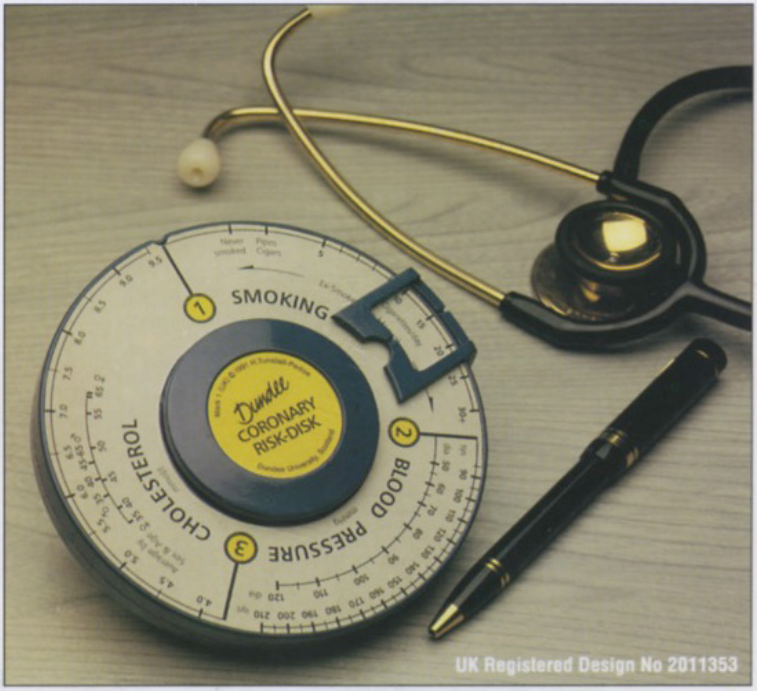
DUNDEE CORONARY RISK-DISK



MANUAL and TECHNICAL DESCRIPTION

WELCOME to the DUNDEE CORONARY RISK-DISK

Professor Hugh Tunstall-Pedoe

The **Dundee Coronary Risk-Disk** was developed in Dundee, in collaboration with a Working Group of the CORONARY PREVENTION GROUP and the BRITISH HEART FOUNDATION. It has been endorsed by both organisations and is incorporated into their joint *Action Plan for Preventing Coronary Heart Disease in Primary Care.* It incorporates results from two major British studies, the *United Kingdom Heart Disease Prevention Project* which took place in England and Wales, and *The Scottish Heart Health Study.*

The **Dundee Coronary Risk-Disk** was developed to help those involved in coronary heart disease prevention:

- to **assess** modifiable coronary risk by **integrating** the major risk factors,
- to **classify** patients according to **priority** for action,
- to **educate** and **motivate** them, **negotiating** on how and what to change,
- to **monitor** and **feed-back** the resulting change, beginning another cycle.

It is appropriate that the **Dundee Coronary Risk-Disk** is circular - keep it turning!

Assessing coronary risk is the first step - **but you must get it right!** Spend a few minutes studying this **MANUAL** before you use the **Dundee Coronary Risk-Disk** on any patients. See that you understand the **Dundee Coronary Risk-Disk,** and how to use it properly, before you start. Try out the practice exercises in the **MANUAL** and get them right, before you start on real patients.

The first part of this booklet is a **MANUAL** which tells you **how.** The second part is a **TECHNICAL DESCRIPTION** which tells you **why.** You should study the whole of the **MANUAL.** The **TECHNICAL DESCRIPTION** is there to read in stages. It will help you to understand what is going on, and should answer a number of questions which you or your patients might ask about the system. Dip into it when you have the time. The **MANUAL** is also available as an educational videocassette. This contains nothing that is not in this booklet, but you may find it helpful reinforcement. Having welcomed you to the **Dundee Coronary Risk-Disk** we wish you a long and productive partnership, along with all the other users.

Hugh Tunstall-Pedoe

Hugh Tunstall-Pedoe
Dundee University
Cardiovascular Epidemiology Unit,
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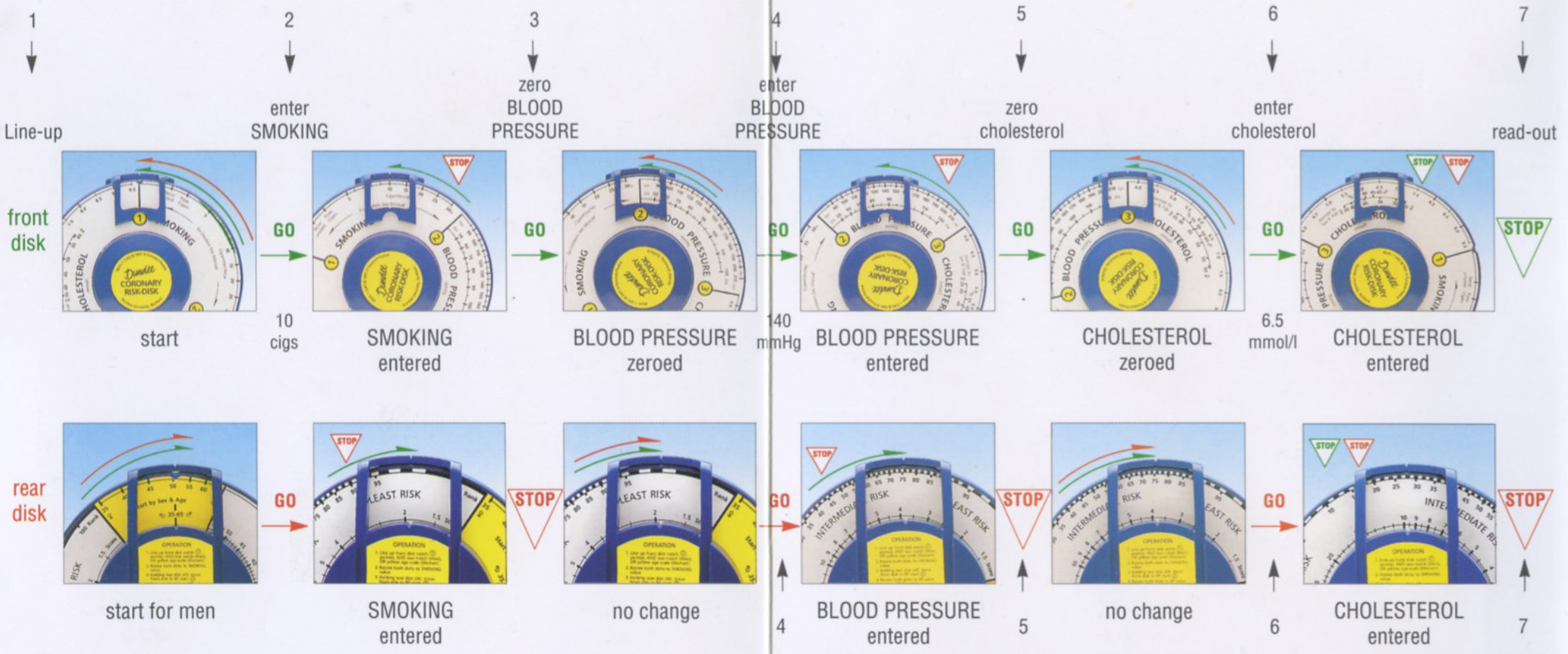
August 1991

Warning :

The designers, sponsors and suppliers of the Dundee Coronary Risk-Disk *disclaim responsibility for any misuse in practice. As a measure of modifiable coronary risk the* Dundee Coronary Risk-Disk *is an aid to coronary prevention. Any suggestion to patients that they definitely will, or will not, have a coronary heart attack, based on the* Dundee Coronary Risk-Disk, *is unwarranted. The design of the* Dundee Coronary Risk-Disk *is registered in Britain, the USA and parts of Europe. Printed matter on the* Dundee Coronary Risk-Disk *itself, this booklet, and the software are copyright.*



DUNDEE CORONARY RISK-DISK

Worked example from pages **9** and **10** of the MANUAL.

Coloured arrows indicate the disk movements that are to be made subsequent to each photograph.

Read text for full explanation.

front disk

rear disk

oblique views of rear disk

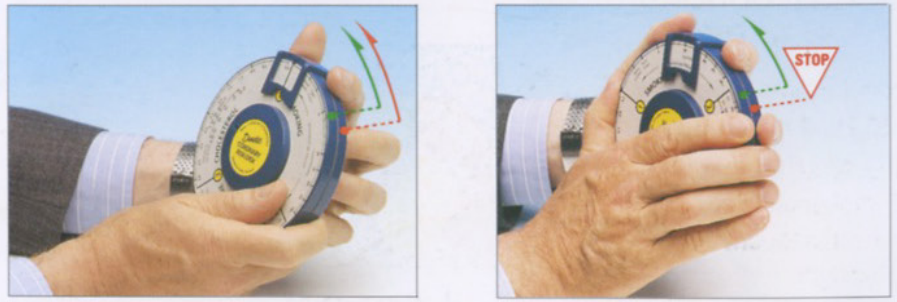
before zeroing BLOOD PRESSURE

after zeroing BLOOD PRESSURE

2

3

HOW TO HOLD THE DISK



to enter SMOKING

to zero BLOOD PRESSURE

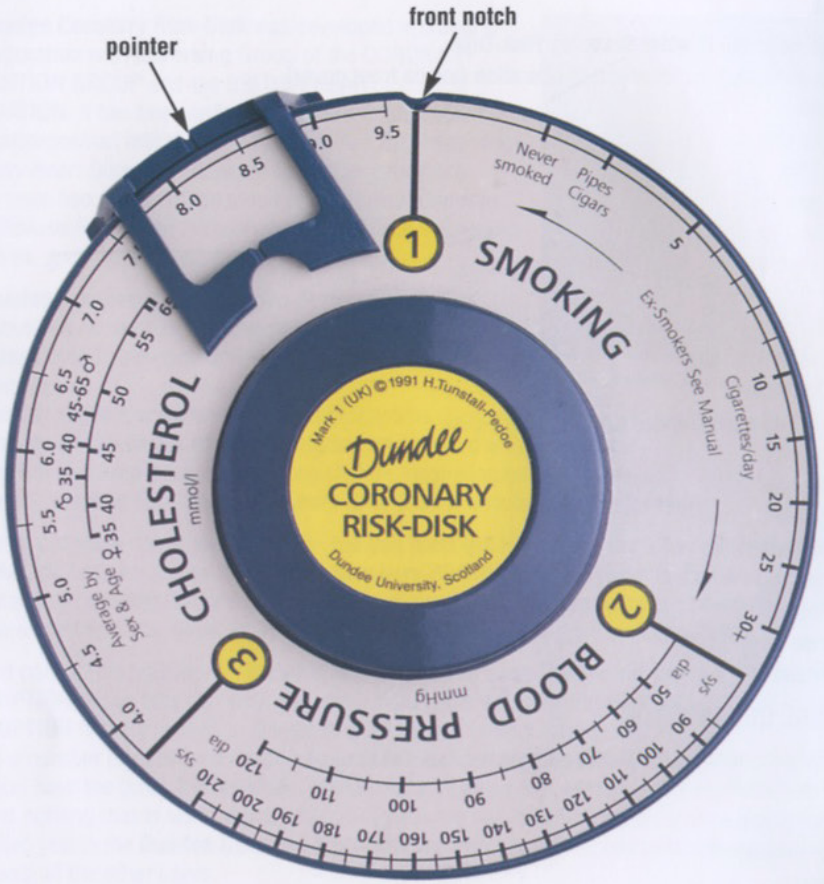
2

3

CONTENTS

MANUAL

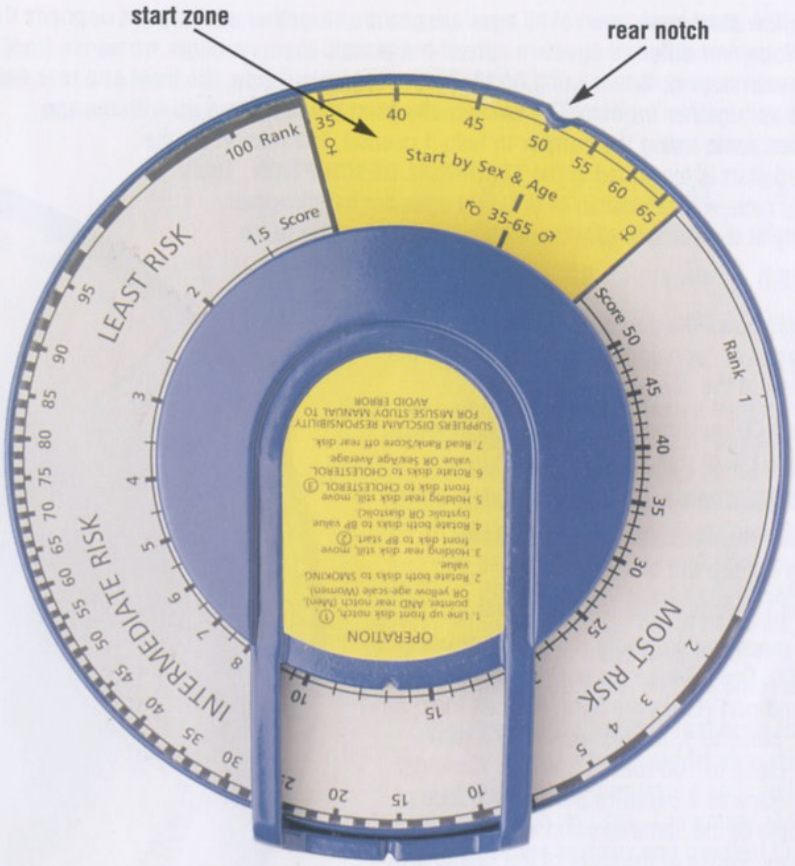
The **Dundee Coronary Risk-Disk,** the instructional videocassette, the software, and the cholesterol colour charts (as above, only printed on A4 size card) can all be ordered through the producers: **Risk-Disk, CVEU, Ninewells Hospital, Dundee DD1 9SY, Scotland.**



This is the front of the **Dundee Coronary Risk-Disk,** showing the scales on the **front disk** and the **pointer.** The **front disk** is moved anticlockwise through the **pointer** which is kept still. The **pointer** passes across three successive linear scales:

SMOKING BLOOD PRESSURE CHOLESTEROL

Each scale in turn is **zeroed** on the **pointer,** and then the value is **entered.** The **front disk** just keeps rolling along! Its movements are colour-coded green. Think of it as the "Go-Go" disk.



This is the rear of the **Dundee Coronary Risk-Disk,** showing the scales on the **rear disk** and the **pointer.** There is an outer scale for *Rank* and an inner scale for *Score.* The **rear disk** is moved clockwise through the **pointer,** in sequence from the yellow **start zone,** via LEAST RISK, through INTERMEDIATE RISK, towards MOST RISK. (See for yourself that anticlockwise viewed from the front is clockwise viewed from the rear).

The **rear disk** is moving when the **front disk** is **entering** a risk factor and it is stationary when the **front disk** is **zeroing** a scale. Its movements are colour-coded in red. Think of it as the "Go-Stop" disk.

START ZONE

In the yellow **start zone**, men of all ages are grouped together at one point opposite the **rear notch.** Women of different ages are spread out around them, younger women in front and older women behind. When lining up the disks for a calculation, the **front** and **rear notches** are lined up together for men. For women, the **front notch** is lined up with the age in the **start zone,** using the **pointer** to help if needed. The reason for the staggered start is explained in the **TECHNICAL DESCRIPTION.** Think of a relay race, where women of different ages are handicapped differently at the start, to give them equal chances at the finish.

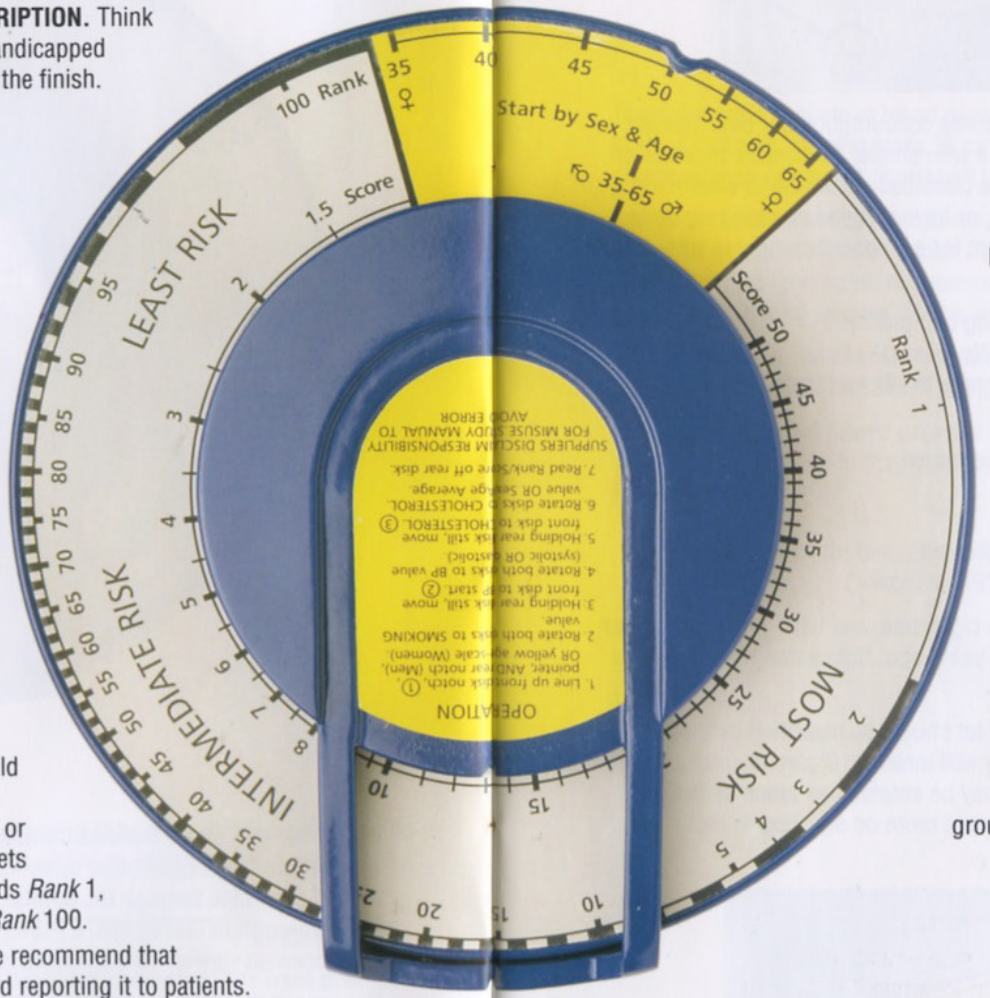
RANK SCALE

The *Rank* shows the person's risk status in percentages or "percentiles" compared with the population of the same age and sex.

- *Rank* 100 means that the person is in the lowest 1% of risk.
- *Rank* 50 is half-way along the scale.
- *Rank* 7 means seventh position down from the top out of 100.
- *Rank* 1 means in the top 1% of risk.

Rank is measured in whole numbers between 1 and 100. Even *Ranks* are shown as dark bands and odd *Ranks* are light. A small rank number, close to 1, means high risk. A rank number close to 100 means low risk. Consider *Dundee Rank* as a person's place in a queue of 100 people of the same sex and age, waiting for a coronary. Those at the front of the queue are likely to get there first. Those at the back of the queue are less likely to get there at all. Patients should try to get away from the front or top of the queue by lowering their risk factors. They will then move back or down the queue. In other words, those whose risk gets worse move "up" the queue (nearer the front) towards *Rank* 1, and those who are improving move down towards *Rank* 100.

Rank is new to the **Dundee Coronary Risk- Disk.** We recommend that you use *Rank* as your main way of assessing risk and reporting it to patients.



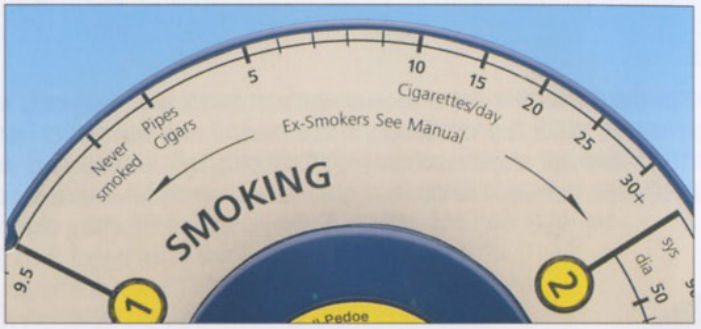
SCORE SCALE

The *Score* is the relative risk of a coronary heart attack over five years, with a scale running from 1.5 to 50. Express *Scores* of less than 10 with one decimal (eg 5.6), and *Scores* of 10 upwards as whole numbers (eg 10, 22, 40), by rounding up or down to the nearest whole number. The *Score* is of value in showing how relative risk changes with a change in *Rank.*

Score	2.5	equals	*Rank*	93
Score	5.0	equals	*Rank*	59
Score	10	equals	*Rank*	27
Score	20	equals	*Rank*	5
Score	40	equals	*Rank*	1

Each time we doubled the *Score* we rotated the **rear disk** by approximately the same amount. Notice that the *Scores* are spread out at the LEAST RISK end and crowded at the MOST RISK end. The *Score* scale is not linear, which is why you cannot simply add risk factors up. The *Ranks* are crowded in INTERMEDIATE RISK, and spread out at the ends. This is because average degrees of risk are the most common, and extremes are rare.

It is important to realise that both *Rank* and *Score* refer to **modifiable** risk, from smoking, blood pressure and cholesterol, relative to age and sex. The **actual** risk varies greatly with age and sex and medical history. A man of 65 with a *Rank* of 28 is at much greater risk than a woman of 40 with a *Rank* of 28. Each is in the same position relative to their age and sex group, but the groups run different risks (see page 32).



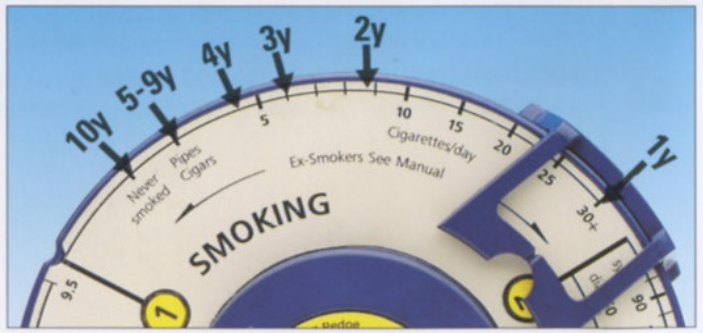
Patients are classified primarily by their average cigarette consumption per day. Classify those who smoke 1-5 cigarettes a day on 5 and those who smoke 30 or more together on 30. Those who do not smoke cigarettes currently, are classified according to whether they never smoked, have always smoked a pipe or cigars, or have stopped smoking cigarettes. The smoking scale covers all these possibilities except for ex-cigarette smokers who are classified as follows.

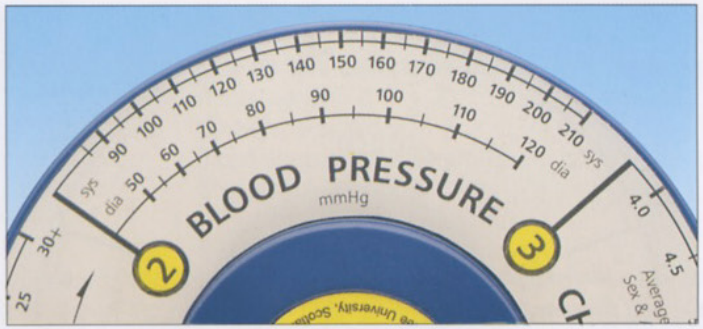
For those ex-cigarette smokers who have quit smoking completely:
- if it was 10 years or more ago, classify them with "Never smoked"
- if it was 5 or more years ago but not 10 classify them with "Pipes Cigars"
- if it was less than 5 years ago proceed as follows:

- find out how much they smoked a year before they stopped,
- find that on the disk,
- look back to the "Never smoked" point,
- divide that distance by the number of years since stopping, and move to that point, provided it is further to the right on the scale than "Pipes Cigars".

The illustration below shows the **pointer** against 30+ cigarettes, and what you would **enter** for a 30 a day smoker who quit different numbers of years ago. Notice that the 30 point is used until the person has quit for more than a year.

Ex-cigarette smokers who smoke Pipes and Cigars a lot should be classified by their previous cigarette consumption, as they are probably still inhaling. Cigarette smokers who are "cutting back" should also be warned that they may be smoking as much as before, getting more from each cigarette. Better to stop. There is more on smoking in the **TECHNICAL DESCRIPTION.**





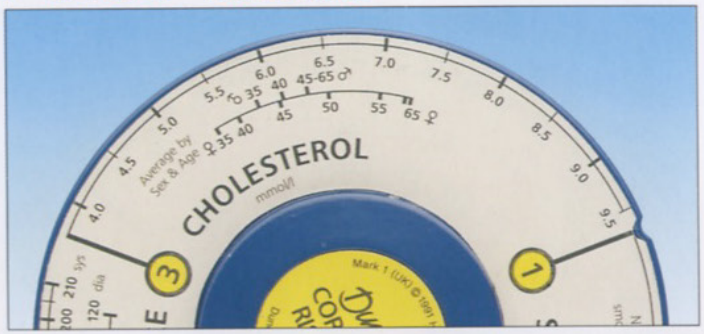
The outer scale is systolic blood pressure, ranging from 90 mmHg to 210 mmHg. The inner scale is diastolic, ranging from 50 mmHg to 120 mmHg. The diastolic reading is for disappearance of sounds (Korotkoff phase 5).

You should use **either** systolic **or** diastolic blood pressure, not both. Decide which reading and scale you are to use, and then use it consistently. If you confuse the two scales, and enter a systolic reading on the inner scale or a diastolic reading on the outer one, **you will get a totally wrong answer**. This is why you are advised to stick to one scale or the other.

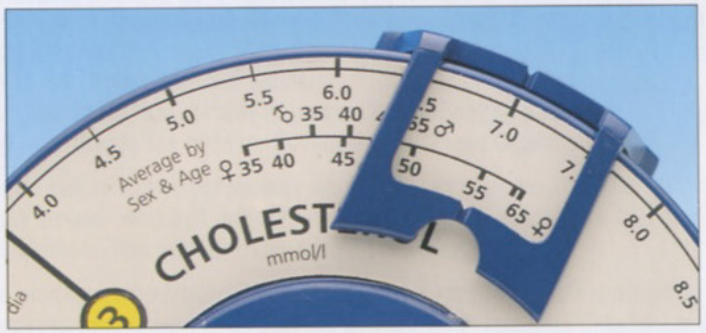
For coronary risk assessment you will need to take blood pressure readings with extra care (See the **TECHNICAL DESCRIPTION**).

Your practice should have a protocol for systematic follow-up of blood pressure readings which are found to be in the hypertensive, or borderline hypertensive range at risk factor assessment.

FRONT DISK continued



If you have a recent blood cholesterol reading for your patient, use the outer cholesterol scale. The outer scale is for **entering** measured cholesterol values ranging from 4.0 to 9.5 mmol/l (154 mg/dl to 366 mg/dl). If the reading is below 4.0 **enter** it as 4.0, and if it is above 9.5 **enter** it as 9.5. Your practice should have a protocol for follow-up of very high cholesterol readings found at risk factor assessment. There are good arguments for relating this to the age and sex of the patient
(See the **TECHNICAL DESCRIPTION** and cholesterol charts).



If you do not have a blood cholesterol reading for your patient, you can still derive a *Provisional Dundee Rank* and *Score* by using the inner cholesterol scale. This shows the average values by sex and age of serum cholesterol in the British population. Use the average for the sex and age of your patient as a substitute reading. You may then decide whether the *Rank* is high enough to warrant an actual blood test, or is low enough to mean that a test is not justified. See Exercise 4 for demonstrations of how this works.

The illustration above shows the **entry** of a substitute cholesterol value for a woman of 55.

HOW TO WORK THE DUNDEE CORONARY RISK-DISK (look also inside front cover)

Having explored all the parts of the **Dundee Coronary Risk-Disk,** we will now work out the *Rank* and *Score* of:

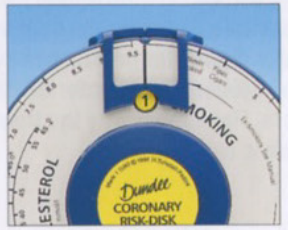
A man aged 45
Smokes 10 cigs/day
Blood pressure 140/88 mmHg
Cholesterol 6.5 mmol/l

1 Line-up

As it is a man, line-up the two notches with each other, and then with the **pointer.** You will find the **pointer** is over the yellow (1) on the smoking scale and over the 35-65 mark for men on the yellow **start zone.**

Notch Alignment

Front View



Rear View

2 Enter SMOKING

With your left hand hold the back of the **pointer** so that the two disks are free to rotate together, and so that the **front disk** is facing you, with the **pointer** at the top. By eye line-up the horizontal groove on the pointer and its two vertical notches with the smoking scale. With your right hand rotate both disks together anticlockwise across the SMOKING scale to the mark for 10 cigarettes. Note that both disks have moved, **front disk** to 10 cigarettes and **rear disk** to Rank 98.

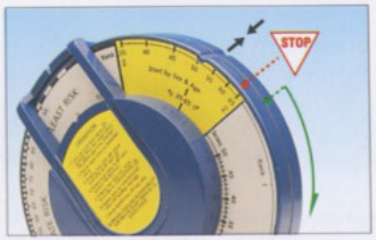
Entry

3 Zero BLOOD PRESSURE

With your left hand, hold the **rear disk** and **pointer** firmly together. (Holding the **rear disk** circumference between your thumb and little finger you can either splint the **pointer** between your thumb and index finger (see photograph) or push your index and middle fingers into the **pointer** rear window.) Use your right hand to rotate the **front disk** by itself, anti-clockwise, the distance from 10 cigarettes to the BLOOD PRESSURE start line (2). Check that the **rear disk** has not moved and is still on *Rank* 98.

Zeroing

Note that the two disks rotated together and the notches stayed in alignment during **entry** of the smoking value. The effect of **zeroing** the **front disk** alone is that the disks are now displaced, because the **front disk** was rotated whilst the **pointer** and **rear disk** were kept stationary.



Rear oblique view before ***zeroing***

Same view after ***zeroing***

The remainder is now repetitive. Having lined up the disks, **entered** smoking and **zeroed** blood pressure, what remains is to enter blood pressure, **zero** cholesterol and **enter** it, using the same basic movements as before. Remember why the **front disk** is called Go-Go and the **rear disk** is called Go-Stop.

	front	rear
enter	Go	Go
zero	Go	Stop

4 Enter BLOOD PRESSURE

Hold the back of the **pointer** with your left hand, and with your right hand rotate both disks together anticlockwise across the BLOOD PRESSURE scale to 140 mmHg systolic. Turn the **Dundee Coronary Risk-Disk** over without dislodging the **pointer,** and you will find that the rear **pointer** has moved further anticlockwise through the LEAST RISK towards the INTERMEDIATE RISK zones of the **rear disk** so that the **pointer** is now on *Rank* 76 on the outer edge. Turn the **Dundee Coronary Risk-Disk** back so that the **front disk** is upwards.

5 Zero CHOLESTEROL

With your left hand, hold the **rear disk** and **pointer** firmly together, as in step 3. With your right hand, rotate the **front disk** by itself, anticlockwise, the distance from 140 mmHg systolic to the CHOLESTEROL start line ③. Check that the rear **pointer** has not moved and is still on *Rank* 76. Turn the **Dundee Coronary Risk-Disk** back so that the **front disk** is upwards.

6 Enter CHOLESTEROL

Hold the back of the **pointer** with your left hand, and with your right hand rotate both disks together anticlockwise across the CHOLESTEROL scale on the outer edge to 6.5 mmol/l.

7 Readout

Turn over the **Dundee Coronary Risk-Disk** without dislodging the **pointer,** and you will see that the **rear disk** is now showing a **pointer** reading of *Dundee Rank* 28 and *Score* 9.8. Do not worry if your results are close but not the same. Small differences in rotation can cause discrepancies of one or two *Ranks*. This error is small compared with that of remeasuring the risk factors themselves.

EXERCISE 1

Woman aged 60
Smokes 10 cigarettes a day
Blood pressure 140/72 mmHg
Cholesterol 6.5 mmol/l

After working through the previous exercise and making sure that you have fully understood all the steps, try doing this one by yourself. Although it is not really necessary to turn over the disk and look at the back between the first line-up and the final readout, you may find it helpful to record the intermediate positions of the **pointer** on the **rear disk** in terms of *Rank* for this exercise only.

If this is your first attempt, I suggest that you calculate the result three times running to see that you get the same answer before you turn over the page. Try to line up the disk, and **enter** and **zero** risk factors as accurately as you can. Do not get too worried by minor inconsistencies in results either way of one or two *Ranks*. These will diminish with practice. Such discrepancies are bound to occur where the *Ranks* are bunched, or a result is near the edge of one *Rank*. You will find they do not occur at extremes of risk where the *Ranks* are more spread out.

EXERCISE 1 - ANSWER

If you used the systolic blood pressure, this is exactly the same as the last case from the risk factor entry point of view. However, the major difference is that this is a woman of 60, and therefore you should not have lined up the notches at the start. Did you? Remember to use the yellow **start zone** for women.

If you used the yellow **start zone** appropriately, you should have the following results:

Using systolic blood pressure of 140 mmHg

After smoking **entry** (10 cigs)	*Rank*	100	*Score*	1.55
After blood pressure **entry** (140 sys)	*Rank*	86	*Score*	3.1
After cholesterol **entry** (6.5)	*Rank*	36	*Score*	8.0

Using diastolic blood pressure of 72 mmHg

After smoking **entry** (10 cigs)	*Rank*	100	*Score*	1.55
After blood pressure **entry** (72 dia)	*Rank*	95	*Score*	2.4
After cholesterol **entry** (6.5)	*Rank*	48	*Score*	6.2

Comment : You may be puzzled by two of the results coming from this exercise:

1 Why do the same risk factor results produce a *Rank* of 28 in a 45-year-old man, but a *Rank* of 36 in a 60-year-old woman?

2 Why does systolic blood pressure in this woman give *Rank* 36 and diastolic *Rank* 48 ?

The answer to the first question is that women of 60 have higher blood pressure levels and serum cholesterol values on average than men of 45. Both the *Rank* and the *Score* are comparing the person concerned with the distribution of risk factors in their own sex and age groups. For the same risk factor levels, therefore, the younger man is nearer the front of the queue for his sex and age than is the older woman.

The reason why the diastolic blood pressure gives a different answer from the systolic in this exercise is obvious when you look at the blood pressure scales, which show you which are the equivalent systolic and diastolic readings in the Dundee system. A diastolic blood pressure of 72 mmHg is equivalent to a systolic reading of 110 mmHg, much lower than the 140 of the measured systolic. Most people will have systolic and diastolic readings which are broadly equivalent, but there will be some who are anomalous like this. We suggest that you standardise your practice on **either** systolic **or** diastolic. The fact that the results disagree in some subjects should not surprise you. The *Dundee Rank* and *Score* are broad estimates of risk to aid patient management and motivation, but it would be wrong to credit them with a spurious accuracy they do not have. The *Ranks* are crowded together in the middle range, and a difference of one unit of diastolic blood pressure can equal one *Rank*.

EXERCISE 2

Man aged 45
Smokes 30 cigarettes a day
Blood pressure 136/86
Cholesterol 8.0 mmol/l

A What is the *Rank* and *Score?*

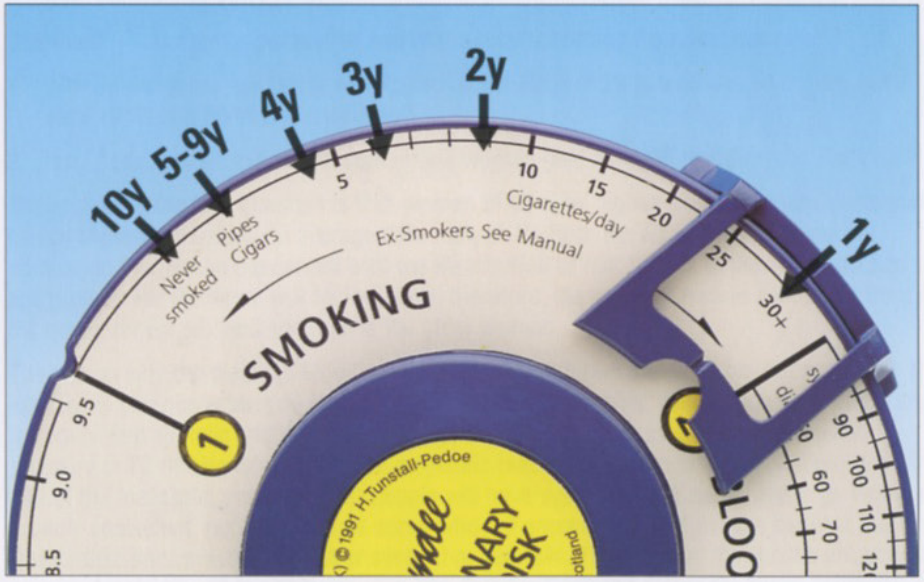
B Recalculate the *Rank* and *Score,* two, three, five and eleven years after stopping smoking, assuming no changes in other risk factors.

EXERCISE 2 - ANSWER

A	Male 45,	30 cigs currently,	SBP 136,	Chol 8.0,	*Rank* 2	*Score* 25
B	Male 47,	30 cigs stopped 2y,	SBP 136,	Chol 8.0,	*Rank* 14	*Score* 14
	Male 48,	30 cigs stopped 3y,	SBP 136,	Chol 8.0,	*Rank* 22	*Score* 11
	Male 50,	30 cigs stopped 5y,	SBP 136,	Chol 8.0,	*Rank* 34	*Score* 8.5
	Male 56,	30 cigs stopped 11y,	SBP 136,	Chol 8.0,	*Rank* 40	*Score* 7.4

Comment : This exercise illustrates the use of the special rules for assessing risk in ex-cigarette smokers. You will remember that the excess risk over never smokers is halved two years after stopping, reduced to one third at three years, to the level of pipe and cigar smokers between 5 and 9 years, and to the level of a never smoker from 10 years onwards. I have added years to this man's age for the exercise, but it makes no difference to the calculations because there is no offset by age for men.

Notice what a big difference heavy smoking makes to the *Rank*. The effect of changing from 30 cigarettes a day to stopping smoking for 11 years is to carry this man (who has rather low blood pressure and high cholesterol) from *Rank* 2 to *Rank* 40. This exercise shows you how much effect completely stopping smoking has on the calculated risk of heavy smokers. They do have to wait more than a year to see the changes, but when they do come, they are large.



EXERCISE 3

Man aged 45
Smokes 30 cigarettes a day
Blood pressure 136/86
Cholesterol 8.0 mmol/l
(The same man as in Exercise 2)

A What happens to his *Rank* and *Score* if he continues smoking but lowers his blood cholesterol to 5.5 mmol/l ?

B What happens to his *Rank* and *Score* if he stops smoking completely for four years, and lowers his cholesterol to 6.5 mmol/l ?

C What happens to his *Rank* and *Score* if he stops smoking completely for four years, and lowers his cholesterol to 5.5 mmol/l ?

EXERCISE 3 - ANSWER

A	Male 45,	30 cigs currently ,	SBP 136,	Chol 5.5,	*Rank* 20	*Score* 12
B	Male 49,	30 cigs stopped 4y,	SBP 136,	Chol 6.5,	*Rank* 48	*Score* 6.2
C	Male 49,	30 cigs stopped 4y,	SBP 136,	Chol 5.5,	*Rank* 68	*Score* 4.4

Comment : In the last few years cholesterol has been the coronary risk factor getting all the publicity and commercial interest. However, the **Dundee Coronary Risk-Disk** takes account of the importance of cigarette smoking and blood pressure as coronary risk factors, as this exercise and the previous one illustrate.

Exercise 2 showed us that by stopping smoking long enough for the effects of smoking to disappear, our man changes his *Rank* from 2 to 40.

This exercise shows us that if he continues smoking and lowers his cholesterol from 8.0 to 5.5, his *Rank* changes from 2 to 20, a smaller change. If he stops smoking for four years, and lowers his cholesterol to 6.5 (a bit above average), his *Rank* is better than what he can achieve from cholesterol change alone. If he stops smoking for four years, and lowers his cholesterol from 8.0 to 5.5, his *Rank* changes to 68, so that he would move from near the front of the coronary queue to two thirds of the way from the front.

The conclusions from these two exercises are:

1. Very high risk arises from combinations of risk factors.
2. Stopping smoking can have the same or a greater effect than a big change in cholesterol.
3. In high risk patients there is room for negotiation with the patient as to which risk factor should be given priority.
4. The biggest reduction in risk is not achieved by major changes in single risk factors, but by more modest changes in two or more.

EXERCISE 4

Man aged 50
Woman aged 50
Woman aged 40
Woman aged 55 } all patients at the Health Centre, Newtown

The Health Centre in Newtown has decided :

- to run a special risk factor counselling clinic for men and women aged 40-59 in the top 15% of multifactorial risk as calculated using the **Dundee Coronary Risk-Disk,** and
- to measure cholesterol in patients who are under care for diabetes or for vascular disease, or on medication for high blood pressure, or who have xanthoma or xanthelasma or juvenile arcus (under 50), or who have a strong family history of hyperlipidaemia or of premature coronary heart disease (coronary heart attack in father below 50 or in mother below 55), and
- to measure cholesterol selectively in those patients who appear from their *Provisional Dundee Rank* to be in the top 25% of multifactorial risk (that is, their *Rank* calculated using the substitute cholesterol values on the **Dundee Coronary Risk-Disk).**

Answer the following questions A to E on these four patients, without looking at the answers overleaf first!

A What are the *Provisional Dundee Ranks* and *Scores* for these four patients, if they smoke 10 cigarettes a day, have blood pressure of 140/88 mmHg, and their cholesterol is not tested?

B Which of these patients would then have had their cholesterol tested by the Newtown practice?

C Which of these patients would have been asked to come to the risk factor counselling clinic?

D Assume that, ignoring the Newtown decisions, these patients all had had their cholesterol measured. Recalculate their *Final Scores* and *Ranks* after the cholesterol values all come back as 6.5 mmol/l.

E Explain the differences between the *Provisional* and *Final Ranks* and *Scores* in each patient, and explain why measuring the cholesterol had such a different effect in each patient.

EXERCISE 4 - ANSWERS

A (What are the *Provisional Scores* and *Ranks?)*

Man 50,	10 cigarettes,	SBP 140,	Chol NK,	*Provisional Rank* 30,	*Score* 9.2
Woman 50,	10 cigarettes,	SBP 140,	Chol NK,	*Provisional Rank* 27,	*Score* 10
Woman 40,	10 cigarettes,	SBP 140,	Chol NK,	*Provisional Rank* 25,	*Score* 10
Woman 55,	10 cigarettes,	SBP 140,	Chol NK,	*Provisional Rank* 25,	*Score* 11

B (Who would have had their cholesterol tested?)

Man 50,	Cholesterol not tested, as *Rank* is lower than 25
Woman 50,	Cholesterol not tested, as *Rank* is lower than 25
Woman 40,	Cholesterol tested, as *Rank* is 25
Woman 55,	Cholesterol tested, as *Rank* is 25

C (Who were asked to come to the risk factor counselling clinic?)

The man of 50 and the woman of 50 and the woman of 55, although of above average risk, do not qualify for special attention. The woman of 40 is in the top 15% of risk, after cholesterol testing and is asked to come for counselling.

D (Recalculate *Rank* and *Score* for measured cholesterol of 6.5 mmol/l)

Man 50	*Final Rank 28*	(was 30)	*Final Score 9.8*	(was 9.2)
Woman 50	*Final Rank 27*	(was 27)	*Final Score 10*	(was 10)
Woman 40	*Final Rank 14*	(was 25)	*Final Score 14*	(was 10)
Woman 55	*Final Rank 32*	(was 25)	*Final Score 8.9*	(was 11)

E (Explain differences between provisional and final risk)

Man 50, Measured cholesterol at 6.5 is very close to the substitute for sex and age of 6.3 mmol/l, so the risk changes little.

Woman 50, Measured cholesterol at 6.5 is the same as the subsitute for sex and age of 6.5 ,mmol/l, so the risk does not change.

Woman 40, Measured cholesterol at 6.5 is far above the substitute for sex and age of 5.6 mmol/l, so the risk increases a lot.

Woman 55, Measured cholesterol at 6.5 is far below the substitute for sex and age of 7.0 mmol/l, so the risk decreases a lot.

For the man of 50, and for the woman of 50, the *Final Rank* is lower than 25. For the woman of 40, the *Final Rank* of 14 indicates a relatively high level of risk, but for the woman of 50 the *Final Rank* of 32 is nearer the average. A cholesterol value of 6.5 mmol/l, although undesirable, is only slightly above average for men aged 45-64, average for women of 50, well above average for women of 40, and well below average for women of 55. (See charts on pages 28 and 29.)

That is the end of the MANUAL for using the Dundee Coronary Risk-Disk. If you now feel confident that you can use it without making mistakes, try it out on some colleagues, and then you can start using it with patients. These exercises should have given you a frame of reference. After each calculation in practice ask yourself, "Is the result sensible?" If not, do it again, checking **line-up, enter,** and **zero** procedures are all right.

DUNDEE CORONARY RISK-DISK

TECHNICAL DESCRIPTION

THE REQUIREMENT FOR THE DUNDEE CORONARY RISK-DISK

The **Dundee Coronary Risk-Disk** was developed by Professor Hugh Tunstall-Pedoe in Dundee during 1989-1991, at the request of the CORONARY PREVENTION GROUP and the BRITISH HEART FOUNDATION, in consultation with a Working Group, chaired by Professor Geoffrey Rose, which was developing *An Action Plan for Preventing Coronary Heart Disease in Primary Care*. The requirement was to produce a simple scoring system which could be used in general practice, a system that would put the coronary risk factors in perspective in relation to each other, and would help doctors to target for special attention those patients at highest risk, with a view to extra counselling on life-style modification. There was concern that, without a popular scoring system, there would be undue emphasis on single risk factors, seen in isolation, such as cholesterol.

There were existing scoring systems, but they were thought to have a number of problems that had prevented any single one being widely adopted:

- some were complicated,
- some were fatalistic in emphasising factors that could not be changed,
- some failed to demonstrate the multiplicative interaction of factors,
- some centred almost entirely on measurement of lipid fractions, or assumed that they
- were measured in all cases.

The Working Group wanted a *Score* which would emphasise a small number of modifiable risk factors, would handle continuous scales of smoking, blood pressure and cholesterol, could be used in the absence of a cholesterol result, would be based on a published British study, and could be easily related to its own distribution in the general population.

The British study chosen was the cohort of factory workers studied in the United Kingdom Heart Disease Prevention Project (UKHDPP). These were men aged 40-59 years in 1971-1973 who underwent a simple cardiovascular risk factor assessment at their place of employment, and were then followed-up, initially for five years, for non-fatal myocardial infarction and for coronary deaths. The number of men studied was 5203, and the number of coronary events was 331.

THE FORMULA

The analysis of the UKHDPP data employed the statistical model known as the Multiple Logistic Function (MLF), to derive constants for a formula showing the relative importance of smoking, blood pressure and cholesterol. The initial formula, as calculated by computer, used age as well as smoking, blood pressure and cholesterol. But then, in order to simplify the model, age was set to 50, the middle of the UKHDPP age range.

$$\text{5-year risk of CHD event } Y = \frac{1}{1 + e^{-(a + b_1x_1 + b_2x_2 + b_3x_3)}}$$

MLF constants (calculation using systolic blood pressure)

$a = -6.8624$

$b_1 = 0.010543$ x_1 = systolic blood pressure mmHg

$b_2 = 0.3627$ x_2 = cholesterol mmol/l

$b_3 = 1.00$ x_3 = smoking code

Never smoked = 0

Ex-smoker, pipe or cigars only = 0.14530

Cigs 1-5	= 0.406
Cigs 5-9	= 0.406 + (Cigs -5) 0.0813
Cigs 10-29	= 0.8125 + (Cigs -10) 0.0312
30 or more cigs/day	= 1.437

If you took up medicine or nursing among other things to get away from complicated mathematics, be of good cheer! We have designed the **Dundee Coronary Risk-Disk** (and the alternative computer software) to do all the calculations for you. All you have to do is to enter the data.

The derivation of the diastolic blood pressure scale and the offsets for women are explained on pages 26 and 24. However, the offsets, which are modifications to constant **a** above are:

35y = +0.5719, 40y = +0.3875, 45y = +0.1922, 50y =+0.0156,
55y = -0.1047, 60y = -0.2219, 65y = -0.3156

with intermediate ages placed appropriately.

DUNDEE SCORE

With the removal of age, the MLF became a **relative risk score.** Because it is relative, and is used with different sexes and different ages, it has no units. However, the central formula is for the percentage risk of a major coronary event over five years in a man aged 50 in the UKHDPP.

Note that the UKHDPP men were all employed, and were 86% of the total invited to attend the survey clinic. These included men with angina or diabetes, and some who had had a previous infarct, as well as the great majority who were free of any symptoms or history. So the relative contributions of smoking, blood pressure and cholesterol derived from the UKHDPP for use in the *Dundee Score* were those which would be found in a mixed population (such as general practice), where the subjects include the disease-free as well as those who may have some evidence of the disease already.

The *Dundee Score* should be considered **not** as a percentage risk over five years, even in men aged 50, but as a measure of **relative risk** for the three major modifiable risk factors. The reason for this is that the absolute level of risk in an individual is determined by several factors which cannot be changed such as age and sex, family history, angina, previous myocardial infarction and diabetes. It is wrong to assign an individual an absolute risk without taking these factors into account, as you would in a life insurance medical. The **Dundee Coronary Risk-Disk** is not about life insurance medicals. It is about motivating patients to change those factors which can be changed, and grading them according to **their degree of modifiable risk.**

Notice that the *Dundee Score* is not obtained by adding risk factors together. The MLF multiplies them through a logarithmic scale. This means that even though you are adding up smoking, blood pressure and cholesterol on linear scales on the front of the **Dundee Coronary Risk-Disk,** the *Score* accelerates upwards faster and faster as each extra bit of risk factor is added. The units of risk are closer and closer together as you go round from the low to the high risk end of the scale.

The *Dundee Score* has been validated against another large study, the *Whitehall Study.* Those in the top 10% of risk using this *Score* were between 6 and 7 times more likely to die from coronary heart disease over the next 5-10 years than those in the bottom 10%.

DUNDEE RANK

The Working Group was concerned that the *Score* in itself would not tell the doctor whether the patient was at high or low risk relative to other people in that age and sex group in the general population. Initially it was suggested that distribution of the *Dundee Score* in different populations by sex and age should be shown in tables. The Score had to be derived from a group of people studied enough years ago for follow-up information to be available. A recent population study was needed to show how the *Score* is distributed in the general population in Britain today.

The CARDIOVASCULAR EPIDEMIOLOGY UNIT of Dundee University carried out large surveys between 1984 and 1986 in the Scottish population involving some 10 000 men and women aged 40-59, the *Scottish Heart Health Study (SHHS),* and smaller numbers of men and women aged 25-64 *(the Scottish MONICA Study).* The 5 000 Scottish men each had their *Score* calculated by computer and then the frequency of each *Score* was counted from highest to lowest. When these frequencies were expressed as percentages of the total and cumulated, it became possible to say which *Score* corresponds to the top 1% of the population (or 1st percentile), which *Score* corresponds to the median value (or 50th percentile), and which *Score* corresponds to the 100th percentile.

When the same calculations were done for women, it appeared that the risk percentiles for women aged 40-59 ran almost exactly parallel to that for men aged 40-59. Each level of *Dundee Score* corresponded to almost exactly the same percentile of the population distribution in men and women. The conversion curves for the two sexes were amalgamated therefore, and the percentiles were renamed *Dundee (Risk) Rank.* This meant that a *Rank* scale could be drawn alongside the *Score* scale, as they can be converted directly backwards and forwards. There was no need for special tables for men and women aged 40-59.

On reflection it was also clear that the *Dundee Rank* was preferable as an indicator of risk than the *Score,* because 1 was the highest and 100 the lowest risk, and each unit represented 1% of the population. An even grading from 1 to 100 is readily understood by everybody, including patients, and can be imagined as a bus queue of 100 people waiting for a coronary.

Risk factor levels in the Scottish population are very similar to those in England so the *Dundee Rank* should apply to the British population generally. It is possible that smoking and blood pressure may be slightly higher on average in Scotland, but marginally so, and not enough to invalidate it. In any case, smoking rates show large social gradients. Because different general practices vary in the sorts of patients they have, it is unlikely that every practice will have exactly 1% of its patients in each of the *Dundee Ranks.* Unless a practice is very representative of the total population, high risk cut-points based on the *Rank* may need to be adjusted in the light of experience to produce the numbers of patients wanted for follow-up. This adjustment does not invalidate the relative ranking of individuals, or the value of the *Dundee Rank* in explaining to patients their modifiable risk status.

WOMEN

When the Scottish men and women were split into 5-year age groups and their *Score* distributions looked at again, interesting differences emerged. In men between 40 and 59, there is very little difference in *Scores* by age, but between 35 and 40 and between 60 and 65, average *Scores* are slightly lower. The *Score* and *Rank* calculations are therefore the same for all men between 35 and 65. Small increases in blood pressure and cholesterol with age are compensated in the *Score* calculation by reduced cigarette consumption. For women there is a gradient of cholesterol and blood pressure with age. The *Score* increases with age unless it is corrected, so that there would be a different set of percentiles or *Ranks* in each 5-year age group. If uncorrected, *Ranks* 1-15, equivalent to *Scores* 14 upwards, would include approximately 15% of each 5-year age group between 35 and 65 in men, but twice as many older women would be above this cut-point as younger ones.

This has been corrected so that the *Dundee Score* gives a uniform *Dundee Rank* in each age group in women. The yellow **start zone** has different start marks for women of different ages. By offsetting the women's start marks according to age, the **Dundee Coronary Risk-Disk** ensures that the same proportion of each age group are categorised by the percentile cut-points that determine high risk (eg *Rank* 10, 15, 20). The offset is equivalent to a correction to constant **a** in the MLF formula. The correction is made to the high risk end of the distribution curve so there may be unimportant anomalies in women with extremely low risk factor levels, some of whom may be either off the scale, or unable to get below 98, depending on their age. The offset does not affect the **relative risk** relationship between two patients. If one is running twice the *Dundee Score* of the other, the degree of offset does not affect this ratio. Because it is a **relative risk score** with no absolute value, the offset does not matter on that account either.

Follow-up studies for coronary disease in women are rare but suggest that their risk factors are the same as those in men. Nonetheless, it is important to realise that the relative weighting of the risk factors to calculate the *Dundee Score* is derived from British men aged 40-59 followed for five years. Coronary risk is lower in women. It is not possible to state with certainty that the relative contribution of the three risk factors, to risk in women, is the same as it is in men.

Not only may the relative weighting of the three risk factors differ for the two sexes, but it may do so also for different age groups, for different periods of follow-up, and between those free of coronary disease, and those with early disease. We know that the relative weighting differs from one country to another (smoking matters much more in Northern countries), and it could vary also from one decade to the next as other environmental factors change.

Despite all these reservations however, the relative weighting is reasonable, consistent with the findings in a number of other follow-up studies, and it performed well in predicting *Whitehall Study* coronary mortality.

SMOKING

The UKHDPP showed a marked gradient of risk with numbers of cigarettes consumed. The 5-year coronary event rate in those reporting themselves to be ex-smokers was much nearer to that in never-smokers than that in current smokers, and the 10-year coronary mortality rate in ex-smokers was insignificantly lower than that in never-smokers. Other studies claim that cigarette smokers do worse than non-smokers but cannot differentiate any effect of numbers of cigarettes smoked. The benefit of stopping smoking is also argued by some who claim that there is little immediate benefit from stopping smoking. The **Dundee Coronary Risk-Disk** is designed on the simple-to-understand, and optimistic basis, that coronary risk is related to numbers of cigarettes consumed, and that stopping smoking results in considerable benefit.

There is a problem however, of how much benefit to confer how quickly on those who quit smoking. In any large follow-up study the number of those who gave up any particular time before the survey is small, and a lot of ex-smokers relapse during follow-up, so the evidence on exactly when the benefit from stopping occurs is arguable. Both respiratory symptoms and blood fibrinogen, increased by smoking, show a large decline in the first two years after stopping smoking, and a continuing slower decline towards never-smokers thereafter. It seems reasonable to follow this trend in apportioning coronary risk after quitting, giving a rapid early benefit which slows down over ten years. However, quitters relapse very frequently, and it is probably not safe to regard someone as stopped until they have done so for a whole year. This explains why the maximum improvement in risk for quitting smoking has been allocated for the period between one and two years after stopping. The rules given on page 4 of the **MANUAL** are arbitrary, but they mix an optimistic assessment of the statistical evidence with an approach aimed to motivate the potential quitter.

How to handle those who have not stopped, but have reduced their consumption, or changed to a pipe or cigars, is even more difficult. A true nicotine addict can reduce his or her cigarette consumption considerably, whilst inhaling more and more of each cigarette, so that the compensation cancels out the apparent benefit. Ex-cigarette smokers who move to pipes or cigars continue to inhale as they did before, something which lifetime pipe and cigar smokers do not do.

In addition to persuading themselves that they have reduced their consumption, smokers will also tend to give optimistic answers to those counselling them to stop. You should try to persuade smokers that reducing consumption is a good thing if it leads to their stopping completely, but a daily count that goes down can very easily go up again. If you wish you can monitor smoke inhalation using an expired carbon monoxide analyser, such as the Bedfont machine, now comparatively cheap and reliable compared with earlier machines. This will demonstrate to you and to the patient the effects of their cigarette consumption, may motivate them, and will detect frank smoking **deception,** where the patient says they have stopped when they have not.

Simple rules have been laid down for apportioning coronary risk, but there are a number of grey areas where the rules are arbitrary. The aim is to help the patient to stop. You may sometimes have to use your judgement as to whether to be generous or stingy in deciding whether to record an improvement.

BLOOD PRESSURE

For classifying coronary risk, blood pressure should be measured with more standardisation of methods and care than might be used simply to classify a clinical value as high or low. In the studies on which the **Dundee Coronary Risk-Disk** is based, blood pressure was taken with the patient seated and relaxed, with the right arm supported on a table at heart level for some minutes before recording. Systolic and diastolic blood pressure were both recorded to the nearest 2 mmHg, the pressure was recorded twice, and the average was taken. Readings were not accepted if too many of them ended in multiples of 10 as this showed insufficient care!

The systolic blood pressure was measured in the same way in both the UKHDPP and SHHS, but, for diastolic blood pressure measurement, there was a discrepancy between the UKHDPP and the SHHS, as the UKHDPP used muffling of sounds (Korotkoff phase 4) and the SHHS used disappearance of sounds (Korotkoff phase 5). For this reason it is the systolic blood pressure that has been used in calculating the *Dundee Score* and *Rank*. The systolic blood pressure scale on the **Dundee Coronary Risk-Disk** has simply been lined up with the commonest equivalent diastolic blood pressure found in the SHHS. In the 1990s, the disappearance of sounds is far more of an international standard for diastolic blood pressure measurement in adults. While the equivalent systolic and diastolic values shown on the **Dundee Coronary Risk-Disk** are correct on average between age 40-59, they vary by sex and age so that they will be less true at the extremes of age. Systolic blood pressure has the advantage of simplicity and is as good a predictor for epidemiological purposes as diastolic. However, clinicians, and clinical trials tend to use diastolic blood pressure, and blood pressure is usually treated to achieve diastolic blood pressure targets, so it is not that easy for everybody to transfer.

As stated in the **MANUAL,** you should decide in your practice whether to use the systolic or the diastolic readings, choose the appropriate scale, and stick to it. Chopping and changing is likely to cause problems. Entering a systolic reading of 120 mmHg on the diastolic scale results in a gross error of classification. The patient's *Score* will be 2.5 times too high and the *Rank* could be out by 35! This is the main argument for using one measure only.

How much coronary risk is reversed by blood pressure lowering is a matter of controversy. A diastolic blood pressure of 80 mmHg, achieved by antihypertensive medication, does not carry the same coronary risk as it does in someone whose blood pressure has always been at that level.

However, with hypertensive patients, it is essential to manage their coronary risk, rather than just manage their blood pressure. Monitoring the *Dundee Rank* of hypertensives on medication can help to emphasise the crucial importance of their not smoking and of their maintaining a low blood cholesterol.

BLOOD CHOLESTEROL

You can use the **Dundee Coronary Risk-Disk** whether or not the patient's cholesterol has been measured. If the patient's cholesterol has already been measured, you can enter the actual cholesterol value. If the cholesterol has not been measured, you can enter a substitute value (see page 8 of the **MANUAL**). After calculating the *Provisional Dundee Rank,* you can make a decision as to whether that patient should have their cholesterol measured. This procedure was illustrated also in Exercise 4 in the **MANUAL.**

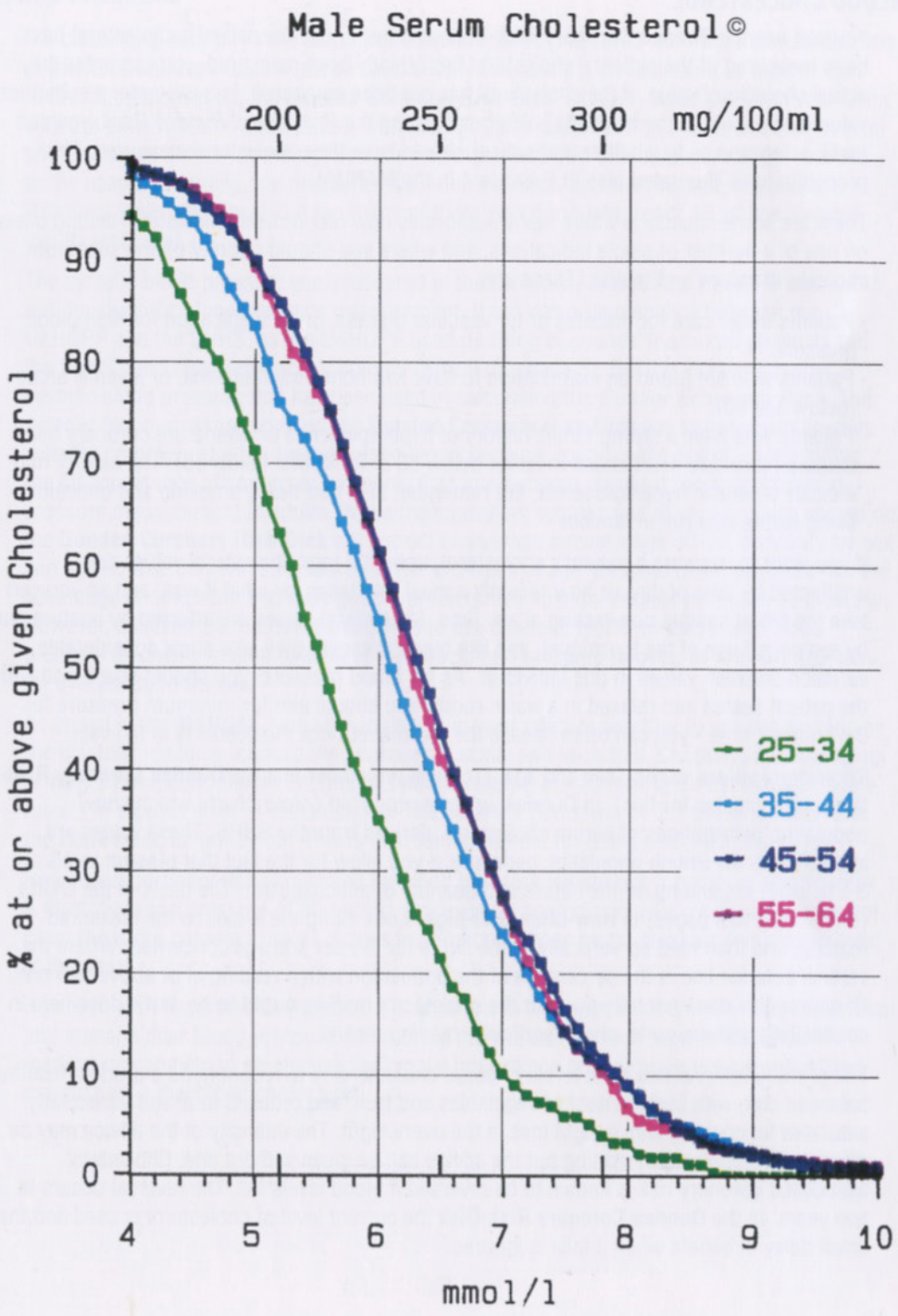
There are some situations where many authorities now recommend cholesterol testing based on one of a number of single indications, and where you should <u>not</u> rely on the substitute cholesterol values on the disk. These are:

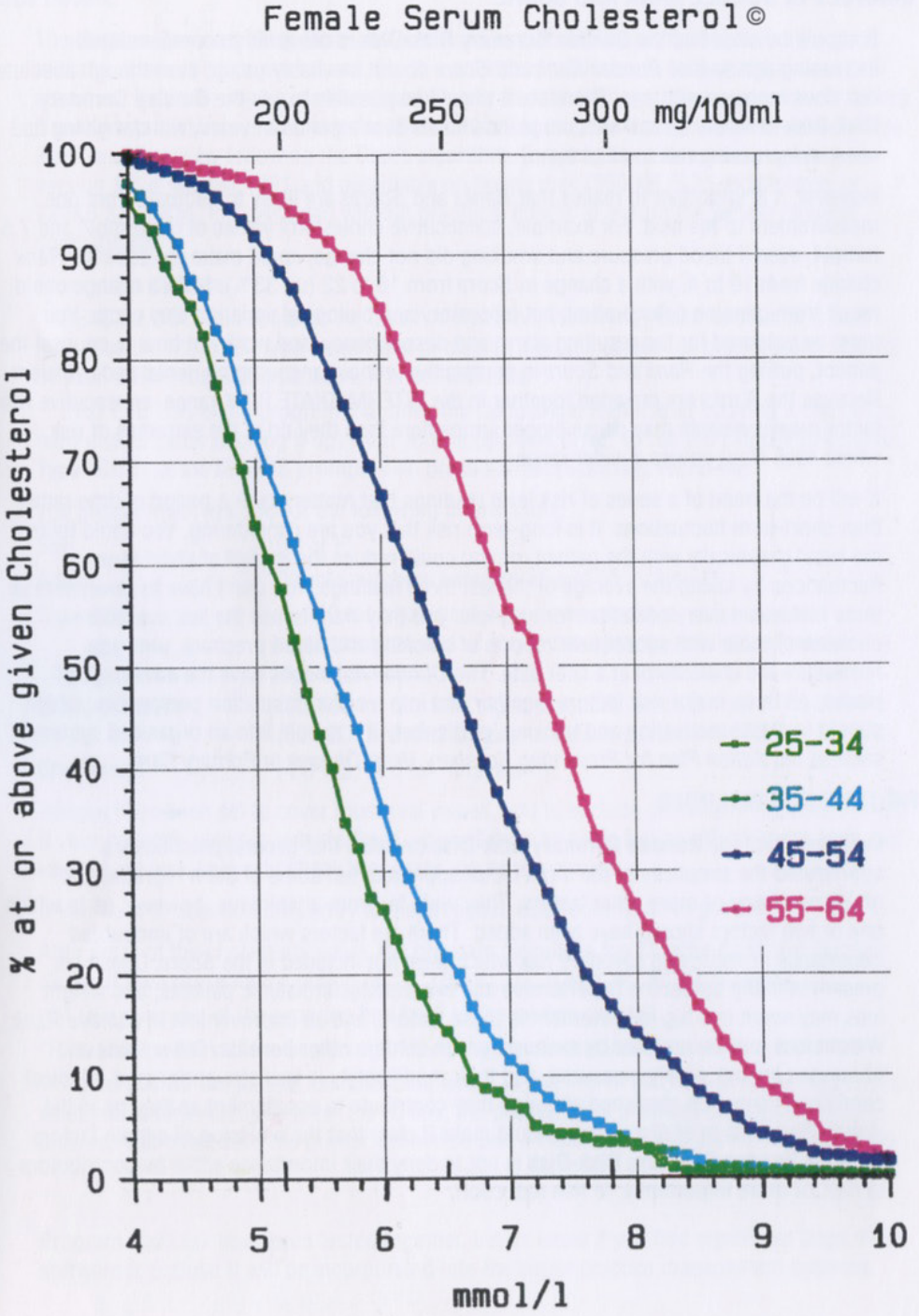
- Patients under care for diabetes or for vascular disease, or on medication for high blood pressure
- Patients who are found on examination to have xanthoma, xanthelasma, or juvenile arcus (below age 50).
- Patients who have a strong family history of hyperlipidaemia or premature coronary heart disease (coronary heart attack in father below 50 or in mother below 55). The history may indicate a genetic hyperlipidaemia, but remember also that heavy smoking and unhealthy living habits also run in families.

If you want to measure a patient's cholesterol, note that total cholesterol values are unaffected by time of day, or how recently a meal was taken, or what it was, and so you can take the blood sample non-fasting at any time. Cholesterol values are affected by posture and by prolonged use of the tourniquet, and like blood pressure they also show considerable variation between values in one individual. As for blood pressure, you should take blood with the patient seated and relaxed in a warm room. You should aim for minimum pressure for the shortest time - you can often release the tourniquet once the needle is in the vein.

Cholesterol values vary by sex and age. (You will remember that the **Dundee Coronary Risk-Disk** compensates for this). In Dundee we have produced colour charts which show population distributions of serum cholesterol, derived from the SHHS. These values are applicable in the British population generally, if you allow for the fact that **plasma** levels are 3-5% lower depending on the nature and quantity of anticoagulant. The basis of the charts (on the next two pages) is **How-often-that-high.** Look along the X-axis to the measured reading, and then read up vertically to the curve for the sex and age concerned. Where the vertical cuts the line is the percentage of the population with a reading at or above that one. Of course this does not tell you what the cholesterol reading **ought** to be, but it does help in counselling patients as to what a particular reading means.

The primary intervention at all levels of blood cholesterol is to recommend a prudent healthy, balanced diet, with high content of vegetables and fruit, and reduced total and particularly saturated fat content, with weight loss in the overweight. The intensity of the advice may be affected by a cholesterol reading but the advice can be given without one. Cholesterol associated coronary risk is known to be reversed if blood levels fall. The reversal occurs in two years. In the **Dundee Coronary Risk-Disk** the current level of cholesterol is used and the small delay in benefit when it falls is ignored.


Male Serum Cholesterol©
200
250
300
mg/100ml
100
90
80
70
60
50
40
30
20
10
0
% at or above given Cholesterol
25-34
35-44
45-54
55-64
4
5
6
7
8
9
10
mmol/l


Female Serum Cholesterol©
200
250
300
mg/100ml
100
90
80
70
60
50
40
30
20
10
0
% at or above given Cholesterol
25-34
35-44
45-54
55-64
4
5
6
7
8
9
10
mmol/l

CHANGES IN DUNDEE RANK AND SCORE

It should be clear that the **Dundee Coronary Risk-Disk** is designed to compensate for increasing age so that *Dundee Rank* and *Score* do not inevitably go up, even though absolute risk does increase with age. Therefore it should be possible to use the **Dundee Coronary Risk-Disk** to follow up and encourage individuals over a period of years, without giving bad news of increasing risk to all of them!

However, it is important to realise that *Ranks* and *Scores* are likely to fluctuate from one measurement to the next. For example, consecutive cholesterol values of 6.5 mmol/l and 7.5 mmol/l, even if blood pressure and smoking did not change, could make the patient's *Rank* change from 10 to 4, with a change in *Score* from 16 to 22 (up 33%). Such a change could result from genuine deterioration, but laboratory and biological variation also occur. You must be prepared for the resulting alarm and despondency, and work out how to counsel the patient, putting the *Rank* and *Score* in perspective without encouraging denial and cynicism. Because the *Ranks* are crowded together in the INTERMEDIATE RISK range, consecutive risk factor measurements may cause bigger jumps here than they do at the extremes of risk, where each *Rank* covers a wider range.

It will be the trend of a series of risk level readings that matters over a period of time rather than short-term fluctuations. It is long-term risk that you are considering. You could follow the trend graphically with the patient, or you could reduce the impact of short-term fluctuations by taking the average of the last three readings. You don't have to remeasure all three factors on every occasion; for example, you may want to use the last available cholesterol value with subsequent reports of smoking and blood pressure, until you remeasure the cholesterol at a later date. The *Dundee Rank* does have the advantage of placing all three major risk factors together and into a wider population perspective, which should facilitate motivation and tracking, particularly if it is built into an organised system such as the *Action Plan for Preventing Coronary Heart Disease in Primary Care.*

FACTORS NOT INCLUDED

Field testing of the **Dundee Coronary Risk-Disk** revealed that general practitioners appreciated the simplicity of the three factor approach, but some of them regretted the omission of one or more other factors. They were far from unanimous, however, as to which one or two factors should have been added. There are factors which are of undoubted importance in improving coronary risk which were not included in the *Score.* Obesity is present in many borderline hypertensive and hypercholesterolaemic patients, and weight loss may result in a big improvement in these factors, and an improvement in *Dundee Rank.* Weight loss may be assisted by exercise, which confers other benefits. Other lipids and fibrinogen are not widely measured, and their modifiability is less straightforward. Medical conditions cannot be abolished although they contribute to assessment as they do in the *Action Plan.* This brief discussion should make it clear that the omission of certain factors from the **Dundee Coronary Risk-Disk** is not to deny their importance either as contributors to risk, or more importantly, to risk reduction.

SOFTWARE

The **Dundee Coronary Risk-Disk** was produced as a portable mechanical device for good reasons. It needs no power source, fits in a pocket or briefcase, is robust and looks attractive. It can be used to demonstrate visually to patients how they are scored and ranked. Nonetheless software is available for IBM compatible microcomputers to derive the *Dundee Rank and Score,* by following the Disk's algorithm. Subject to revision, the program is in version 1.5 in August 1991 and obtainable on floppy disk (360 KB, 5.25 inch format, or 720KB 3.5, inch). It is designed without graphical effects to ensure the widest range of compatibility.

Files on the disk are:

README.DOC This contains the latest information, which may contradict what is said here. Use the MSDOS "Type" command to display it on the screen, or print it using MSDOS or your word-processing package. It is an ASCII file.

DRD.EXE This is the program that does the calculation. Run it after copying it onto your hard disk or (after backing it up) from your floppy disk drive. To run the Dundee calculation: Type "DRD" at the MSDOS prompt, then press ENTER (=carriage RETURN).

The program will ask you for the following information:

Sex	(M or F)
Age	(Whole numbers between 35 and 65 inclusive)
Cigarettes	(1-150 for cigarettes, 0 for never-smokers, -1 for pipe and cigar smokers, and -2 for ex-smokers; ex-smokers prompt more questions)
Blood pressure	(50-120 for diastolic blood pressure, precede with d, e.g. "d84") (80-220 for systolic blood pressure, precede with s, e.g. "s126")
Cholesterol	(4.0-9.5, or 0 for not known)

Ranges have been set to cover most real values, and to exclude potentially erroneous ones. If your patient's result is outside these, you will have to settle for the official outer limit, but you should look back and check these rare values are correct.

If you want to abandon data entry and start again, use "Control-C" to get out.

After entry of the cholesterol value, the program calculates the *Dundee Rank and Dundee Score.* It then presents the option of: "P" (Print), "Q" (Quit), or "R" (Run again).

"Q" takes you out of the program and back to the system prompt.

"R" takes you back to the beginning of the program so that you do another calculation.

"P" asks you for the patient identification, which is one line of text in free-format (up to you what you enter). After you enter the ID line, the program will print out the data that you entered. You must have the printer connected and on line or you will get an error message.

Program and Disk have been tested together. Let us know if you find significant bugs. If the software is popular it will be incorporated into the larger practice management systems.

FURTHER READING

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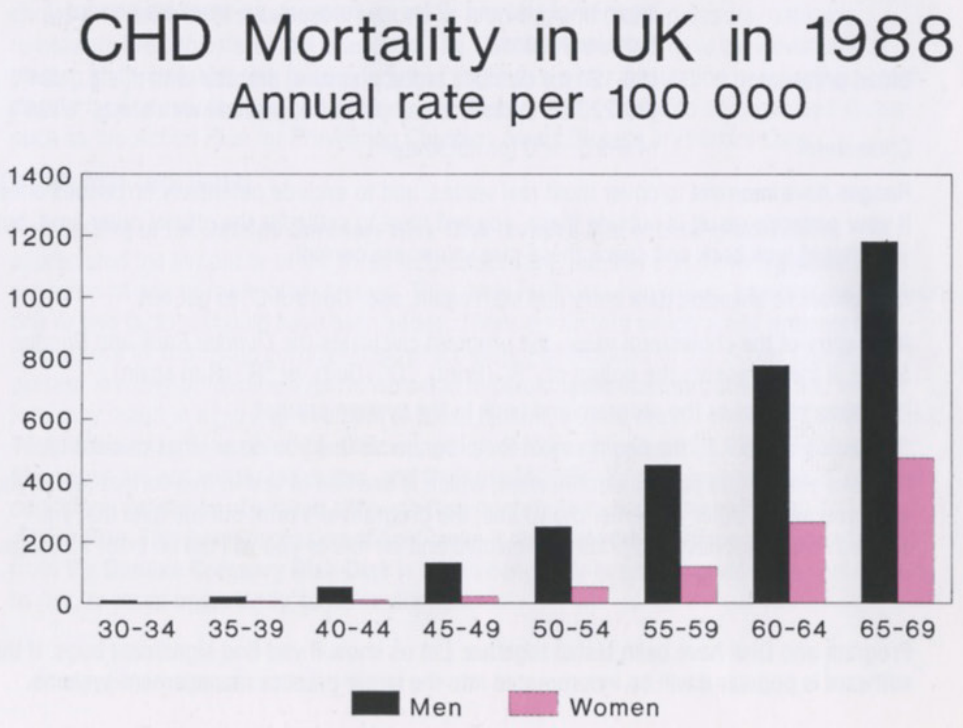

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The industrial design of the manufactured version of the **Dundee Coronary Risk- Disk** was done by David Sommerville and David Gerrard of Gerrard and Medd, Designers, Edinburgh.

Early Coronary Risk calculators which worked on the slide-rule principle and which have come to our attention were designed by: Dr Malcolm Carruthers (cylindrical) c 1974, St Mary's Hospital Medical School, London, and by Drs RD Thorsen, DR Jacobs and RH Grimm (disk) 1979, Laboratory of Physiological Hygiene, School of Public Health, University of Minnesota, Minneapolis, USA.

No originality is claimed for the idea of using a circular slide-rule to calculate coronary risk. Original features of the **Dundee Coronary Risk-Disk are:**

a) Producing a measure of relative risk by excluding sex and age as risk factors, and thereby having one scale for all adult sex and age groups.

b) Restricting to the three major modifiable risk factors.

c) Introducing the concept of *Rank* by which a patient's place in the relative risk scale can be related easily to the rest of the population.

July 1990	Winner of Scottish finals in Colleges and Universities Class of TOSHIBA YEAR OF INVENTION organised by the Design Council. Development grant.
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February 1991	Educational grant from the SCOTTISH HEALTH EDUCATION GROUP, transferred to HEALTH EDUCATION BOARD FOR SCOTLAND.
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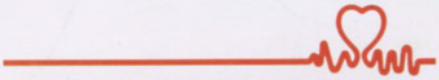

THE CORONARY PREVENTION GROUP

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