

Cardiovascular Disease Risk Assessment and Management for Primary Care

Acknowledgements

With thanks to the consumers and sector stakeholders who contributed during workshops/discussions and the expert advisory group: Assoc Prof Gerry Devlin, Dr Paul Drury, Dr Fraser Hamilton, Dr Ben Hudson, Katie Inker, Prof Rod Jackson, Prof Jim Mann, Dr Helen Rodenburg, Prof Tim Stokes, Dr Jim Vause, Assoc Prof Susan Wells, Prof Michael Williams and Vanessa Young.

Citation: Ministry of Health. 2018. *Cardiovascular Disease Risk Assessment and Management for Primary Care*. Wellington: Ministry of Health.

Published in February 2018
by the Ministry of Health
PO Box 5013, Wellington 6140, New Zealand

ISBN 978-1-98-853933-1 (online)
HP 6747

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What's new in 2018 CVD risk assessment and management?

Risk assessment

- Cardiovascular disease (CVD) risk assessment and management for people aged 30 to 74 years without prior CVD is now based on new five-year CVD risk prediction equations from the New Zealand PREDICT study, to be known as the NZ Primary Prevention Equations. There are separate equations for people with and without diabetes.
- People aged 75 years and older are outside the age range included in the NZ Primary Prevention Equations. Therefore risk estimates in this population will only be approximations but are potentially useful.
- It is no longer possible to use paper charts to estimate CVD risk due to the increased number of predictors in the new equations. Risk assessment and communication will now require access to an electronic decision support system that should be integrated within primary care patient management systems.
- Outcomes predicted are the combination of hospitalisations and deaths from ischaemic heart disease (including unstable angina), stroke, transient ischaemic attack (TIA), heart failure and peripheral vascular disease.
- The risk equations include NZDep, CVD preventive medications, and a diagnosis of atrial fibrillation as new predictors.
- Family history of premature CVD is now defined as having a first-degree relative hospitalised or having died due to a heart attack or stroke before age 50 years.
- A history of heart failure is now included as part of a history of established CVD. Therefore these patients do not require risk assessment with the primary prevention equations.
- A measurement of serum creatinine (to calculate eGFR) is now recommended to identify people with chronic kidney disease. Patients with an eGFR less than 30 ml/min/m² have a CVD risk equivalent to those with established CVD. Therefore these patients do not require risk assessment with the primary prevention equations.
- Begin CVD risk assessments in men aged 45 years and women aged 55 years.
- For Māori, Pacific and South Asian populations, and people with known significant CVD risk factors, risk assessment is now recommended to begin in men aged 30 years and in women aged 40 years, 15 years earlier than other population groups.
- **Repeat CVD risk assessments** are recommended at the following intervals:

Five-year risk level	Repeat CVD risk assessment
< 3 percent	10 years
3–9 percent	5 years
10–14 percent	2 years
15+ percent	1 year, as part of annual management review

- For people with severe mental illness (schizophrenia, major depressive disorder, bipolar disorder, schizoaffective disorder), CVD risk assessment is recommended from age 25 years. Repeat assessments should follow every two years, unless the risk is 15 percent or more, when it should be repeated every year.

Risk assessment – diabetes

- CVD risk assessment and management is a recommended component of the annual diabetes review, in people with type 2 diabetes.
- The new risk prediction equations for people with type 2 diabetes include: duration of diabetes, BMI, eGFR, ACR, HbA_{1c} and hypoglycaemic medications; in addition to the risk factors in equations for people without diabetes.
- No specific risk equations are available for people with type 1 diabetes, although the same main disease variables (diabetes duration, renal disease, glycaemic control) apply as for type 2 diabetes. CVD risks for this group are substantially higher than for people with type 2 diabetes (50% higher in men and up to 90% higher in women).

Risk management

- Encourage a healthy lifestyle (smoking cessation, healthy diet, regular physical activity, optimal weight) in everyone.
- Assessing five-year CVD risk is pivotal to guide decision-making for primary prevention. Individuals with the highest risk have the most to gain.
- Risk communication is critical to making shared decisions about risk management. Communicate the results of risk assessment to all patients.
- Tools for risk communication and displaying the benefits and harms of management should be integrated within primary care patient management systems.
- An estimated five-year CVD risk of 15 percent or more is considered to be equivalent to the risk for people with prior CVD. Lipid-lowering and blood pressure-lowering drug treatment is strongly recommended and aspirin should be considered in some groups.
- A diagnosis of asymptomatic carotid disease (including plaque identified on carotid ultrasound) or asymptomatic coronary disease (including coronary artery calcium score > 400) or plaque identified on CT angiography is associated with increased CVD risk. These patients should be considered to have an estimated five year risk of 15 percent or more. Lipid-lowering and blood pressure-lowering drug treatment is strongly recommended and aspirin should be considered in some groups
- During shared decision-making, it is reasonable to consider pharmacological treatment of modifiable risk factors for patients with estimated five-year CVD risk of 5–15 percent. For patients in this risk group, the benefits and harms of lipid-lowering and blood pressure lowering drugs should be presented and discussed to allow an individualised informed decision about whether to start treatment.

Lipid management

- Substituting dietary saturated fat with mono and polyunsaturated fats is the most effective dietary approach to reducing low-density lipoprotein cholesterol (LDL-C) while maintaining or increasing high-density lipoprotein cholesterol (HDL-C).
- Statins are the preferred choice of lipid-lowering drugs with each 1.0 mmol/L reduction in LDL-C associated with a 25 percent relative risk reduction events over five years
- For individuals with a total cholesterol to HDL-cholesterol (TC/HDL-C) ratio of eight or more, after lifestyle modifications, drug treatment is recommended regardless of predicted CVD risk.

- For individuals with a five-year CVD risk of 15 percent or more, lipid-lowering drug treatment, in addition to dietary changes, is strongly recommended, with an LDL-C treatment target below 1.8 mmol/L.
- For individuals with a predicted five-year risk between 5 and 15 percent the benefits and harms of lipid-lowering drugs should be presented and discussed to allow an individualised informed decision about whether to start treatment. A target LDL-C reduction of 40 percent or greater is recommended if drug treatment commenced.
- Once target LDL-C is considered satisfactory, an annual review is recommended.

Blood pressure management

- Out-of-office blood pressure (BP) measurement, assessed by ambulatory or home BP monitoring, is an important adjunct to office BP measurement and should be considered if ‘white-coat’ hypertension, resistant hypertension or drug-induced hypotension suspected.
- The ideal blood pressure for most individuals is likely to be below 120 mmHg systolic and 75 mmHg diastolic.
- For each 10 mmHg reduction in systolic blood pressure, RCTs demonstrate that patients will achieve an approximate 20 percent relative risk reduction in CVD events over five years.
- Reducing salt and alcohol intake, losing weight and increasing physical activity are effective ways to reduce BP and should be encouraged in all patients with office BP of 130 mmHg systolic or 80 mmHg diastolic or greater.
- For individuals with persistent office BP of 160 mmHg systolic (150 mmHg on ambulatory and home monitoring) and/or 100 mmHg diastolic (95 mmHg on ambulatory and home monitoring) or more, after lifestyle modifications, drug treatment is recommended regardless of predicted CVD risk.
- For individuals with a five-year CVD risk of 15 percent or more, with persistent office BP of 130 mmHg systolic and/or 80 mmHg diastolic or greater or an equivalent level from ambulatory or home blood pressure monitoring, drug treatment in addition to lifestyle changes, is strongly recommended.
- For individuals with five-year CVD risk between 5 and 15 percent with persistent office BP of 140 mmHg systolic and/or 90 mmHg diastolic or greater, or an equivalent level from ambulatory or home BP monitoring, the benefits and harms of BP-lowering drugs should be presented and discussed to allow an individualised informed decision about whether to start treatment.
- If drug treatment is commenced, a target office BP less than 130 mmHg systolic and less than 80 mmHg diastolic is recommended.
- Caution is recommended in lowering BP in older people who may be at particular risk of treatment-related harms.
- Angiotensin converting enzyme (ACE) inhibitors or angiotensin II receptor blockers (ARBs), calcium channel blockers and thiazide diuretics are all suitable first-line drugs, either as monotherapy or in some combinations unless contraindicated.
- Once target BP is reached, an annual review is recommended. For stable individuals, home BP monitoring and electronic communication with the physician may provide an acceptable alternative to office monitoring.

Aspirin

- In patients under 70 years with a five-year CVD risk of 15 percent or greater the benefits of aspirin may outweigh the bleeding risk and should be considered. Potential benefit (reduction in non-fatal MI and possible small net years gained) and bleeding risk must be carefully assessed and discussed during shared decision-making.

- In patients aged over 70 years with a five-year CVD risk of 15 percent or more the balance of benefits and harms cannot be determined with aspirin and use is not recommended for primary CVD prevention.
- In patients with a five-year CVD risk of less than 15 percent, aspirin for primary prevention of CVD alone is not recommended.

Diabetes management

- Healthy lifestyle measures (smoking cessation, healthy diet, regular physical activity, optimal weight) should be strongly encouraged for people with diabetes.
- All people with diabetes, especially the newly diagnosed, should be offered training in self-management.
- Optimise glycaemic control to an appropriate level in consultation with the individual patient. The target range agreed will generally be more stringent in younger and fitter patients (eg, 50–55 mmol/mol or lower) than older, co-morbid or frail patients and those prone to hypoglycaemia (eg, 55–64 mmol/mol or higher).
- Remember the risk of hypoglycaemia from sulphonylureas and insulin (including combination therapy), especially in older people.

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The review process

In 2015 the Ministry of Health commissioned the Heart Foundation to review the relevant evidence on CVD risk assessment and management. As part of this review, the University of Auckland VIEW research group provided the Heart Foundation with two pre-publication papers describing new CVD risk prediction equations. Seven areas identified for review were:

- the expected real-world benefit to New Zealanders of having New Zealand-specific risk stratification and risk equations
- the CVD risk assessment window or frequency for different risk categories
- the evidence for medication treatment thresholds and goals of treatment
- lifestyle interventions, including dietary advice that is sustainable for populations with health literacy challenges
- effective ways to encourage those at increased CVD risk to change their behaviour in a sustained way and take their medication, including through effective risk communication, shared decision-making and goal setting
- co-morbidity with serious mental illness, the increased risk linked with serious mental illness, and impact of antipsychotic medications
- overall consistency of New Zealand guidelines with new international guidelines.

The review focused on available recent quality-assured international guidance and existing systematic reviews. To answer the research questions, it reviewed all relevant recent quality-assured guidance from other countries, any relevant Cochrane or other systematic reviews and meta-analyses. It also included recent research studies to address the question of mental health and CVD.

The focus was on updating the evidence since the last major update, which had been for the 2012 Primary Care Handbook. Therefore, the review specifically looked at guidelines, reviews and evidence published since 2011.

The Heart Foundation conducted an evidence review update in 2017.

Existing clinical guidelines

The review identified existing clinical guidelines from relevant national guideline-producing bodies and the United States National Guideline Clearing House (www.guideline.gov). It included only guidelines and guideline producers that met agreed international quality standards (AGREE) (Brouwers et al 2010). The review examined relevant evidence tables, evidence summary and, where appropriate, the structured decision-making process ('evidence to recommendations') of the guideline development group and recommendations. The following sections are based on the findings from this review.

A researcher identified a core set of guidelines for all review areas to include. Two experts, a cardiologist (Associate Professor Gerry Devlin) and a general practitioner and guidelines expert (Professor Tim Stokes), peer-reviewed identified guidelines.

Existing systematic reviews

The review searched existing systematic reviews (including Cochrane reviews) in each area where indicated. Only reviews published in 2011 or later, were included unless there was a specific reason for inclusion of an earlier review. The steps of the review – searching, review selection, quality appraisal and presentation of findings – followed the Smith et al (2011) methodology for reviewing systematic reviews.

Primary research studies

Where no relevant systematic reviews or clinical guideline evidence summaries existed, the review conducted a rapid systematic review of primary studies in line with international best practice for evidence-based guideline development. It followed the methods guidance that the United Kingdom's National Institute for Health and Care Excellence (NICE) produced for its guideline developers (NICE 2012), which is based on the approach of the Cochrane Collaboration.

Recommendations for cardiovascular disease risk assessment

Why estimate CVD risk?

The overarching principle for a high-risk CVD prevention strategy is that the benefits of CVD risk-reducing interventions are proportional to the estimated CVD risk.

The 2003 New Zealand CVD guidelines (New Zealand Guidelines Group 2003) supported a targeted high-risk clinical strategy for vascular disease prevention by shifting the emphasis from managing single risk factors to treating individuals according to their estimated five-year CVD risk derived from multivariable CVD risk prediction equations. This approach complemented public health prevention strategies that have already had a major impact on mortality and incidence through their effects on cigarette smoking and consumption of saturated fat and salt (Tobias et al 2006, 2008).

Both population-wide and risk-based strategies are needed to further reduce the burden of CVD in our communities. An increasing concern is that the steadily rising prevalence of overweight and obesity worldwide could reverse the favourable trends in vascular disease event rates. If it does, high-risk preventive interventions will become increasingly important.

Meta-analyses of randomised controlled trials (RCTs) now provide consistent, high-quality evidence that the absolute benefits of blood pressure (BP) and lipid-lowering drugs are largely determined by patients' predicted pre-treatment vascular risk (Cholesterol Treatment Trialists' Collaborators et al 2012; Blood Pressure Lowering Treatment Trialists' Collaboration et al 2014).

New PREDICT equations

In 2003 the Health Research Council of New Zealand funded the PREDICT cohort study. The study's purpose was to develop new prediction models for the New Zealand population, while simultaneously supporting the implementation of guidelines through computerised decision support (Wells et al 2015). As of December 2015, general practitioners and nurses had assessed 400,728 patients using PREDICT (Appendix A). Through matching each individual's encrypted National Health Index number to national hospitalisation and mortality data sets, it was possible to develop a series of CVD risk assessment (CVDRA) equations.

The new PREDICT CVDRA equations estimate that:

- 74 percent of the eligible population has less than 5 percent five-year risk of CVD
- 24 percent of the eligible population has a 5–14 percent risk
- 2 percent of the eligible population has a risk of 15 percent or higher.

Note: The eligible population includes all men without prior CVD aged 45–74 years, all women without prior CVD aged 55–74 years. It also includes Māori, Pacific or South-Asian peoples from an age 15 years younger than the starting age for the general population.

Reasons for using a five-year risk

This document continues to recommend estimating five-year risk (rather than 10-year risk as used in many other countries) because:

- most randomised controlled trials of CVD preventive medications are based on five years of treatment or less, and therefore the best estimates of treatment benefits are over five rather than 10 years
- both risk and risk management can change significantly over 10 years and therefore predicting 10-year risk is likely to be less meaningful in practice than predicting over five years
- practitioners are used to this approach
- the median follow-up of participants in the PREDICT cohort used to derive new risk prediction equations is currently about five years.

What to measure and record

It is no longer appropriate or possible to use paper-based charts to estimate CVD risk as the new risk prediction equations (Appendix A) include too many additional variables.

Note also that a number of other high-risk populations are not included in this risk equation update (Appendix B).

Table 1 sets out and defines the variables involved in a CVD risk assessment.

Table 1: Variables required for CVD risk assessment

Variable	Definition
Variable category: Socio-demographic factors	
Age (date of birth)	Age in whole years – calculate by subtracting date of birth from the date of assessment and dividing by 365.25.
Gender	Male or female as per enrolment.
Ethnicity	Prioritised Level 2 and relevant Levels 3 and 4 ethnicity coding according to ethnicity categories within CVDRA equations.
NZ Index of Deprivation score	Quintile of deprivation.
Variable category: Family history	
Premature ischaemic CVD	A first-degree relative (parent or sibling) was hospitalised by or died from a heart attack or stroke before the age of 50 years.
Type 2 diabetes	Type 2 diabetes in first-degree relative (parent, sibling or child).
Variable category: Past medical history	
Angina	History of stable or unstable angina.
Myocardial infarction	Previous heart attack, including both non-ST elevation myocardial infarction (non-STEMI) and ST elevation myocardial infarction (STEMI).
PCI	Previous percutaneous coronary intervention (PCI), including coronary angioplasty and stenting.
CABG	Previous coronary artery bypass graft (CABG) procedure.
Ischaemic stroke	Diagnosed ischaemic stroke with neurological signs and symptoms lasting more than 24 hours.

TIA	History of transient ischaemic attacks (TIAs) – signs and symptoms typical of a stroke but with full recovery in less than 24 hours.
Peripheral vascular disease	Atherosclerotic peripheral vascular disease of any peripheral arteries (eg, to legs and feet), including carotid and vertebral arteries. Diagnosis could be based on: <ul style="list-style-type: none"> • clinical signs and symptoms such as claudication • diminished foot pulses and carotid bruits • radiological evidence or prior surgical procedures • abdominal aortic aneurysm • asymptomatic carotid disease.
Familial hypercholesterolaemia	Raised levels of total cholesterol and LDL cholesterol consistent with autosomal dominant inheritance.
Atrial fibrillation	ECG confirmed atrial fibrillation.
Heart failure	Heart failure diagnosis.
Diabetes	Diagnosed with type 1 diabetes, type 2 diabetes or type unknown.
Duration of diabetes	Calculate by subtracting the year of electronic submission from the year of diagnosis of diabetes.
Urinary albumin:creatinine ratio (ACR) if diabetes present	Urinary albumin:creatinine ratio in mg/mmol.

Variable category: Measure risk factors

Smoking	0 = No – never 1 = No – quit over 12 months ago 2 = No – quit within 12 months 3 = Yes – up to 10 per day 4 = Yes – 11–19 per day 5 = Yes – more than 20 per day
HbA _{1c} or fasting glucose	Use single non-fasting HbA _{1c} in mmol/mol to screen for diabetes. Note: This measure may be misleading in some circumstances. If you have concerns about its validity in any individual, then fasting plasma glucose mmol/L is recommended – see below.
Blood pressure	Use the average of two seated BP measurements taken at least 10 minutes apart.
Non-fasting lipid profile	Use a single non-fasting total cholesterol to high-density lipoprotein cholesterol (TC:HDL-C) ratio in calculating CVD risk.
Serum creatinine/eGFR	Serum creatinine in umol/L. Calculate eGFR using CKD-EPI equation.
BMI	Measure weight in kilograms and height in metres. Calculate body mass index (BMI) by kg/m.

Variable category: CVD medications dispensed during the six months prior to risk assessment

Lipid-lowering medications	Statins, fibrates, other (eg, ezetimibe, niacin).
BP-lowering medications	Angiotensin-converting enzyme (ACE inhibitor), angiotensin II receptor blocker (ARB), beta blockers, calcium channel blockers, thiazides and other BP-lowering medications.
Antiplatelet and anticoagulant medications	Aspirin, clopidogrel, dipyridamole, prasugrel, ticagrelor, ticlopidine. Warfarin, dabigatran, rivaroxaban, apixaban, phenindione.

Diabetes assessment

A single non-fasting glycated haemoglobin (HbA_{1c}) measured by an accredited laboratory is the recommended screening test (Ministry of Health 2013). If it is not possible to measure HbA_{1c} or there are concerns about its validity, then a fasting plasma glucose is recommended (Ministry of Health 2013).

The New Zealand Society for the Study of Diabetes and the Ministry of Health have recommended that the threshold for a diagnosis of diabetes using HbA_{1c} is 50 mmol/mol.

HbA_{1c} results may be falsely low in people:

- with a high turnover of red blood cells
- taking iron, vitamin B12 or any other product that temporarily increases red blood cell production
- who have undergone a blood transfusion any time in the previous three months.

HbA_{1c} results may be falsely high in people with:

- iron deficiency anaemia
- vitamin B12 or folate deficiency
- alcoholism or chronic renal failure
- certain haemoglobinopathies (Braatvedt et al 2012)

In symptomatic people, a single HbA_{1c} of 50 mmol/mol or higher is diagnostic of diabetes for the majority of people (see exceptions below).

In asymptomatic people, an HbA_{1c} of 50 mmol/mol or higher strongly indicates diabetes, but a second test is required to confirm it. (Ideally repeat a second HbA_{1c} at least three months later or use a fasting plasma glucose.)

Table 2 summarises the guidelines for diagnosing diabetes.

Table 2: Recommended guidelines for the diagnosis of diabetes

HbA _{1c}	Fasting glucose equivalent	Diagnosis	Comments
≥ 50 mmol/mol, with symptoms	≥ 7.0 mmol/L, with symptoms	Diabetes	
≥ 50 mmol/mol, no symptoms	≥ 7.0 mmol/L, no symptoms	Diabetes	Conduct a second HbA _{1c} test ≥ 50 mmol/mol to confirm diagnosis (after three months).
41–49 mmol/mol	6.1–6.9 mmol/L	Pre-diabetes	Offer lifestyle advice. Perform CVD risk assessment and follow recommendations for management. Repeat testing of HbA _{1c} every 12 months. Note: CVD risk increases with increasing HbA _{1c} .
≤ 40 mmol/mol	≤ 6.0 mmol/L	Diabetes unlikely	Normal range. Repeat HbA _{1c} at next CVD assessment or when clinically indicated.

Estimating CVD risk

Don't use the NZ Primary Prevention Equations for patients with pre-existing CVD (Table 3) as aggressive risk management and lifestyle modification is strongly recommended in these patients.

Similarly, don't use NZ Primary Prevention Equations in patients with CHF, familial hypercholesterolaemia, chronic kidney disease or diabetes with overt nephropathy or other renal disease as defined in Table 3, given their very high risk and need for individualised management.

Calculate five-year risk using the NZ Primary Prevention Equations for men or women aged 30 to 74 years.

Patients with diabetes are at increased cardiovascular risk. Duration of diabetes, the presence of albuminuria or impaired renal function and poor glycaemic control are also independent CVD risk factors in these patients. Therefore, new diabetes-specific equations, which incorporate these variables, should be used.

A CVD risk assessment should be considered as the starting point for estimating an individual patient's CVD risk. It is expected that the clinician performing a risk assessment will use their clinical expertise and knowledge of the individual patient to consider whether the calculated result is likely to underestimate or overestimate risk. For example, among people with serious mental illness, or who are morbidly obese, the risk will be higher than calculated with these equations.

People aged 75 years and older are outside the age range included in the NZ Primary Prevention Equations. Therefore risk estimates outside this age range will only be approximations but are potentially useful.

The recommended age at which to start CVDRA also varies for some subgroups within the population (Table 4).

Table 3: Patient groups in whom the NZ Primary Prevention Equations should not be used

Risk group	Estimating risk
Prior CVD or risk equivalent (assumed to have a 5-year CVD risk > 15 percent)	Prior CVD event: angina, myocardial infarction, percutaneous coronary intervention, coronary artery bypass grafting, transient ischaemic attack, ischaemic stroke, peripheral vascular disease. Congestive heart failure. Familial hypercholesterolaemia Patients with chronic kidney disease (eGFR < 30 ml/min/1.73 m ²). Diabetes with overt nephropathy or other renal disease (eGFR <45 ml/min/1.73m ²).
People aged 75 years and older, depending on comorbidities	The age range for using PREDICT primary prevention risk equations is 30–74 years. Calculations outside this age range are approximations, but are potentially useful.

Table 4: When to start risk assessments for men and women in different population subgroups

Population subgroup	Men	Women
Individuals without known risk factors	Age 45 years	Age 55 years
Māori, Pacific peoples or South-Asian* peoples	Age 30 years	Age 40 years
People with other known cardiovascular risk factors or at high risk of developing diabetes Family history risk factors: <ul style="list-style-type: none"> • diabetes in first-degree relative (parent, brother or sister) • hospitalisation for or death from heart attack or stroke in a first-degree relative before the age of 50 years (father or brother, mother or sister) • Familial hypercholesterolaemia Personal history risk factors: <ul style="list-style-type: none"> • people who smoke • gestational diabetes • HbA_{1c} 41–49 mmol/mol • BMI ≥ 30 or truncal obesity (waist circumference ≥ 102 cm in men or ≥ 88 cm in women) • eGFR < 60 but > 45 ml/min/1.73 m² † • atrial fibrillation 	Age 35 years	Age 45 years
People with diabetes (type 1 or 2)	From the time of diagnosis	From the time of diagnosis
People with severe mental illness (Appendix C)	From age 25 years	From age 25 years

* South-Asian peoples: Indian, including Fijian Indian, Sri Lankan, Afghani, Bangladeshi, Nepalese, Pakistani, Tibetan.

† eGFR estimated glomerular filtration rate.

Recommendations for cardiovascular disease risk management

Cardiovascular risk is on a continuum, meaning that anyone is potentially at risk but some more than others. The overall goal is to reduce CVD risk for individuals through making shared decisions.

Communicating CVD risk

Patient communication and joint clinical/patient management decisions are critical components of the CVD risk assessment and management process. It is inappropriate to conduct a virtual assessment without risk communication as many people may have modifiable risk factors even though cardiovascular medications are not immediately indicated.

A primary care practitioner needs to be able to communicate risk effectively to the patient and should also recognise that decision support tools for different levels of health literacy are useful adjuncts to help patients understand risk.

Heart age and risk trajectory visual aids can be helpful to facilitate risk communication.

Shared treatment decisions

Shared treatment decisions should take into account:

- the individual's estimated five-year combined¹ CVD risk (and estimated 5-year treatment benefits), heart age and risk trajectory
 - Note: the five-year CVD risk is used mainly to assess the benefits of initiating individualised interventions (eg, drugs) over the next five years, whereas the heart age and risk trajectory is used to facilitate patient understanding of their longer-term risk and assess the benefits of longer-term lifestyle changes
- the recommendations based on benefits, harms and cost-effectiveness which should be graphically displayed showing the benefits and harms of management options
- the individual's clinical state, age, comorbidities, frailty and life expectancy
- personal preferences (after the individual is fully informed about the evidence-based recommendations).

Decisions about the order in which to start interventions should take into account individual risk factor levels, potential side effects, other concurrent illness, compliance and personal preference. It is frequently appropriate to treat multiple risk factors simultaneously.

Blood pressure-lowering and statin medications work independently to lower risk; therefore, either or both will be effective depending on the estimated CVD risk.

¹ The word 'combined' is used to reflect the calculated risk based on the combined effects of known cardiovascular risk factors.

A health literacy communication and decision support tool should be implemented to:

- present the individual's estimated five-year CVD risk, heart age and risk trajectory
- present estimated five-year CVD risk with and without intervention as a graphic presentation (for example, as two pictorial displays of absolute risk, each showing 100 faces or figures and the number of those at risk)
- quantify the adverse effects of interventions
- allow presentation of the effect of interventions on a person's risk of all CVD events.

The following are other common requirements for these tools.

- The tools are computer generated and integrated with the patient management system (PMS).
- They automatically populate from PMS data and automatically populate risk results back into the patient's record in the PMS.
- They show the effect of a range of interventions, including:
 - lifestyle changes such as smoking cessation, increasing physical activity, dietary change and reducing alcohol
 - medications such as statins, antihypertensive and aspirin.
- The patient can use these tools to access their risk assessment electronically from home.
- The clinician can print a copy of a patient's risk assessment and management advice.
- Ideally all these tools should be web-based so that, as new risk algorithms and other new evidence are published, they can be updated at a single open source.

While these tools communicate risk numerically, using narratives, personal stories and explanations from people with whom the patient can identify can also help patients grasp the concepts of CVD risk management

Management thresholds

Predicted five-year CVD risk of less than 5 percent

The first treatment threshold to consider is the risk below which CVD medications are **generally not** recommended. This is the point below which harms from treatment might exceed the expected benefits of therapy. Internationally it is generally accepted that this level is approximately 5 percent five-year CVD risk.

The magnitude of the benefits and harms of lipid-lowering and blood pressure-lowering drug treatment should be discussed with patients who have an estimated five-year CVD risk of 5–15 percent and drug treatment considered, particularly for those in the higher part of this risk spectrum.

An estimated five-year CVD risk of 15 percent or higher is considered to be equivalent to the risk for people with prior CVD. Patients in this risk group should be treated similarly to those with prior CVD. Lipid-lowering and blood pressure-lowering drug treatment is recommended. The evidence supporting aspirin's role in primary prevention is weaker than for BP lowering and statins. Therefore aspirin should be considered for primary prevention only in people under 70 years with a five-year CVD risk higher than 15 percent.

A diagnosis of asymptomatic carotid disease (including plaque identified on carotid ultrasound) or asymptomatic coronary disease (including coronary artery calcium score > 400 or plaque identified on CT angiography) is associated with increased CVD risk. These patients should be considered to have an estimated five year risk of 15 percent or more. Lipid-lowering and blood pressure-lowering drug treatment is strongly recommended and aspirin should be considered in some groups.

Table 5: Recommended interventions, goals and follow-up based on cardiovascular risk assessment for clinicians

Cardiovascular risk	Lifestyle	Drug therapy*	Follow-up
Established CVD	<ul style="list-style-type: none"> Lifestyle advice (diet, weight management, physical activity, smoking cessation). 	<ul style="list-style-type: none"> Strong evidence supports pharmacotherapy for modifiable risk factors, and antiplatelet therapy for secondary prevention. 	<ul style="list-style-type: none"> Review annually
> 15 percent CVD risk	<ul style="list-style-type: none"> Lifestyle advice (diet, weight management, physical activity, smoking cessation). 	<ul style="list-style-type: none"> Strong evidence supports using statins and blood pressure lowering to prevent CVD events and deaths. 	<ul style="list-style-type: none"> Review annually Repeat risk assessment annually.
5–15 percent CVD risk	<ul style="list-style-type: none"> Lifestyle advice (diet, weight management, physical activity, smoking cessation). 	<ul style="list-style-type: none"> Discuss the magnitude of the benefits of statins or blood pressure lowering with the patient, based on the evidence that the higher the risk for the patient, the more likely they are to benefit. 	<ul style="list-style-type: none"> For risk level 5–9 percent, repeat risk assessment at five years. For risk level 10–14 percent, repeat risk assessment at two years.
< 5 percent CVD risk	<ul style="list-style-type: none"> Lifestyle advice (diet, weight management, physical activity, smoking cessation). 	<ul style="list-style-type: none"> Evidence indicates medication management has limited benefit. 	<ul style="list-style-type: none"> For risk level < 3 percent, repeat risk assessment at 10 years. For risk level 3–5 percent, repeat risk assessment at five years.

* For people with diabetes we recommend an annual review.

Supporting behaviour change

Tailor lifestyle advice (weight management, diet, physical activity and smoking cessation) to the individual's circumstances.

The greater a patient's CVD risk, the greater potential they have to benefit from lifestyle change in the short term. For those patients with a high burden of modifiable risk factors, but low five-year risk (as illustrated by their high heart age and steep risk trajectory), early lifestyle changes will significantly impact on their longer-term risk.

As part of lifestyle advice, reinforce the wide range of benefits gained from having an optimal weight (eg, improved mobility and quality of life) and stopping smoking (eg, reduced cancer risk, pulmonary health and cost savings).

Base specific lifestyle interventions on a behavioural counselling approach. This approach aims to help people gain the skills and motivation to alter their eating patterns or physical activity habits. Techniques include: self-monitoring, training to overcome common barriers, goal setting, providing guidance on shopping and food preparation, role playing, and arranging support or referral.

Diet and physical activity

Everyone needs to be active and eat well to maintain a healthy lifestyle. Diet and physical inactivity are two of the top five risk factors contributing to 'health loss' in New Zealand. Together they account for 15–20 percent of health loss, mostly through their contribution to cardiovascular disease and diabetes.

The *Eating and Activity Guidelines for New Zealand Adults* (Ministry of Health 2015a) provide evidence-based recommendations on healthy eating and being physically active. They take the form of statements developed by interpreting the key international evidence for the New Zealand context. We encourage health practitioners and others to use this information as the basis for helping New Zealand adults and their whānau to eat well, be regularly physically active, and achieve and maintain a healthy weight. Accompanying health education resources for the public are also available with simple messages around salt and portion size.

Weight management. The *Clinical Guidelines for Weight Management in New Zealand Adults* (Ministry of Health 2017) recommend a stepped approach to helping people to achieve and maintain a healthy weight. For all people with a body mass index of 25 or more, the guidelines recommend a combination of changes in food/nutrition and physical activity, along with behavioural strategies to support these changes.

Stopping smoking

A systematic approach works best – following the ‘ABC approach’ for smoking cessation.

- Ask about and document smoking status for all patients aged 15 years and older.
- For all people who smoke, advise them to stop and offer cessation support.
- These two steps can be completed in 30 seconds.
- **Offer cessation support.** In this way, you will prompt more people to make a quit attempt than you will by just advising them to quit on medical grounds. (For example, offering a smoking cessation medicine or behavioural support can increase the frequency of quit attempts by 39 percent and 69 percent respectively.)
- Make a strong recommendation to use support in addition to medication and be enthusiastic about the advantages.

A number of tools are available to support people to stop smoking.

Go to the Ministry of Health website (www.health.govt.nz, search for ‘stop smoking services’) for information from each of the regional stop smoking services.

Lipid lowering

Substituting dietary saturated fat with mono and polyunsaturated fats is the most effective dietary approach to reducing low-density lipoprotein cholesterol (LDL-C) while maintaining or increasing high-density lipoprotein cholesterol (HDL-C).

There is good evidence from an individual person meta-analysis of RCTs that the benefits of lipid-lowering is directly proportional to a person’s pre-treatment CVD risk. Treatment-related benefits are apparent in all risk groups, although the benefit is very small when 5-year risk is below 5 percent.

Statins are the preferred choice of lipid-lowering drugs as they consistently reduce morbidity and mortality across a wide range of population subgroups regardless of cholesterol levels.

For each 1 mmol reduction in LDL-C, RCTs demonstrate that patients will achieve an approximate 25 percent relative risk reduction in CVD events over 5 years.

There is no established LDL-C drug treatment threshold, as no trials have demonstrated an LDL-C level below which further lowering is not associated with further reduction in CVD risk.

In secondary prevention current treatment targets vary between about 1.6 and 1.8 mmol/L and it is assumed that the ideal LDL-C level for both primary and secondary prevention is similar and below the treatment targets.

For individuals with a total cholesterol (TC) TC/HDL-C ratio of 8 or more, after lifestyle modifications, drug treatment is recommended regardless of predicted CVD risk.

For individuals with a five-year CVD risk of 15 percent or more, lipid-lowering drug treatment, in addition to dietary changes, is strongly recommended, with an LDL-C treatment target of below 1.8 mmol/L.

For individuals with a predicted 5-year risk between 5 and 15 percent the benefits and harms of lipid-lowering treatment should be clearly presented using the electronic decision aid to allow an individualised informed decision about whether to start treatment. A target LDL-C reduction of 40% or greater is recommended if drug treatment commenced.

The absolute benefit of a 40 percent reduction in LDL-C should be calculated and presented using the electronic decision aid. This will facilitate shared decision making and an informed decision about whether to begin treatment. For example, if a patient with a 5-year CVD risk of 10 percent and an LDL-C of 4.0 mmol/L is given 20mg of atorvastatin their 5-year risk would fall from approximately 10/100 to 6/100. In other words for every 100 people treated for 5 years, there would be about four fewer CVD events.

Before starting a patient on lipid-modifying medication, consider possible causes of dyslipidaemia (eg, familial hypercholesterolemia, hypothyroidism, renal disease, steroid treatment).

Table 6 outlines the potency of different statins at a range of doses. Any statin dose can reduce cardiovascular risk. If a person cannot tolerate a high-dose statin, aim to treat with the maximum tolerated dose or consider changing to an alternative agent. Consider stopping the statin and, when the symptoms have resolved, re-challenge to check if the symptoms are indeed related to statin therapy.

Table 6: Statin potency table – approximate equivalence

Treatment intensity	Pravastatin	Rosuvastatin	Atorvastatin	Simvastatin	% ↓ LDL-C
Low	20 mg			10 mg	30%
Medium	40 mg		10 mg	20 mg	38%
Medium	80 mg	5 mg	20 mg	40 mg	41%
High		10 mg	40 mg	80 mg	47%
High		20 mg	80 mg		55%
Very high		40 mg			63%

Statin side effects

Statins are generally well tolerated. Large-scale randomised controlled trials report similar discontinuation rates to placebo.

Serious side effects from long-term statin therapy are rare.

- Five cases of myopathy occur for every 10,000 people treated for five years.
- Additional muscle-related problems occur in 10–20 cases for every 10,000 people treated per year. Of these cases, only one is expected to have substantially elevated creatine kinase levels.
- There are 50 to 100 new cases of diabetes for every 10,000 treated for five years. The reduction in CVD events outweigh any harm from the increase in diabetes incidence even for people at low CVD risk.

Monitoring

Monitor non-fasting lipids every 6 to 12 months until the agreed management target has been achieved.

Annual monitoring is appropriate once agreed target achieved.

Monitoring liver function tests with statin use is not considered necessary as the risk of liver toxicity appears negligible.

Only check creatine kinase (CK) in those who have symptomatic muscle pain, tenderness or weakness. Remember the risk of myopathy is usually dose-related and is increased in older people and with combination treatments.

- For muscle pain without CK rise, consider reducing the dose or discontinuing the statin but also consider rechallenging once symptoms subside.
- With a CK rise 3–10 times above normal with symptoms, reduce the dose or discontinue it, and monitor symptoms and CK regularly – every week.
- With a CK rise more than 10 times above normal with symptoms, discontinue the statin immediately.

Special considerations

For individuals with a total cholesterol to high-density lipoprotein cholesterol (TC:HDL-C) ratio of 8 or higher, lipid-lowering treatment is usually recommended

Familial hypercholesterolemia

Raised levels of total cholesterol and LDL cholesterol consistent with autosomal dominant inheritance. If lipid levels of family members not available, a history of premature heart disease in a first degree relative is supportive of the diagnosis. Tendon xanthomas confirm the diagnosis but are not always present.

Elevated triglycerides

Very high triglyceride levels (11mmol/L or more) may warrant treatment regardless of the calculated risk as patients are at high risk of pancreatitis.

Patients in this group are often overweight or obese and may have excessive alcohol use and uncontrolled diabetes.

Lifestyle modification and, for those with type 2 DM, the use of insulin or oral hypoglycaemic agents may dramatically reduce triglyceride levels. Statins may reduce triglycerides levels. Fibrates (bezafibrate and gemfibrozil are available in New Zealand) reduce triglyceride levels and limited clinical trial evidence indicates that they may reduce coronary heart disease events and ischaemic stroke.

Where patients have sustained triglyceride levels of 11 mmol/L or more, after lifestyle measures and diabetes management, refer them for prompt specialist assessment.

Cholesterol levels may also be raised in people with markedly raised triglyceride levels. If cholesterol levels do not fall in parallel with the fall in triglycerides, base management on cardiovascular risk assessment.

Blood pressure lowering

Measurement of blood pressure

- Out-of-office BP, assessed by ambulatory or home BP monitoring, is an important adjunct to office BP measurement.
- Ambulatory or home monitoring may be helpful in the following:
 - suspected ‘white-coat’ hypertension (occurs in one in four patients)
 - marked variability in clinic BP measurements or between clinic and home BP measurements
 - suspected drug-induced hypotension
 - identifying true resistant hypertension.

Guidance for home blood pressure measurement

- Use a validated device calibrated with office BP assessment.
- Take morning measurements before breakfast, before morning medications and after five minutes in a sitting position.
- Take evening measurements before going to bed, after medication and after five minutes in a sitting position.
- For each measurement, take two consecutive measures, one minute apart.
- Record all values with notes to explain obvious variations (eg, drinking coffee before measurement).
- Use the average of all readings (Table).

Table 7: Approximate equivalence points of clinic BPs to ambulatory BPs and home BPs using different BP recording methods

Measurement method			
Clinic BP	130/80	140/90	160/100 mmHg
Ambulatory or 24-hour BP (daytime average)	125/75	135/85	150/95 mmHg
Home BP	125/75	135/85	150/95mm Hg

Secondary causes of raised BP

Consider secondary causes of raised BP in younger people and/or in individuals with persistently elevated readings on multiple pharmacological agents. Such causes include high alcohol intake, sleep apnoea, oestrogen and glucocorticoid administration, anti-inflammatory agents, cyclosporin and use of sympathomimetics.

Rarer causes that require further investigation in severe or resistant hypertension (especially in younger individuals) are renal disease, coarctation of the aorta, renal artery stenosis, phaeochromocytoma, Cushing syndrome and Conn syndrome.

We recommend seeking specialist opinion where you suspect secondary causes.

Management of raised blood pressure

Reducing salt and alcohol intake, losing weight and increasing physical activity are effective ways to reduce BP and should be encouraged in all patients with office BP more than 130 mmHg (systolic) or 80 mmHg (diastolic).

The ideal blood pressure for most people is likely to be below 120 mmHg systolic and 75 mmHg diastolic.

The most recent Cochrane systematic review of RCTs reported that blood pressure-lowering drug treatment does not significantly reduce CVD events in people without prior CVD with BP in the range of systolic 140–159 mmHg or diastolic 90–99 mmHg. However the participants in the included studies had an average five year CVD risk of less than 3 percent.

A more recent systematic review, including higher risk patients, demonstrated that blood pressure-lowering drug treatment significantly reduced stroke and all cause mortality, for patients in the same blood pressure range as the Cochrane review.

Recent evidence also supports a more aggressive approach to BP management once pharmacotherapy begins. A systematic review and network meta-analysis of 42 trials, including 144,220 patients, shows linear associations between mean achieved systolic blood pressure and risk of cardiovascular disease and mortality, with the lowest risk at a systolic blood pressure of 120–124mmHg.

For each 10 mmHg reduction in systolic blood pressure, RCTs demonstrate that patients will achieve an approximate 20 percent relative risk reduction in CVD events over five years.

The 2017 AHA/ACC guideline's recommended treatment goal is to reach office BP levels of less than 130mmHg (systolic) and less than 80 mmHg (diastolic) if pharmacotherapy is commenced.

For patients with persistent office BP of 160 mmHg or more systolic (150 mmHg on ambulatory and home monitoring) and/or 100 mmHg or more diastolic (95 mmHg on ambulatory and home monitoring), after lifestyle modifications, drug treatment is recommended regardless of predicted CVD risk.

For patients with a five-year CVD risk of 15 percent or more, with persistent office BP of 130 mmHg systolic and/or 80 mmHg diastolic or more, or an equivalent level from ambulatory or home blood pressure monitoring, drug treatment in addition to lifestyle changes, is strongly recommended.

For patients with five-year CVD risk between 5 and 15 percent with persistent office BP of 140 mmHg systolic and/or 90 mmHg diastolic or more, or an equivalent level from ambulatory or home BP monitoring, the benefits and harms of BP-lowering drugs should be presented and discussed to allow an individualised informed decision about whether to start treatment. During shared decision making benefits and harms should be clearly presented using the electronic decision aid.

The absolute benefit per 10mmHg reduction in systolic blood pressure should be calculated and presented using the electronic decision aid. This will facilitate shared decision-making and an informed decision about whether to begin treatment. For example, if a patient with a five-year CVD risk of 10 percent and an SBP of 150 mmHg is given treatment that lowers their SBP to 130mmHg their five-year CVD risk would fall from approximately 10/100 to 6/100. In other words, for every 100 people treated for five years, there would be about four fewer CVD events.

Angiotensin converting enzyme (ACE) inhibitors or angiotensin II receptor blockers (ARBs), calcium channel blockers and thiazide diuretics are all suitable first-line drugs, either as monotherapy or in some combinations unless contraindicated.

Treatment target

If pharmacotherapy is commenced, a target office BP of less than 130 mmHg systolic and less than 80 mmHg diastolic is recommended.

Management goals should be individualised. Exercise caution in managing BP in older patients and in patients with diabetic neuropathy, particularly if postural symptoms exist who may be harmed by overly aggressive BP lowering.

Monitoring

Once BP control is satisfactory, review every 12 months. For stable patients, home BP monitoring and electronic communication with the physician may be an acceptable alternative.

If blood pressure remains uncontrolled, consider cause(s), such as poor adherence, persistent white-coat effect or use of BP-raising substances.

Diabetes

This section draws on evidence from Inzucchi et al (2015) and de Boer et al (2017).

Healthy lifestyle measures (smoking cessation, healthy diet, regular physical activity, optimal weight) are equally or more applicable in all people with diabetes.

Optimise glycaemic control to an appropriate level for the individual patient in consultation with them. The target range agreed will generally be more stringent and lower for younger and fitter patients (eg, 50–55 mmol/mol) than for older, co-morbid and frail patients (eg, 55–64 mmol/mol or higher). These and other major considerations are discussed in Inzucchi et al (2015).

Offer training in self-management to all people with diabetes, especially the newly diagnosed. After diagnosis, optimising glycaemic control within 6–12 months offers long-term benefit.

Always consider hypoglycaemia from sulphonylureas and insulin (and combination therapies containing them), especially in the elderly, frail and those living alone, among whom it is common.

Metformin remains the mainstay of pharmacological treatment for type 2 diabetes. Around 5 percent of individuals cannot tolerate any dose even after titration.

When lifestyle and oral agents fail to achieve adequate control appropriate for the individual, initiate insulin without undue delay. Regimens include nocturnal intermediate, once-daily basal, pre-mixed and multiple injection regimens; the choice will depend on the individual patient's circumstances.

Alternative agents for particular patient groups include pioglitazone, DPP-4 inhibitors, GLP-1 agonists and SGLT-2 inhibitors; some of the latter two groups show evidence of benefit on CVD and renal outcomes in clinical trials. In New Zealand, only pioglitazone is currently funded.

Microvascular risk increases exponentially and macrovascular risk increases substantially with worsening glycaemic control. The greatest individual benefit is achieved with a reduction in higher levels of HbA_{1c}.

Worsening glycaemic control increases microvascular risk (retinopathy, nephropathy and neuropathy) more substantially than macrovascular risk.

Microvascular disease risk increases progressively from HbA_{1c} levels above the threshold for diagnosed diabetes (48–50 mmol/mol).

Macrovascular disease risk increases from HbA_{1c} levels in the high normal range.

The greatest individual benefit of glycaemic control on microvascular disease is achieved with a reduction in the highest HbA_{1c} levels, thus a reduction in HbA_{1c} from 90 to 70 mmol/mol is of greater absolute benefit than a reduction from 70 to 50 mmol/mol.

Blood pressure considerations in diabetes

Treatment of increased blood pressure improves CVD outcomes and also reduces the incidence and progression of diabetic renal disease and retinopathy. Strong evidence from clinical trials and meta-analyses supports targeting blood pressure reduction to at least below 140/90 mmHg in most adults with diabetes.

Lower blood pressure targets, 130/80 mmHg or less may be beneficial for selected patients with high absolute cardiovascular disease risk if they can be achieved: such lower targets may be considered on an individual basis. Caution is recommended with lower BP targets in older people and in patients with neuropathy, particularly if postural symptoms are present.

Preferred drugs shown to reduce CVD events in people with diabetes include ACE inhibitors, ARBs, thiazide diuretics and calcium channel blockers. When renal disease is present (albumin: creatinine ratio higher than 2.5–3.5 and/or eGFR is below 60ml/min/m²), an ACE inhibitor or ARB should be first-line therapy. Measure renal function (eGFR), albumin:creatinine ratio and serum potassium 5–10 days after when starting treatment and regularly during treatment.

Antiplatelet therapy

In patients under 70 years with a five-year CVD risk higher than 15 percent the benefits of aspirin may outweigh the bleeding risk and should be considered. Potential benefit (reduction in non-fatal MI and possible small net years gained) and bleeding risk must be carefully assessed and discussed during shared decision making.

In patients aged over 70 years the balance of benefits and harms of aspirin is not clear and therefore use is not recommended for primary CVD prevention alone.

In patients with a five-year CVD risk of 15 percent or less, aspirin for primary prevention of CVD alone is not recommended.

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Appendix A: Components in new CVD risk assessment equation

	Population	Coefficients in the model	Outcomes	Time period
<p>PREDICT-CVD 1°</p> <p>Separate models for men and women</p>	<p>Included 400,728 people aged 30–74 years</p> <p>Aug 2002 – Dec 2015</p> <p>175,283 women 225,445 men</p> <p>Excluded People with:</p> <ul style="list-style-type: none"> • prior CVD • diabetes with renal disease or eGFR < 30 • heart failure or on loop diuretics 	<p>Age in years; gender</p> <p>Ethnicity (Māori, Pacific, Indian, Chinese/other Asian, European)</p> <p>New Zealand Index of Deprivation quintile 2001 (1 = least deprived and 5 = most deprived)</p> <p>Smoking status (three categories: never, ex-smoker, current)</p> <p>Diabetes (no, yes [combined type 1, type 2, type unknown])</p> <p>Family history of premature CVD (no/yes)</p> <p>History of atrial fibrillation (no/yes)</p> <p>Systolic blood pressure mmHg (mean of two measures) continuous</p> <p>TC:HDL-C</p> <p>Blood pressure-lowering, lipid-lowering or antiplatelet/anticoagulant medication dispensed during the six months prior to the index risk assessment (no/yes)</p>	<p>Deaths or hospitalisation for myocardial infarction, unstable angina, other coronary heart disease, ischaemic stroke, haemorrhagic stroke, transient ischaemic attack, peripheral vascular disease, congestive heart failure, other ischaemic CVD-related deaths.</p>	<p>Five years</p>
<p>Diabetes Cohort Study</p>	<p>Included 36,127 people aged 25–85 years with type 2 diabetes</p> <p>January 2000 – December 2006</p> <p>Excluded People with prior CVD</p>	<p>Age, gender</p> <p>Ethnicity (Māori, Pacific Indo-Asian, East Asian, other)</p> <p>Duration of known diabetes (per year)</p> <p>Age at diagnosis (per year)</p> <p>Systolic BP per 10 mmHg</p> <p>Smoking status (non-smoker, previous smoker, current smoker)</p> <p>TC:HDL-C</p> <p>HbA_{1c}</p> <p>Albuminuria (no albuminuria, micro albuminuria, macro albuminuria)</p>	<p>Deaths or hospitalisation for myocardial infarction, unstable angina, other coronary heart disease, ischaemic stroke, transient ischaemic attack, peripheral vascular disease, coronary or peripheral vascular procedures</p>	<p>Five years</p>

Appendix B: Other high-risk populations not specified in new equations

The New Zealand-based risk scores that this document sets out will underestimate risk for some patient groups who have underlying medical conditions or are on specific therapies.

Note: Consider the NICE guideline on cardiovascular disease risk assessment and reduction, clinical guideline 181, as summarised below (NICE 2014).

Recognise that standard CVD risk scores will underestimate risk in people who have additional risk because of underlying medical conditions or treatments. These groups include people:

- treated for HIV
- with serious mental illness
- taking medicines that can cause dyslipidaemia, such as antipsychotic medication, corticosteroids or immunosuppressant drugs
- with autoimmune disorders such as systemic lupus erythematosus, and other systemic inflammatory disorders (NICE 2014).

People with chronic kidney disease

Chronic kidney disease has been defined as abnormalities of kidney function or structure present for more than three months, with implications for health (Kidney Disease: Improving Global Outcomes CKD Work Group 2013). This includes all people with markers of kidney damage and those with an estimated glomerular filtration rate (eGFR) of less than 60 ml/min/1.73 m² on at least two occasions separated by a period of at least 90 days (with or without markers of kidney damage) (Kidney Disease: Improving Global Outcomes CKD Work Group 2013).

Evidence indicates that reduced eGFR is also an independent risk factor for all-cause mortality and cardiovascular disease events in both high-risk and low-risk populations, including those with diabetes (Chronic Kidney Disease Prognosis Consortium et al 2010; Matsushita et al 2015). The NICE (2014) guidelines also recommend the following when assessing primary prevention of CVD:

Do not use a risk assessment tool to assess CVD risk in people with an estimated glomerular filtration rate (eGFR) less than 30 ml/min/m². These people are at increased risk of CVD.

Older people

People aged 75–84 years make up 4.4 percent of New Zealand's population. They are a diverse group expected to double in number by 2035 (Ministry of Social Development 2015). While many suffer from chronic conditions, increasing numbers are fit, thriving and still in the workforce. People are also living longer. Life expectancy has increased by over 10 years in the last 50 years and will rise further (Statistics New Zealand 2015). However, it is in this age group that 28 percent of ischaemic heart disease deaths, 29 percent of stroke deaths, 24 percent of hospitalisations for ischaemic heart disease and 30 percent of hospitalisations for stroke occur in the New Zealand population (Ministry of Health 2015b; Statistics New Zealand 2015).

Once a person turns 75 years, the 2003 CVD guidelines and handbooks advise general practitioners to use ‘clinical judgement’, taking into account ‘the results of a risk assessment, the likely benefits and risks of treatment and the person’s values’. This advice exposes large gaps in knowledge. The Framingham CVD risk prediction equation, derived from research on people under 75 years old, has not been validated for people aged 75–84 years. The new NZ Primary Prevention equations have the same limitation (developed for people aged 30–74 years).

Furthermore, the evidence that older age groups will benefit from treatment is limited. While they are likely to achieve similar benefits to younger people, the risk of adverse drug events increases with age and a growing number of medications. In addition, older people commonly have several long-term conditions and, if an individual has CVD along with other diseases, it impacts how best to manage their prognosis.

Given the lack of evidence on the best approach to managing CVD in older people, those at high CVD risk are often not treated, which research links with increased hospitalisations and death (Gallagher et al 2008). Experts debate whether failing to treat an older person is a form of ageism, or if overtreatment and polypharmacy should be reversed by de-prescribing. Furthermore, no studies have investigated older people’s preferences in regard to drug treatment.

Therefore for healthy people over 75 years with few co-morbidities and an estimated life expectancy of more than 5 years, we recommend estimating their 5-year CVD risk using the NZ Primary Prevention equations and discussing the same management options as for people under 75 years of age.

Appendix C: Cardiovascular disease risk assessment and serious mental illness

The definition of ‘people with a serious mental illness and/or addiction’ includes those who have been diagnosed with schizophrenia, major depressive disorder, bipolar disorder, schizoaffective disorder and/or addiction.

People who experience serious mental illness (SMI), particularly schizophrenia, have significantly reduced life expectancy and a premature mortality rate two to three times higher than the general population (Cunningham et al 2014). Cardiovascular disease (CVD) is a major contributor, accounting for 40–50 percent of premature deaths (Ringen et al 2014).

Strong evidence indicates that the risk of developing CVD is higher in people diagnosed with SMI (see Table A1). This increased risk is due in part to established risk factors, including smoking and diet, but is also related to the metabolic effects of psychotropic medication. Studies that controlled for known CVD risk factors still found an increased relative risk. Some studies have identified mental illness as an independent risk factor for CVD, specifically in psychosis (Ösby et al 2014) and depression (Van der Kooy et al 2007).

The increased CVD risk for people who experience SMI is present at an earlier age than in the general population. For people with psychosis, CVD risk factors are present from a very early age (Correll et al 2014; McLean et al 2014; Foley et al 2015; Goldstein et al 2015).

Table A1: Pooled estimates of relative risk of CVD in people with serious mental illness from meta-analyses published between 2000 and 2015

Diagnosis	Relative risk*	References	Number of studies
Schizophrenia**	1.53 (CI = 1.27–1.86) CVD		13 studies
	1.71 (CI = 1.91–2.46) Stroke	Fan et al 2013	(3,549,950 participants)
	1.20 (CI = 0.53–1.53) CHD		
Depression	1.56 (CI = 1.30–1.87) IHD	Charlson et al 2013	8 studies (35,000 participants)
	2.69 (CI = 1.63–4.43) CHD	Rugulies 2002	11 studies
	1.46 (CI = 1.37–2.08) CVD	Van der Kooy et al 2007	28 studies (80,000 participants)
	1.90 (CI = 1.48–2.42) CHD	Nicholson et al 2006	21 studies (124,509 participants)

Key: CHD = coronary heart disease CI = confidence interval CVD = cardiovascular disease.
IHD = ischaemic heart disease

* The risk estimates from single studies were adjusted for a variety of confounders, including age, sex, ethnicity, diabetes, hypertension, hyperlipidaemia, smoking, diet, physical exercise and alcohol consumption.

** While only one meta-analysis is identified in this table for people with psychosis, several large recent cohort studies found higher CVD risk and mortality from CVD for people with psychosis.

Obese people with SMI have a significantly higher cardiovascular risk than obese people without SMI. Recent studies also support the possibility of a direct effect of antipsychotics on cardiovascular risk, which varies between medications. CVD risk is approximately 1.5 to 3 times higher in patients with schizophrenia and bipolar disorder, and on average 1.5 times higher in those with major depression. Higher dosages, polypharmacy and the treatment of old or young people are associated with more adverse impacts (Correll et al 2015).

Current CVD risk assessment tools are likely to underestimate the risk for people who experience SMI

Studies have found that CVD risk assessment tools underestimate cardiovascular risk for people who experience SMI (Rugulies 2002; McLean et al 2014). One study has looked at modifying risk assessment protocols specifically for this population (Osborn et al 2015).

There are inequities in assessing and managing CVD risk and CVD for people diagnosed with SMI

Several studies point to inequities in assessing and managing CVD risk and CVD in people who experience SMI (de Hert et al 2011; Smith et al 2013). The evidence for specific interventions to reduce CVD risk among people with SMI is limited, although some evidence supports behavioural and pharmacological interventions, particularly in the area of weight loss (Gierisch et al 2014; McGinty et al 2015).

People who experience SMI have a significantly higher risk of dying from CVD than their general population counterparts

In the only New Zealand study, the standardised mortality ratio from CVD for people using mental health services compared with the general population was 1.69 (Cunningham et al 2014). This is consistent with international studies, which have found a standardised mortality ratio for people with SMI ranging from 1.6–2.5 (Ringen et al 2014). A large study in the United Kingdom (Osborn et al 2007) found that people with SMI aged 18–49 years were three times more likely to die from heart disease than those in the same age group without SMI, while in people with SMI aged 50–75 years the risk was doubled.

The authors concluded that people who experience SMI have a greater risk of CVD than their counterparts in the general population. Established risk factors such as smoking and diet do not fully account for this increased risk. Inequities in assessing and managing CVD risk are likely to contribute, as are the cardiometabolic effects of particular psychotropic medications. In a large study of patients with schizophrenia, mood disorders or dementia, the adjusted odds ratio of acute myocardial infarction risk was 2.52 (95 percent, CI: 2.37–2.68) for any antipsychotic, 2.32 (95 percent, CI: 2.17–2.47) for first-generation antipsychotics and 2.74 (95 percent, CI: 2.49–3.02) for second-generation antipsychotics (Lin et al 2014).

Recommendations

NICE clinical guideline 178, which has new sections on managing physical health care across both primary and secondary care, recommends that:

GPs and other primary healthcare professionals should monitor the physical health of people with psychosis or schizophrenia when responsibility for monitoring is transferred from secondary care, and then at least annually (NICE 2014).

NICE clinical guideline 181 recommends that health professionals:

recognise that standard CVD risk scores will underestimate risk in people who have additional risk because of underlying medical conditions or treatments. These groups include . . . people with serious mental health problems . . . [and] . . . people taking medicines that can cause dyslipidaemia such as antipsychotic medication, corticosteroids or immunosuppressant drugs (NICE 2016).