • Use fats, oils and salt sparingly to flavour food • Drink six to eight glasses of fluid (1.5 – 2.0 litres) daily <p>Further reading: <i>Health Promotion Board. ABC of Healthy Eating</i> URL: www.hpb.gov.sg/edumaterials/download.aspx?id=1344</p> <p><i>Health Promotion Board. Fat matters</i> URL: www.hpb.gov.sg/personas/download.aspx?id=1812</p>
Maintain a healthy weight	<ul style="list-style-type: none"> • Target to have your BMI between 18.3 to 22.9 kg/m² • Keep your waist circumference equal or less than <ul style="list-style-type: none"> – 80 cm for women – 90 cm for men • If you are overweight, aim to lose only 0.5 kg per week. A slow and steady weight management is healthier and easier on the body <p>Further reading: <i>Health Promotion Board. Obesity</i> URL: www.hpb.gov.sg/edumaterials/download.aspx?id=2038</p>

What you can do	Recommendations
Engage in regular physical activity	<ul style="list-style-type: none"> • If you are not exercising regularly, start today with ten minutes of brisk walking and build up as your physical fitness improves. You will enjoy the better health that comes with regular exercise • Target to exercise regularly – e.g. brisk walking 30 minutes a day five days a week, or a pedometer reading of 10,000 steps a day • If you enjoy doing other exercises, be regular in doing them <p>Further reading: <i>Health Promotion Board. Let's Get Active. Your Guide to Physical Activity</i> URL: www.hpb.gov.sg/edumaterials/download.aspx?id=5672</p> <p><i>Health Promotion Board. Let's Brisk Walk!</i> URL: www.hpb.gov.sg/edumaterials/download.aspx?id=5674</p>
Cut back on cigarettes	<ul style="list-style-type: none"> • See your doctor if you need help to quit smoking or to discuss more about it <p>Further reading: <i>Health Promotion Board. Quit Tips</i> URL: www.hpb.gov.sg/smokefree/article.aspx?id=458</p> <p><i>Health Promotion Board. How to Quit?</i> URL: www.hpb.gov.sg/smokefree/article.aspx?id=438</p>
Limit alcohol use	<ul style="list-style-type: none"> • Avoid alcohol bingeing • Ask your doctor's advice on setting the limits on alcohol consumption <p>Further reading: <i>Health Promotion Board. Alcohol and Health – Set Your Drinking Limits</i> URL: www.hpb.gov.sg/foodforhealth/article.aspx?id=2714</p>



Table 8. Prevent and treat your medical conditions

What you can do	Recommendations
Keep your cholesterol levels in check	<p>Desirable levels are:</p> <ul style="list-style-type: none"> • Total Cholesterol – Less than 5.2 mmol/L (200 mg/dL) • HDL-cholesterol – Equal or greater than 1.0 mmol/L (40 mg/dL) • LDL-cholesterol – Less than 3.4 mmol/L (130 mg/dL) • Triglycerides – Less than 2.3 mmol/L (200 mg/dL) <p>Check with your doctor the levels to set for yourself</p> <p>Further reading: <i>Health Promotion Board. Lower Your Cholesterol</i> URL: www.hpb.gov.sg/personas/download.aspx?id=1986</p>
Keep your blood pressure levels in check	<p>Normal blood pressure levels are:</p> <ul style="list-style-type: none"> • Systolic BP – Less than 130 mm Hg • Diastolic BP – Less than 80 mm Hg <p>Check with your doctor the levels to set for yourself</p> <p>Further reading: <i>Health Promotion Board. Do You have High Blood Pressure?</i> URL: www.hpb.gov.sg/edumaterials/download.aspx?id=1800</p>
Keep your blood sugar levels in check	<p>Optimal (target goal for majority of patients) are:</p> <ul style="list-style-type: none"> • HbA1c – 6.5 – 7.0% • Pre-meal glucose – 6.1 – 8.0 mmol/L • Two-hour post-meal glucose – 7.1 – 10.0 mmol/L <p>Check with your doctor the levels to set for yourself</p> <p>Further reading: <i>Health Promotion Board. Be Aware of Diabetes</i> URL: www.hpb.gov.sg/edumaterials/download.aspx?id=3488</p> <p><i>Health Promotion Board. Keep Your Diabetes Under Control</i> URL: www.hpb.gov.sg/edumaterials/download.aspx?id=3494</p>

What you can do	Recommendations
Take your medicines regularly	<ul style="list-style-type: none"> • Take your medicines regularly even if you feel well <p>Check with your doctor on the targets of control if they are not optimal</p> <p>Further reading: <i>Health Promotion Board. Chronic Disease Management</i> URL: www.hpb.gov.sg/chronicdisease/diabetes/control_instructions.htm</p>
Go for regular monitoring if you have chronic medical conditions	<ul style="list-style-type: none"> • You need regular monitoring if you have high cholesterol levels, high blood pressure or diabetes <p>Check with your doctor on the desired frequency of regular monitoring</p> <p>Further reading: <i>Health Promotion Board. Health Screening</i> URL: www.hpb.gov.sg/data/hpb.home/files/whp/health_fac/</p>

Recommended guidelines for cardiovascular screening – men and women

Screening	Age 18 – 24	Age 25 – 29	Age 30 – 34	Age 35 – 39	Age 40 – 44	Age 45 – 49	Age 50 – 54	Age 55 – 59	Age 60 – 64	Age 65 – 69
Cardiovascular risk factors – lifestyle factors and medical conditions										
Smoking	Check at first visit and document on a regular basis									
Physical activity	Check at first visit and periodically – type of activity, level, intensity and the duration of physical activity									
Unhealthy diet	Check at first visit and periodically (Follow Singapore Health Promotion Board's guidelines on healthy eating)									
Unhealthy weight	Check your BMI and waist circumference every year									
High lipids	Check fasting lipids starting at 40 years and every three years if results are optimal (Those with cardiovascular risk factors may need to start screening at an earlier age)									
High blood pressure	Check during any visit to the physician if not screened before									
	Check every two years if diastolic BP is below 85 mmHg and systolic BP below 130 mmHg Check yearly if diastolic BP 85-89 mmHg or systolic BP 130-139 mmHg Persons with higher BP or major coronary risk factor, e.g. diabetes, need more frequent measurement									
Diabetes mellitus	Check fasting blood glucose starting at 40 years and every three years if results are optimal (Those with cardiovascular risk factors may need to start screening at an earlier age)									
Asymptomatic cardiovascular disease (global cardiovascular risk assessment)										
Low risk	Only global cardiovascular risk assessment is needed. Resting ECG is not recommended									
Moderate risk	Additional tests may be needed to reclassify patient to high risk (See Table 3)									
High risk	Exercise Treadmill Test (ETT) is needed for evaluation prior to risk reduction therapy Cardiac stress imaging is needed for those with an abnormal exercise ECG (See Table 3)									
Pre-participative assessment										
Sports and recreational activities (Category 1)	You are encouraged to read the PAR-Q and answer 'Yes' or 'No' See your doctor if indicated									
Sports and recreational activities (Category 2)	You are encouraged to read the PAR-Q and answer 'Yes' or 'No' See your doctor if indicated									
Competitive sports	You should go for an appropriate pre-participation physical assessment to be done by your doctor every year									

Have any questions?

Write them here so you can ask your doctor!

For more information, call HealthLine at **1800 223 1313** during office hours to speak to our Nurse Advisors.