CAA MIS 007

Cardiovascular Risk

CIVIL AVIATION AUTHORITY OF NEW ZEALAND
Medical Information Sheets

Ischaemic Heart Disease, caused by areas of heart muscle not receiving enough oxygen to function correctly, is relatively common in our community. Ischaemic Heart Disease is often also called Coronary Artery Disease because it is blockage of the arteries of the heart (coronary arteries) that leads to less blood (and oxygen) than needed getting through to the muscle of the heart (myocardium).

Because our hearts need more oxygen and blood when we exercise, or when our heart rate increases for any other reason, we usually become aware of Ischaemic Heart Disease due to chest pain with exertion. Sometimes, however, Ischaemic Heart Disease makes itself known suddenly and unexpectedly with a heart attack being the first thing you know about it.

Ischaemic Heart Disease is the No 1 cause of death in New Zealand, causing more deaths than all types of cancer put together. Not only does Ischaemic Heart Disease cause death, but it is also the cause of many collapses and other impairments.

Ischaemic Heart Disease is an important medical condition for civil aviation regulatory authorities to consider, because it is so common and because it causes incapacitation.

What causes Ischaemic Heart Disease?

Ischaemic Heart Disease is usually caused by blockage or narrowing of the blood vessels that supply blood, and oxygen, to the heart muscle itself. This narrowing is most often caused by the build-up, over time, of a fatty material called atheroma.

What causes atheroma?

There is no simple answer to this question. A wide variety of factors appear to contribute to the likelihood, or risk, of someone having significant amounts of atheroma in their coronary arteries. Some, but not all, of these risk factors are:

Age - Risk increases as age increases;

Gender - Males generally at higher risk;

Blood pressure - Risk increases as blood pressure increases above normal limits;

Abnormalities of sugar metabolism - Diabetics and people with some pre-diabetic conditions are at higher risk;

Smoking - Smoking increases risk which reduces substantially a year after having stopped smoking;

Blood cholesterol and lipid levels - High cholesterol levels are usually associated with higher risk;

Family history of heart attacks or strokes - Such a family history is usually associated with higher risk, especially if family members suffered heart attacks or strokes at younger ages;

Ethnicity - Some different ethnic groups appear to have higher risk of heart problems;

History of heart attacks or strokes - Associated with higher risk.

Can Ischaemic Heart Disease be detected?

Yes. There are tests that can, reasonably accurately, detect whether enough oxygen is getting through to the heart muscle during periods of exercise. These tests include Exercise Tolerance Tests (ETT), usually in the form of an

exercise stressed electrocardiogram (stress test, stress ECG), exercise stressed echocardiogram (stress echo), or an exercise stressed radionucleotide scan (thallium scan or nuclear scan).

Why not do these tests on everyone?

Some countries stop pilots flying when they reach a certain age. Some countries require all pilots to have a stress test when they reach a certain age.

Requiring everyone, or everyone over a certain age, to have a stress test can be very expensive and will also result with a significant number of people being initially 'diagnosed' as having Ischaemic Heart Disease and then later being shown not to have Ischaemic Heart Disease (false positive test results).

New Zealand does not stop people flying at a certain age. New Zealand also does not require people to routinely have a stress test once they reach a certain age.

So, what does New Zealand do?

In New Zealand we evaluate the cardiovascular risk of all medical certificate applicants who are over 40 years of age. If an applicant does not have excessive cardiovascular risk, then no further testing is required and, everything else being okay, they are issued a medical certificate.

If an applicant does have excessive cardiovascular risk, then they are tested, usually via an ETT, to make sure that their heart gets enough oxygen during exercise before they are issued a medical certificate.

The New Zealand medical standards contain a requirement that applicants who have increased risk of Ischaemic Heart Disease be tested to demonstrate that the heart muscle gets enough blood and oxygen during exercise (see 'Looking at the law' section at the end of this document).

How is the cardiovascular risk worked out?

For CAA medical certification purposes, the cardiovascular risk of an applicant is calculated using the PREDICT method. This method replaces the New Zealand Guidelines Group's (NZGG) guidelines "The assessment and management of cardiovascular risk". The PREDICT tool is superior to the other methods previously used.

This method uses the risk factors already mentioned to calculate a 5-year percentage risk of the applicant suffering a cardiovascular 'event' ... such as a heart attack.

Figure 1 shows the online PREDICT risk calculator being used to calculate the cardiovascular risk of a 55-year-old male pilot of European ethnicity who is not diabetic, a non-smoker, with no family history of cardiovascular disease, and taking no blood pressure or lipid-lowering medication. His blood pressure was measured as 130/70 mmHg, his blood lipid profile showed total cholesterol = 4.6 mmol/l and HDL cholesterol = 1.2 mmol/l. Using these values, the PREDICT calculator returns a 5-year cardiovascular risk of 2.5% (see Figure 1, below).

If they were, instead, 60 years old, a diabetic smoker with a family history of cardiovascular disease, and everything else was the same, their PREDICT 5-year cardiovascular risk would have been calculated as being 9.6%. If that person were, instead, 65 years of age the risk would be calculated at 12%.

How much cardiovascular risk is "excessive"?

A 5-year cardiovascular risk of 10%, or higher, is considered as being excessive for the purpose of the CAA medical standards.

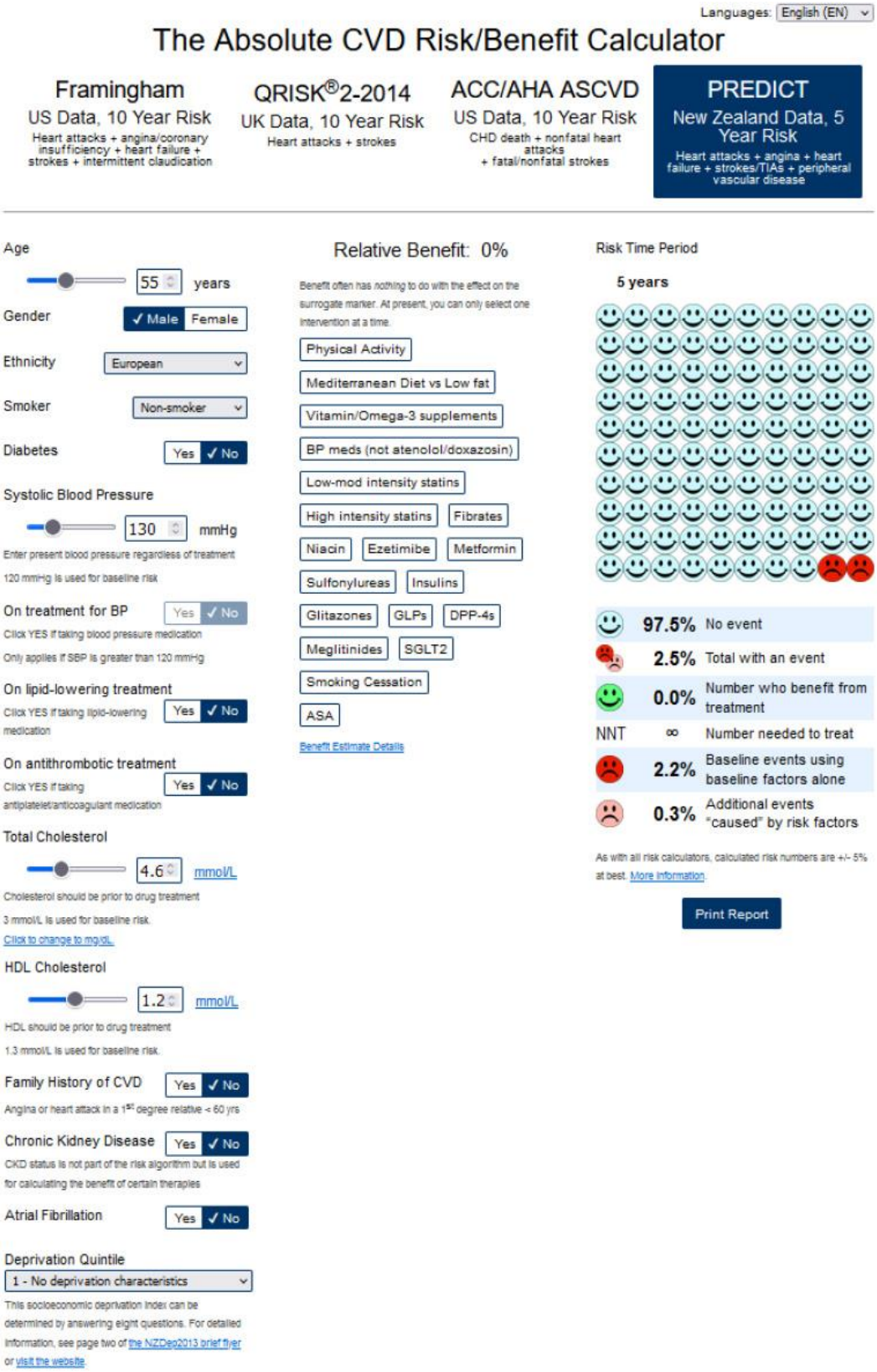
Can my doctor use a different cardiovascular risk calculator?

There are many different tools that are used for estimating cardiovascular risk. Many of these are adequate for day-to-day clinical medical practice, but none are better than the PREDICT tool. For reasons of consistency, and because there is no better tool available, the PREDICT tool should be used to calculate cardiovascular risk for New Zealand civil aviation What about calcium scoring?

A calcium score is a standardised measure of how much calcium can be detected in the blood vessels surrounding the heart. A low calcium score is associated with a lower risk of coronary artery disease problems while a high calcium score is associated with a higher risk.

CAA accepts a calcium score of zero as an alternative to a normal ETT. A calcium score of zero is accepted for a longer period, 5-years. A calcium score of zero is quite rare, although the test is less expensive than an ETT.

Figure 1. Example Cardiovascular Risk calculation using NZGG method



This screenshot, from the PREDICT tool on the https://cvdcalculator.com/ website, showing the cardiovascular risk calculation for a 55-year-old male, as described above. The calculated risk is 2.5%, a value that would not be considered excessive and would not require further investigation. A 65-year-old male, with all other factors the same, would also have an acceptable cardiovascular risk, at 4.9%.

The usual way to do this is to have an ETT, usually an exercise stressed electrocardiogram (stress test, stress ECG). Sometimes your doctor will recommend a different type of ETT, such as an exercise stressed echocardiogram, but usually a stress ECG is sought. A calcium score result of zero is an alternative to the ETT but is very unlikely in an applicant who has an increased cardiovascular risk calculated using PREDICT.

An ETT needs to be performed to a certain specific protocol, but that is something that most heart clinics are familiar with. The results of your stress ECG (or other ETT) are read first by the cardiologist supervising the test and then later by a CAA consultant cardiologist.

If this stress ECG (or other ETT) clearly shows that there is no abnormality of myocardial perfusion (reported as a 'negative' test) then you will be assessed as meeting the medical standards. If the ETT results are either ambiguous or show the presence of any myocardial perfusion abnormality (positive) then you will probably be recommended to see a cardiologist for further testing and/or treatment if necessary.

In some cases, a stress ECG can be ambiguous, or positive but further testing is negative. Usually, these cases are assessed as meeting the medical standards.

Will I get a medical certificate if I have Coronary Artery Disease?

Most adults have some degree of atheroma in their coronary arteries, and minor degrees of coronary artery disease are not necessarily associated with significantly elevated cardiovascular risk.

Whether or not an applicant with coronary artery disease, or elevated cardiovascular risk, is issued with a medical certificate will depend on the extent and nature of their disease. If there is clearly no myocardial perfusion abnormality then, if everything else is okay, a medical certificate is likely to be issued.

Will I need to get a stress test at my next medical?

This will depend on whether your cardiovascular risk has changed since your last medical assessment. Usually, a negative stress test result is relied upon for 1 - 2 years, 1 year for aviation professionals and 2 years for private pilots. If your cardiovascular risk remains elevated, then it is likely that further testing will be required to exclude any abnormality of myocardial perfusion, either 1 or 2 years later.

If, 1 - 2 years later, your cardiovascular risk has reduced into the acceptable range then no stress test is likely to be required. It is important, not only for your medical certification but also for your general health and long-term survival, to reduce your cardiovascular risk factors. You should seek the advice of your medical practitioner to assist you with reducing your cardiovascular risk factors.

What about age?

Age is the single most powerful independent risk factor for cardiovascular disease. Because of this, age is an important factor in all cardiovascular risk calculations. The PREDICT risk calculations, based on several risk factors, are more accurate than risk calculations based on age alone. The PREDICT risk calculations, because they are based on a larger and more modern set of data, also tend to return lower risk values than the other methods that are available.

What if I don't agree with a decision concerning my cardiovascular risk?

You are always able to seek review of CAA medical certification decisions. Some people seeking review of decisions use the Convener process, some make an Appeal to the District Court, and some use other methods. For further information on review/appeal options, you may wish to consult the Medical Information Sheet on the topic (MIS 005 'What Are My Review Options?').

Looking at the law

Civil Aviation Rule Part 67: Medical Standards

Rules 67.103 (Class 1), 67.105 (Class 2), and 67.107 (Class 3) include provisions that require an applicant to have no significant* history or diagnosis of heart problems, to have no significant coronary artery disease, and to not have elevated cardiovascular risk unless normal myocardial perfusion can be demonstrated.

The exact wording of the class 1 cardiovascular system medical standards is shown below. These standards state that an applicant must−

(1) have no history or diagnosis of any condition of the heart or circulatory tree that is of aeromedical significance; and

(2) without limiting paragraph (d)(1), have no history or diagnosis of any of the following specific medical conditions, to an extent that is of aeromedical significance:

(i) coronary artery disease;

(ii) left bundle branch block;

(iii) right bundle branch block unless ischaemic causes have been excluded;

(iv) uncontrolled hypertension;

(3) without limiting paragraph (d)(1), have no disorder requiring a cardiac pacemaker; and

(4) have no excessive cardiovascular risk factors unless normal myocardial perfusion can be demonstrated.

The class 2 and class 3 cardiovascular system medical standards are virtually identical in their wording to their class 1 counterpart.

The details of the CAA cardiovascular risk assessment procedure and further testing are found in the medical General Directions (GDs) which can be downloaded from the CAA website.

* In the CAA medical standards *significant* refers to 'aeromedical significance' which is defined in Rule 67.3(a): "A medical condition is of aeromedical significance if, having regard to any relevant general direction, it interferes or is likely to interfere with the safe exercise of the privileges or the safe performance of the duties to which the relevant medical certificate relates".

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