# 1C Cardiovascular health and risk

# 1C Checkpoint

### 1C.1 Risk, correlation and cause

1      Risk describes the probability that an event will happen; correlation is when two different sets of data appear to be similar or linked in some way; causation is when an event, act or behaviour directly causes a specific result.

2      There are many other causes of death than those related to smoking. A smoker may die from one of these before a smoking-related disease kills him or her. Some smokers will have their smoking-related disease cured. Not all smokers are adversely affected by smoking – their genetic make-up may mean smoking-related diseases will not affect them.

       Award marks for any other sensible points.

3      Stay obese: people stay obese because it is hard to lose weight; they like to eat; it isn't always easy to take exercise; they minimise the risk and assume they will not have problems.

       More becoming obese: modern food is often high in fats and so high in calories; people do less physical exercise as they drive rather than walk; many jobs are becoming less physical with computers and machines; people spend a lot of time at computers and TVs, so not doing exercise, etc.

4      Maldives has a higher percentage of the population dying of CVD relative to UAE but a similar incidence of obesity. The data shows that 25% of the population in Maldives smoke, and we also know there are many people who are overweight and with diabetes in the UAE. To make realistic comparisons, we need information about smokers in the UAE and the size of the overweight population and percentage with diabetes in Maldives.
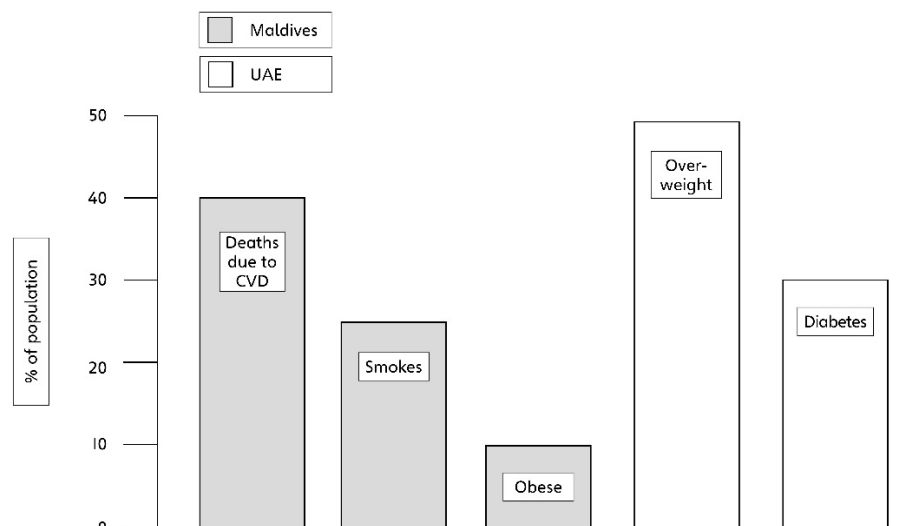
## 1C.2 Investigating the causes of CVDs

1    Use large sample sizes; carry out the study over many years; try to isolate the factor being studied keeping all other factors constant if possible.

2

(a)    A greater proportion of identical twins both die from heart disease than fraternal twins, in all age groups measured. As identical twins have identical genes, and fraternal twins do not, this suggests that there is a genetic link to heart disease, though this is probably not the only factor (otherwise the values for identical twins would be much higher).

(b)    Heritability is greater in younger men. The apparent fall as men get older may be due to the chances of them dying from other, age-related diseases or accidents before they die from heart disease. Or the fact that everyone is more likely to be affected by heart disease as they get older.

## 1C.3 Risk factors for cardiovascular disease

1    Non-modifiable risk factors are beyond your control, while modifiable risk factors are factors you can do something about.

2    (a)    Non-modifiable – any two from: genes, age, sex.

Modifiable – any two from: smoking, exercise, weight, stress, diet, or any other sensible lifestyle factor.

(b)    For each factor given, students must provide a clear explanation of the link to atherosclerosis and CVDs.

3    (a)

| Income of countries | Low | Low/middle | High/middle | High |
|---|---|---|---|---|
| Deaths per 100,000 population | 91 | 173 | 235 | 253 |

(b) Make a bar graph of the above data with 'Deaths per 100,000 population' on x axis.

(c)    Three reasons from:

People in poorer countries are …

- less likely to be obese

- more likely to do a lot of physical work

- likely to do a lot more exercise in terms of walking where cars not available, no TVs etc

- less likely to eat rich, fatty food

- may smoke less because of cost

- any other sensible points.

## 1C.4 Diet and cardiovascular health

1    BMI is body mass index, which is a comparison of weight and height.

2    Ali's BMI is 23.03, which is ideal.

3    (a)    About 9 stone 7 lbs to 13 stone (*c.* 60 kg to *c.* 82 kg)

      (b)    About 7 stone 3 lbs to 9 stone 11 lbs (*c.* 45 kg to *c.* 62 kg)

      (c)    6 feet is considered obese from *c.* 15 stone 9 lbs (*c.* 98 kg); 1 m 58 cm is considered obese from *c.* 11 stone 12 lbs (*c.* 75 kg).

4    (a)    BMI does not take into account natural changes in body composition with age, does not allow for people who are very fit and active and have high muscle mass and therefore can overestimate risk for some people.

      (b)    Waist to hip ratio is waist size (cm) / hip size (cm). Easy to measure, obvious changes with gain or loss in weight, good predictor of heart disease risk as measures fat.

5    (a)    Apparent correlation between high intake of dietary fat and raised blood cholesterol. However, this is now regarded as over-simplistic as it depends on many other factors including exercise, type of fats, other dietary factors, genetics, etc. Also discovered **low-density lipoproteins (LDLs)**, made from *saturated* fats, cholesterol and protein, which bind to cell membranes before being taken into the cells. If levels of some types of LDLs are high, your cell membranes become saturated and so more LDL cholesterol is left in your blood. **High-density lipoproteins** (**HDLs)** are made from *unsaturated* fats, cholesterol and protein. They carry cholesterol from body tissues to the liver to be broken down, lowering blood cholesterol levels. HDLs can even help to remove cholesterol from fatty plaques on the arteries, reducing the risk of atherosclerosis. So, the balance between HDLs and LDLs seems a better indicator of risk of CVDs than cholesterol alone.

      (b)    Heart disease is multifactorial – not the result of any one factor in your lifestyle and genetics. The more information scientists have, the more realistically they can estimate the risk of an individual developing heart disease.

6    Confusion – people expect scientists to give them a clear answer, but scientists are constantly changing their ideas in line with evolving evidence. People who had changed their eating habits – e.g. reduced the levels of fat in their diets – to help reduce the risk of heart disease, could be expected to be upset to find they might have made no difference.

    People who were pleased – had either never bothered to change to try and eat more healthily or felt they could add fatty food they enjoyed back into their diet. Any other sensible point.

## 1C.5 Dietary antioxidants and cardiovascular disease

1    (a)    10% reduction
      (b)    25% reduction

2    The evidence of the fruit and vegetables shows a correlation between an activity and an outcome. The evidence for the effect of antioxidants on heart disease is trying to find a causal mechanism for the correlation observed.

3    Look for points such as using the same concentration of DCPIP in each case, some volume of fruit juice from each fruit, repeat measurements and taking a mean, etc.

## 1C.6 Using the evidence

1    Losing weight is easier to organise and fit into daily life than increasing activity levels.

2       The two groups have very different lifestyles and are likely to be genetically different, so there may be other factors that are causing the difference in blood pressure.

3       Some people will overestimate and some underestimate the risk because most people don't know whether their blood pressure is affected by salt or not. Some people will listen to health warnings, or be told their blood pressure is raised, and be very concerned about their salt levels. Others will be unaware of the amount of hidden salt they eat and think they are alright or feel that people have eaten salt for centuries and come to no harm.

4       Whether we like salty foods or not is most likely to affect how much we eat of them. Also, if we eat a lot of processed food, which contains a lot of hidden salt, we may be oblivious to our salt intake.

5       Many possible answers but must be supported by reasonable argument. For example: it is a waste of money as most people do what they feel happiest with and ignore the advice; it is money well spent as the more people who live healthily, the fewer will need treatment for these diseases later.

## 1C.7 The benefits and risks of treatment

1       If the side-effects of the medication are unpleasant and affect daily life too much, the patient may give up on the treatment because their perceived risk of the reason for taking the medication (in other words, the dangers of the illness) may be much lower than the actual risk. Also, the perceived risk of taking the medication and experiencing side-effects may be much higher than the actual risk.

2       The meta-analysis published in a journal has looked at a large number of studies, which increases the reliability of the findings. A daily dose of plant sterols reduces LDL cholesterol.

3       (a)     So that some patients don't receive the treatment (without realising it) and this is the only factor that is different between the treatment group and control group.

        (b)     Patients taking the placebo don't get the benefits of taking the drug (if there are any). Possible reason for placebos being unethical include where those receiving the placebo suffer more or are more likely to die during the drug trial.

4       (a)     People with a high HDL level have plenty of 'good' cholesterol already. So, lowering the level of the LDLs will give them a very healthy balance in their blood.

        (b)     The best groups to treat are those which will receive the greatest benefit, such as smokers and women in this ethnic group.

# 1C Exam practice

1  (a)  C

   (b)  Multifactorial means that many factors contribute to the development of a disease, atherosclerosis is not caused by one factor.

   (c)  (i) C

   (ii) No carbohydrate means less energy intake, so weight loss is possible. Fat eaten will replace the energy in the diet. Need to eat polyunsaturated fats, avoid eating saturated fats. Low fibre diet may increase absorption of fats, high saturated fat could cause more atherosclerosis.

2  (a)  Correlation means that as one factor changes another factor also changes. Cause

   means that the change in one factor makes the other factor change. Correlation may be a result of cause, however there may be a third factor that causes both the others to change.

   (b)  Large numbers of participants; designed and carried out by independent scientists; data come from reliable sources that have been accurately recorded.

   (c)  area of lumen = $\pi r^2$

   area = $3.142 \times 0.5^2 = 0.785 \text{ mm}^2$

   The atheroma takes up approximately half this area – so the area of the atheroma is $0.785/2 = 0.393 \text{mm}^2$

3  (a)  B

   (b)  The artery at C supplies blood to a larger part of the ventricle than either B or A. Larger part of ventricle would be starved of oxygen. Larger part of ventricle muscle could die. May cause cardiac arrest.

   (c)  (i) smoking increases risk; in men of all ages; risk is doubled for men under 45; increase in risk is much smaller for older men.

   (ii) not many women of that age smoke OR recoding of data was not reliable.

   (iii) A

   (iv) % increase in men = $100 \times (8.2 - 6.0) / 6 = 36.7\%$

   % increase in women = $1.8 \times 1.367 = 2.5\%$

4  (a)  High blood pressure; leads to damage to lining of artery wall; split in endothelium leads to deposition of fatty substances to repair wall.

   (b)  Reduced lumen of coronary artery; reduces blood flow to ventricle muscle; less delivery of oxygen to muscle; blood clot or thrombus can block artery; stops blood flow and oxygen delivery; muscle dies.

   (c)  44.7% = 380, therefore number of people in survey = $100 \times 380/44.7 = 850$ people. 38% of 850 = 323 people had diabetes.

   % with high blood cholesterol = $100 \times 212/850 = 24.9\%$

   (d)  Two of:

   • genetic factors (disposition)

   • obesity

- smoking

- high salt diet

- diet high in saturated fats

- poverty.

5 (a) Perception of risk depends on how familiar people are with the activity, how much they enjoy the activity and whether or not they approve of the activity.

(b) (i) C

(ii) Lose weight; exercise more; modify diet to eat more vegetables and less red meat.

(iii) Waist to hip ratio.

(c) Student answers could include the following points:

- food is relatively cheap

- many people may eat ready-prepared meals that are often very high in energy content

- advertising

- many people eat out in fast food restaurants

- over dependence on cars rather than walking.

6 (a) They will reduce chance of a thrombus forming, so a clot is less likely to get caught in a narrowed artery.

(b) Student answers should include the following:

- antihypertensives will reduce blood pressure

- so, there is less chance of damaging the artery walls

- statins reduce blood cholesterol levels

- so, less likely to be deposited in artery walls

- these treatments mask the cause

- it would be better to educate people to lose weight, eat more healthily, get more exercise

- this would be cheaper for the health services.

(c) (i) Student answers should include the following:

- pieces of fruit reduce risk to 0.9 on the relative risk scale

- reduces risk compared to 4 or fewer pieces

- 6 pieces do not reduce risk any further

- therefore 5 pieces seems a suitable number to recommend.

(ii) 7 pieces does reduce risk further, to 0.7 on the relative risk scale; this suggests that recommending 7 pieces of day would bring greater benefits.