

# Appearances are deceptive

## “Unwarranted survivals” and “anomalous deaths” from coronary heart disease: prospective survey of general population

Alex McConnachie, Kate Hunt, Carol Emslie, Carole Hart, Graham Watt

### Abstract

**Objectives** To assess survival in people who are at apparent high risk who do not develop coronary heart disease (“unwarranted survivals”) and mortality in people at low risk who die from the disease (“anomalous deaths”) and the extent to which these outcomes are explained by other, less visible, risk factors.

**Design** Prospective general population survey.

**Setting** Renfrew and Paisley, Scotland.

**Participants** 6068 men aged 45-64 years at screening in 1972-6, allocated to “visible” risk groups on the basis of body mass index and smoking.

**Main outcome measures** Survival and death from coronary heart disease by age 70 years.

**Results** Visible risk was a good predictor of mortality: 13% (45) of men at low risk and 45% (86) of men at high risk had died by age 70 years. Of these deaths, 12 (4%) and 44 (23%), respectively, were from coronary heart disease. In the group at low visible risk other less visible risk factors accounted for increased risk in 83% (10/12) of men who died from coronary heart disease and 29% (84/292) of men who survived. In the high risk group 81/107 who survived (76%) and 19/44 (43%) who died from coronary heart disease had lower risk after other factors were considered. Different risk factors modified risk (beyond smoking and body mass index) in the two groups. Among men at low visible risk, poor respiratory function, diabetes, previous coronary heart disease, and socioeconomic deprivation modified risk. Among men at high visible risk, height and cholesterol concentration modified risk.

**Conclusions** Differences in survival between these extreme risk groups are dramatic. Health promotion messages would be more credible if they discussed anomalies and the limits of prediction of coronary disease at an individual level.

### Introduction

Coronary heart disease accounts for a quarter of deaths in Britain<sup>1</sup> and remains a priority in public health.<sup>2</sup> Smoking, a high fat diet, lack of exercise, and obesity are well established risk factors, as are less “visible”<sup>3</sup> factors such as hypertension, cholesterol concen-

tration, diabetes,<sup>1</sup> and respiratory function.<sup>4</sup> Although recent policy acknowledges broader influences on health,<sup>5,6</sup> strategies for preventing coronary heart disease have relied heavily on mass health promotion aimed at persuading individuals to minimise behavioural risks. There is little evidence that this approach has been successful.<sup>7,8</sup>

This lack of success cannot be attributed to lack of knowledge. Recognition of behavioural risk factors<sup>9-12</sup> has been incorporated into “lay” epidemiology<sup>13,14</sup> of heart disease as an element of “coronary candidacy”—the kind of person who “should” or “should not” develop heart disease.<sup>11,15</sup> Highly visible risk factors, including a person’s tobacco consumption, weight, levels of activity, and diet, are invariably invoked<sup>10,11,13</sup> in both retrospective explanations of past coronary events (particularly fatal heart attacks<sup>16</sup>) and in discussions of the likelihood of future events.

The candidacy system, however, is also recognised as fallible and incorporates the observation that “it never seems to happen to the people you expect it to happen to.”<sup>13</sup> Violations to candidacy are noted and discussed,<sup>13</sup> particularly when they occur within people’s families.<sup>17</sup> At the high end of the risk spectrum attention focuses on the “unwarranted survivor,”<sup>13</sup> graphically characterised as “Uncle Norman,”<sup>10</sup> who lives to a ripe old age despite flaunting advice on coronary health.<sup>10,11,13</sup> At the low end of the spectrum, attention focuses on the anomalous (unexpected) victim, the last person you’d expect to have a coronary event,<sup>10</sup> typically a slim, non-smoking, active man<sup>11</sup> who has a fatal heart attack at a young age despite an exemplary lifestyle. Discussions of these anomalies lead to doubts about advice on coronary health.

While qualitative research highlights the importance of these anomalies in lay discussions of coronary risk, their prevalence has not been examined in formal epidemiological research. These violations to candidacy are, by definition, exceptions, but how exceptional are they and can they be explained by other less visible risk factors?

### Methods

#### Participants

We used data from the Renfrew/Paisley (Midspan) study, in which 15 406 people aged 45-64 years were

Department of General Practice, University of Glasgow, Glasgow G12 0RR  
Alex McConnachie  
*statistician*  
Graham Watt  
*professor*

MRC Social and Public Health Sciences Unit, University of Glasgow G12 8RZ  
Kate Hunt  
*senior research scientist*  
Carol Emslie  
*research associate*

Department of Public Health, University of Glasgow, G12 8RZ  
Carole Hart  
*research fellow*

Correspondence to: K Hunt  
Kate@msoc.mrc.gla.ac.uk

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**Table 1** Mean (SD) of continuous risk factors and number (percentage) for discrete risk factors among men in groups according to level of visible risk factors at screening

	Low risk (n=337)	Intermediate risk (n=5538)	High risk (n=193)
Mean (SD) body mass index (kg/m <sup>2</sup> )	23.2 (1.6)	25.8 (3.2)	31.9 (1.8)
Mean (SD) No of cigarettes/day	0	11.6 (11.8)	27.0 (8.3)
Current smokers	0	3216 (58.1)	193 (100.0)
Former smokers	0	1538 (27.8)	0
Mean (SD) age at screening (years)	55.2 (5.0)	55.2 (5.1)	54.8 (5.1)
Manual social class	201 (59.6)	3858 (69.7)	140 (72.5)
Area of high deprivation	55 (16.3)	1163 (21.0)	45 (23.3)
Mean (SD) height (m)	1.69 (0.07)	1.69 (0.07)	1.70 (0.06)
Mean (SD) blood pressure (mm Hg):			
Systolic	144.9 (21.8)	149.3 (23.1)	156.8 (25.2)
Diastolic	83.8 (12.3)	86.0 (13.3)	91.7 (14.0)
Mean (SD) cholesterol concentration (mmol/l)	5.71 (0.93)	5.85 (0.97)	5.90 (0.92)
Mean (SD) predicted FEV <sub>1</sub>	94.9 (25.0)	87.9 (22.4)	88.2 (19.3)
Grade II Rose angina	14 (4.2)	304 (5.5)	13 (6.7)
Grade I Rose angina	26 (7.7)	724 (13.1)	36 (18.7)
Prolonged chest pain	19 (5.6)	559 (10.1)	23 (11.9)
Diabetes	6 (1.8)	74 (1.3)	5 (2.6)
Previous stroke	2 (0.6)	78 (1.4)	5 (2.6)
Myocardial infarction or ischaemia*	11 (3.3)	234 (4.2)	16 (8.3)

\*Evidence seen on electrocardiogram: infarction—Minnesota codes 1-1 or 1-2; ischaemia—Minnesota codes 4-1, 4-2, 5-1, or 5-2.

screened for cardiovascular risk factors between 1972 and 1976.<sup>18</sup> Our analyses excluded women (n=8354) because few women in the age range analysed had died and coronary candidacy in lay epidemiology focuses on men.<sup>11</sup> We also excluded men born after 31 December 1926 (n=826), people who had left the United Kingdom (n=6), and those with missing data (n=152). The sample size for analysis was 6068, with 1828 deaths in men aged < 70 years. The main outcome was survival or death from coronary heart disease by the age of 70 years by 31 December 1996.

#### Data collected

We divided the sample into three subgroups on the basis of visible risk factors (that is, factors obvious to a lay observer).<sup>3</sup> The 1972-6 survey did not include data on diet or on overall levels of physical activity. Hence, visible risk was defined in terms of body mass index (kg/m<sup>2</sup>) and smoking at screening. Men with a body mass index of  $\geq 30$  who smoked at least 20 cigarettes a day were defined as at high visible risk (n=193, 3%). Men who had never smoked and had a body mass

index of < 25 were classified as at low visible risk (n=337, 6%). All others (n=5538, 91%) were allocated to the large heterogeneous category of intermediate visible risk. We considered deaths from coronary heart disease (ICD-9 (international classification of diseases, ninth revision) codes 410-414) before age 70 years among the low risk group as “anomalous deaths” and survivors to age 70 in the high risk group as “unwarranted survivors.”

We compared men in the three groups according to other risk factors (social class, area deprivation score, height, blood pressure, total cholesterol concentration, predicted forced expiratory volume in one second (FEV<sub>1</sub>) and markers of morbidity related to coronary heart disease at screening (grade 1 or 2 angina as assessed by the Rose angina questionnaire,<sup>19</sup> prolonged chest pain for more than half an hour, self reported diabetes or stroke, and electrocardiographic evidence of previous myocardial infarction or myocardial ischaemia. In these comparisons we used compared analysis of variance for continuous risk factors and  $\chi^2$  tests for dichotomous risk factors. We also compared proportions of men who survived to age 70 years or died before that age from coronary disease.

#### Analysis

To explore “anomalous deaths” among men at low risk and “unwarranted survival” among men at high risk we compared survivors and those who died from coronary heart disease before age 70 years according to all risk factors within their risk group. We used logistic regression analysis to investigate whether these other risk factors predicted which men in the low visible risk group died from coronary heart disease and which men in the high visible risk group survived to age 70 years.

We fitted a baseline logistic regression model in the intermediate group, adjusting for the two risk factors which defined the extreme groups of visible risk: smoking (never, former, < 20 cigarettes a day,  $\geq 20$  cigarettes a day) and body mass index (< 25,  $\geq 25$ , and < 30,  $\geq 30$ ). The outcome was death from coronary heart disease by age 70 years, and we excluded men who died from other causes before that age. We fitted a second model, adjusting for smoking, body mass index, and all other risk factors.

We applied these models to predict the probability that each individual in the low and high risk groups would die from coronary heart disease before age 70 years. Under the baseline model all men considered to be at low risk had the same (low) predicted risk of death from coronary heart disease, and all men at high risk had the same (high) predicted risk.

Under the fully adjusted model we considered each man's set of risk factors in addition to smoking and body mass index. Some men in the low visible risk group could be at greater risk under the fully adjusted model than under the baseline model because of other detrimental risk factors. Equally, some of the high visible risk group could be at lower risk once other factors were considered.

By fitting models based on data from the intermediate risk group, we developed risk functions that were independent of survival in the two extreme risk groups.



Athlete Florence Griffith-Joyner (1959-98) died of an apparent heart attack just 10 years after winning her first Olympic gold medal

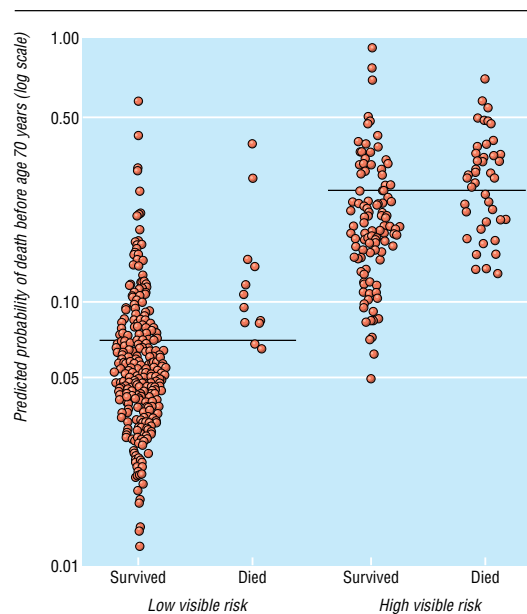
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## Results

Table 1 shows comparisons for men in the three groups on visible and other risk factors. There was a gradient of risk across the categories. Men in the categories of higher visible risk also had poorer risk profiles for coronary heart disease for occupational social class, systolic and diastolic blood pressures, cholesterol, and Rose angina. They were more likely to report prolonged chest pain or to have evidence of previous myocardial infarction or ischaemia. Respiratory function was better in the men at low visible risk (never smoked) than in the other groups. Age at screening, proportion living in areas with high deprivation, height, and diabetes or previous stroke did not differ between the groups.

Most men (292, 87%) in the low risk group survived to age 70 years compared with 69% of men in the intermediate group and 55% (107) of men in the high risk group (table 2). Half (44/86) of deaths of men aged <70 years in the high risk group were due to coronary heart disease compared with 41% (692/1697) in the intermediate group and 27% (12/45) in the low risk group ( $P < 0.001$ ). Thus 23% (44/193) of men at high visible risk had died from coronary heart disease before the age of 70 years compared with 13% (692) and 4% (12) of men at intermediate and low visible risk ( $P < 0.001$ ). Deaths from cancer were also less common among men in the low risk group (data not shown). There were no other significant differences in cause of death between the groups.

Table 3 compares risk factors among survivors and those who died from coronary heart disease before age



Predicted probabilities of death before age 70 years, based on adjusted model derived from data on men at intermediate visible risk, for men at low and high visible risk who survived to age 70 years or died from coronary heart disease before age 70 years. Horizontal lines represent predicted probabilities for men at intermediate risk, adjusted for categories of smoking and body mass index

**Table 2** Number (percentage) of men who survived to age 70 years or who died, according to level of visible risk factors

	Low risk (n=337)	Intermediate risk (n=5538)	High risk (n=193)	$\chi^2$ test P value
Survived to age 70	292 (86.6)	3841 (69.4)	107 (55.4)	<0.001
Died before age 70	45 (13.4)	1697 (30.6)	86 (44.6)	
Causes of death before age 70:				
Coronary heart disease	12 (3.6)	692 (12.5)	44 (22.8)	<0.001
Other causes	33 (9.8)	1005 (18.1)	42 (21.8)	<0.001

70 years within the low and high risk groups. We excluded from subsequent analysis those men who had died from other causes. Compared with survivors men at low visible risk who died from coronary heart disease had poorer respiratory function at screening. They were also more likely to have diabetes, electrocardiographic evidence of previous coronary heart disease, and live in areas with high deprivation.

Among men at high visible risk those who survived were on average taller and had lower cholesterol concentrations than those who died from coronary heart disease. They also had lower blood pressure, and fewer had electrocardiographic evidence of previous coronary heart disease (although these differences were of borderline significance).

**Table 3** Continuous and discrete risk factors in men who survived to age 70 years and those who died from coronary heart disease\*, according to level of visible risk factors at screening. Figures are numbers (percentage) of men unless stated otherwise

Risk factor	Low visible risk			High visible risk		
	Survived (n=292)	Died† (n=12)	P value‡	Survived (n=107)	Died† (n=44)	P value‡
Mean (SD) age at screening	55.2 (5.1)	55.2 (4.6)	0.97	55.5 (5.3)	53.8 (4.5)	0.068
Manual social class	176 (60.3)	7 (58.3)	1.00	75 (70.1)	33 (75.0)	0.69
Area of high deprivation	44 (15.1)	5 (41.7)	0.029	26 (24.3)	8 (18.2)	0.52
Mean (SD) height (m)	1.70 (0.07)	1.70 (0.07)	0.82	1.71 (0.06)	1.68 (0.06)	0.016
Mean (SD) systolic blood pressure	143.9 (21.7)	152.3 (20.1)	0.16	154.7 (25.6)	162.8 (25.8)	0.072
Mean (SD) diastolic blood pressure	83.4 (12.0)	85.4 (13.3)	0.58	90.3 (15.0)	94.6 (12.0)	0.061
Mean (SD) cholesterol concentration (mmol/l)	5.75 (0.89)	5.84 (0.99)	0.77	5.81 (0.88)	6.36 (1.02)	0.002
Mean (SD) predicted FEV <sub>1</sub>	96.4 (23.9)	80.1 (22.3)	0.021	88.6 (20.5)	87.9 (19.0)	0.84
Grade II Rose angina	10 (3.4)	2 (16.7)	0.084	7 (6.5)	2 (4.5)	0.72
Grade I Rose angina	20 (6.8)	1 (8.3)		19 (17.8)	10 (22.7)	
Prolonged chest pain	15 (5.1)	1 (8.3)	0.48	12 (11.2)	7 (15.9)	0.43
Diabetes	1 (0.3)	2 (16.7)	0.004	4 (3.7)	0 (0.0)	0.32
Previous stroke	2 (0.7)	0 (0.0)	1.00	3 (2.8)	0 (0.0)	0.56
Myocardial infarction or ischaemia§	6 (2.1)	2 (16.7)	0.035	4 (3.7)	6 (13.6)	0.064

\*Men who died from other causes excluded from analysis.

†Men who died from coronary heart disease before age 70 years.

‡Analysis of variance or Fisher's exact test.

§Evidence seen on electrocardiogram.



The figure shows predicted risk of death from coronary heart disease before and after adjustment for the less visible risk factors. The dispersion of risk estimates for individuals within each group, after we accounted for all available risk factors, shows that risk can be increased or lessened when more risk factors are considered. In men at low visible risk, 10 of the 12 who died from coronary heart disease were at increased risk compared with their predicted probability of death derived from the baseline model. In contrast, only 84/292 survivors (29%) in the low risk group were at increased risk due to other risk factors ( $P < 0.001$ ). In men at high visible risk, 81/107 (76%) survivors and 19/44 (43%) who died from coronary heart disease had lower risk in the fully adjusted model ( $P < 0.001$ ).

The figure also shows the much lower risk of death of the low risk survivors compared with men at high visible risk, even after we considered all available risk factors for coronary heart disease.

### Discussion

Obesity and heavy smoking together were good markers of increased risk of death and of early death from coronary heart disease. Just over half of men in the high risk group survived to the age of 70, and nearly a quarter of the group died from coronary heart disease. These two highly visible risk factors were also good markers of other less visible risk factors and existing coronary disease. High risk survivors had better profiles of risk factors that are less visible to the lay observer than men at high risk who died from coronary heart disease. Men at low risk who died from coronary heart disease had poorer profiles than low risk survivors. This suggests that the lay epidemiologist's concentration on highly visible risk factors alone may exaggerate the apparent inexplicable nature of the anomalies that are so widely discussed.



Defying all the odds for surviving into old age

### What is already known on this topic

People pay attention to visible risk factors, such as smoking and weight, in explaining or predicting coronary events but are aware that these behavioural risk factors fail to explain some early deaths from coronary heart disease (in those with "low risk" lifestyles) and long survival (in those with "high risk" lifestyles)

Such violations to notions of coronary candidacy undermine people's belief in the worth of modifying behavioural risk factors for coronary heart disease

### What this study adds

Visible risk status was a good marker for other coronary risk factors at the extremes of the risk distribution

Most men at low visible risk (slim, never smoked) who died prematurely from coronary heart disease had poorer risk profiles on other less visible risk factors; similarly, men at high visible risk (obese, heavy smokers) who survived often had more favourable profiles on other risk factors

### Limitations of analysis

The data in the Renfrew/Paisley study enabled us to characterise ideal types, which had been identified in our earlier qualitative research with some of the offspring of the original Renfrew/Paisley cohort.<sup>11 12 16 17 20</sup> We have formalised people's descriptions of men at the visible extremes of risk for coronary disease and shown how many violated notions of candidacy. We were limited to criteria based on body mass index and smoking, which incontrovertibly increase epidemiological risk and are highly visible to a lay observer. The questionnaire in the 1972-6 survey did not include questions on overall levels of activity, diet, or family history, although each of these is important in professional and lay epidemiological assessments of coronary risk.<sup>20</sup>

Secondly, we took survival to the age of 70 years as our main outcome. This may be too young for the "unwarranted survivors"<sup>13</sup> in the high risk group and too old for the "anomalous deaths" as people typically describe death at a much younger age as defying their expectations. Even with this broader criterion the number of "anomalous deaths" was small. Given that men had to be 45-64 years at screening, any men in the study area who died from coronary heart disease at younger ages could not have taken part.

Another limitation is that the classification into visible risk group was based on status at screening. Clearly, men's status may have changed during follow up—for example, a heavy smoker might have become obese or could have reduced or given up smoking.

### Implications for health promotion

Ten years ago Frankel et al observed that simple health promotion messages concerning individual risk factors "are at best only a partial presentation of the epidemiological evidence,"<sup>14</sup> and over 25 years ago Geoffrey Rose remarked on the "painful truth" that "in a Western

Fags and fat woo death  
But sometimes not. Why, you ask.  
Mystery of life

population the commonest cause of death—by far—is coronary heart disease. Everyone, in fact, is a high-risk individual for this uniquely mass disease.<sup>21</sup>

Health promotion messages may be more favourably received if they deal directly with the anomalies that lay and professional epidemiologists have long recognised. There is then the opportunity to emphasise that differences in survival between the two groups are dramatic: a quarter of the men at visibly high risk have died from coronary heart disease by the age of 70 compared with only one in 20 men at visibly low risk; and most people who survive despite apparent high risk (“anomalous survivals”) have lower levels of less visible risk factors. The fact that there is a considerable minority who survive beyond three score years and ten, despite being at very high risk on a range of risk factors, indicates that a better understanding of this group’s apparent lack of susceptibility to risk could be of public health importance.

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## Longevity of screenwriters who win an academy award: longitudinal study

Donald A Redelmeier, Sheldon M Singh

### Abstract

**Objective** To determine whether the link between high success and longevity extends to academy award winning screenwriters.

**Design** Retrospective cohort analysis.

**Participants** All screenwriters ever nominated for an academy award.

**Main outcome measures** Life expectancy and all cause mortality.

**Results** A total of 850 writers were nominated; the median duration of follow up from birth was 68 years; and 428 writers died. On average, winners were more successful than nominees, as indicated by a 14% longer career (27.7 v 24.2,  $P = 0.004$ ), 34% more total films (23.2 v 17.3,  $P < 0.001$ ), 58% more four star films (4.8 v 3.1,  $P < 0.001$ ), and 62% more

nominations (2.1 v 1.3,  $P < 0.001$ ). However, life expectancy was 3.6 years shorter for winners than for nominees (74.1 v 77.7 years,  $P = 0.004$ ), equivalent to a 37% relative increase in death rates (95% confidence interval 10 to 70). After adjustment for year of birth, sex, and other factors, a 35% relative increase in death rates was found (7% to 70%). Additional wins were associated with a 22% relative increase in death rates (3% to 44%). Additional nominations and additional other films in a career otherwise caused no significant increase in death rates.

**Conclusion** The link between occupational achievement and longevity is reversed in screenwriters who win academy awards. Doubt is cast on simple biological theories for the survival gradients found for other members of society.

Editorial by Davey Smith

Sunnybrook and Women’s Hospital, Toronto, ON, Canada M4N 3M5  
Donald A Redelmeier  
clinician scientist  
Sheldon M Singh  
researcher

Correspondence to: D A Redelmeier  
dar@ices.on.ca

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