Case Study Three

An Epidemiological Study - The Risk of Heart Disease

Epidemiology is the branch of medical statistics concerned with examining the incidence of disease and the risks associated with a range of factors such as lifestyle, the environment, poverty, etc.

There have been many studies to identify the likely causes of heart disease and some risks are now well documented, e.g. smoking and high blood pressure. This case study is concerned with both of these well-documented risks but also examines triglyceride levels and other related blood measurements as risk factors for heart disease. (Triglycerides are fats found in the blood stream.)

The study is concerned with what is termed a *major coronary event* including a myocardial infarction, more commonly known as a heart attack. A myocardial infarction (MI) is damage to heart muscle as a result of interruption of the blood supply (a coronary thrombosis). Patients experience severe chest pain which typically spreads to the arms and throat. The main danger is that the heartbeat becomes very rapid and chaotic and, as a result, the patient may die.

The PROCAM Study

The PROCAM study, also known as the Münster Heart Study, was a major study conducted in Germany in the 1980s to examine the risk of heart disease amongst people at work. The full study involved employees at 52 companies and authorities in Germany. Participation was voluntary and the participation rate varied from company to company, ranging from 40% to 80% and averaging 60%.

All participants completed a case history questionnaire, measurements of blood pressure, height and weight were recorded, and an ECG together with a blood sample were taken. Triglyceride and other lipid concentrations were determined from the blood sample.

The data considered here is for almost 5,000 middle-aged men (aged 40 to 65 years) who voluntarily entered the study and were subsequently followed up for an eight year period. Follow-up was by means of a questionnaire sent to participants every 2 years to determine the occurrence of myocardial infarction, stroke or death. By using both mail and telephone reminders the overall response rate was 96%.

For the purposes of the study a major coronary event is defined as non-fatal myocardial infarction, fatal MI or other sudden cardiac death. 258 such events were observed amongst 4,639 men.

Table 1 overleaf shows the percentage of males in different subgroups having a major coronary event during an eight year period. This provides estimates of *risk* associated with the various factors studied.

Consider the risk factor smoking. 9.1% of the smokers experienced a major coronary event compared to only 3.9% of the non-smokers. Thus the risk is 2.3 times (9.1/3.9) higher for smokers compared to non-smokers. This ratio is termed the *relative risk.* A relative risk of 1.0 corresponds to either outcome having the same risk.

Questions of Interest

i. Other medical research suggests that smoking and hypertension (high blood pressure) lead to increased risk of heart disease. Does this study agree with previous findings?

ii. What can be concluded about the risks associated with Diabetes and Previous Myocardial Infarction compared to the risk associated with smoking?

iii. What are the risks associated with Obesity and Triglyceride Levels as suggested by the data from this study?

Table 1

Incidence of Major Coronary Events within Eight Years of Initial Examination

Variable	No. of Participants	No. of Major Coronary Events	Event Rate (%)	Relative Risk
Cholesterol (mg/dl)				
< 205	1,505	43	2.9	
205 - 239	1,576	73	4.6	1.6
> 239	1,558	142	9.1	3.2
HDL cholesterol (mg/dl)				
> 49	1,544	48	3.1	
40 - 49	1,513	78	5.2	1.7
< 40	1,582	132	8.3	2.7
LDL cholesterol (mg/dl)				
< 133	1,521	35	2.3	
133 - 163	1,514	65	4.3	1.9
> 163	1,466	146	10.0	4.3
Triglycerides (mg/dl)				
< 105	1,524	49	3.2	
105 - 166	1,571	81	5.2	1.6
> 166	1,544	128	8.3	2.6
Systolic blood pressure (mm/Hg)				
< 124	1,429	60	4.2	
124 - 138	1,496	71	4.7	1.1
> 138	1,714	127	7.4	1.8
Fasting blood glucose (mg/dl)				
< 96	1,609	64	4.0	
96 - 104	1,596	88	5.5	1.4
> 104	1,434	106	7.4	1.9
Body Mass Index (kg/m^2)				
< 25.0	1,515	65	4.3	
25.0 - 27.3	1,586	86	5.4	1.3
> 27.3	1,531	107	7.0	1.6
Smoking				
Non-smoker	3,195	126	3.9	
Smoker	1,444	132	9.1	2.3
Hypertension (WHO)				
Normotensive	3,827	186	4.9	
Hypertensive	812	72	8.9	1.8
Diabetes mellitus?				
No	4,262	222	5.2	
Yes	377	36	9.5	1.8
Myocardial infarction in family history?				
No	3,909	205	5.2	
Yes	730	53	7.3	1.4