

## Physical exercise to reduce cardiovascular disease risk

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The modern story of exercise and cardiovascular disease began in 1949 when Jeremy N. Morris and colleagues (Morris *et al.* 1953*a,b*) first began to understand how both vocational and leisure-time physical activity relate to fitness and risk of CHD. They studied London transit workers, postal service employees and civil servants. Initially they found bus conductors on London's double-decker omnibuses to be at lower risk than bus drivers; what disease the conductors did develop was less severe, and they were more likely to survive an attack.

More recently, Morris *et al.* (1990) studied a random sample of 3591 British civil servants who were followed over an 8-year period ending in 1977, during which time 268 men died. Subjects were classified as having engaged in vigorous activities (requiring  $\geq 35.1$  kJ (7.5 kcal), i.e.  $\geq 6$  metabolic equivalents of energy output), or not. Of the subjects 22% reported some kind of vigorous exercise and their death rate was 4.2 per 100. The remaining 78% reported no vigorous exercise and their mortality rate was twice as high, i.e. 8.4 per 100. This differential in death rates persisted when account was taken of age, smoking, obesity and successive intervals of follow up.

A myriad of other populations have been studied for physical activity and physiological fitness in relation to health (US Department of Health and Human Services, 1996). Here we describe a study of 17 549 men who entered Harvard College between 1916 and 1950 (Paffenbarger *et al.* 1978), and when aged 55–84 years responded to a 1977 questionnaire on their personal characteristics, health status and lifestyle habits. These patterns have been related to cardiovascular disease mortality over a 16-year follow-up period, 1977–1992, when 1856 men died (Paffenbarger *et al.* 1986*a,b*; Paffenbarger & Lee, 1999).

Among Harvard alumni there were strong significant associations between lower death rates and higher levels of each of the following: walking, stair climbing, sports play and combinations of these activities, measured in kJ/week. Gradients of benefit from more active lifestyles were consistent throughout, and were independent of age, smoking, hypertension and obesity. As compared with the one-third of men least active, the middle third of men experienced a 23% reduction in death rate during follow up and the one-third of men most active, a 32% reduction. Light activities (requiring  $< 4$  metabolic equivalents of energy output), moderate activities (4–5 metabolic equivalents of energy output), and vigorous activities ( $\geq 6$  metabolic equivalents of energy output) each predicted lower death rates.

These men were studied for the effect on all-cause mortality from changing physical activity habits. Men who had increased or decreased their activity by less than 1032 kJ (250 kcal)/week between the 1960s and 1977 were considered in an 'unchanged' category. Compared with their death rates, gradient reductions in mortality were observed with increased levels of physical activity, and gradient increases in mortality with decreased levels of activity. At the extremes of this gradient, men who had increased their energy expenditure by  $\geq 5160$  kJ (1250 kcal)/week had a 20% lower risk of death than men in the unchanged category; men who decreased their activity by 5160 kJ (1250 kcal)/week had a 26% higher risk (Paffenbarger *et al.* 1993, 1994).

Vigorous activity should be encouraged. In today's world, where time is a precious commodity, one 0.5 h period of vigorous exercise expends as much energy as does moderate activity carried out for two or three times as long.

### Cardiovascular disease: Physical activity: Death rate

#### References

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