Influence of socioeconomic status on cardiovascular diseases in Hong Kong

S L Wong, S P B Donnan

Abstract

Study objective—The aim was to explore the relationships between five socioeconomic variables and three main cardiovascular diseases (ischaemic heart disease, hypertensive disease, and cerebrovascular disease) in Hong Kong.

Design—This cross sectional study used data from the 1986 by-census and registered death data for 1985 to 1987 in Hong Kong. For each of 24 districts, the correlation coefficients between log standardised mortality ratios for the three cardiovascular diseases and the percentages of professional and administrative workers, production and agricultural workers, persons aged 15 and over having tertiary education, households with higher income, and people living in private residential blocks were calculated. Besides simple linear regression and correlation, factor analysis was used to produce a new single surrogate measure summarising the five most useful variables in 24 sets of districts.

Setting—The whole Hong Kong area (population approximately 5.5 million) was divided into 24 districts, which were the study units.

Measurements and main results—For ischaemic heart disease in men, the correlation coefficients of the log standardised mortality ratios with the five socioeconomic variables as well as with the factor score were all statistically significant. For women, statistical significance was obtained in only two of five socioeconomic variables. No such trends were obtained for the other two cardiovascular diseases for either men or women.

Conclusions—The study suggests that in Hong Kong in recent years, a higher level of socioeconomic status is associated with higher risk of death from ischaemic heart disease; but this association is not present for hypertensive disease and cerebrovascular disease.

During the past two decades, cardiovascular diseases have become the leading causes of death in Hong Kong, as in other developed countries.¹⁻³ For the three year period 1985 to 1987, deaths due to hypertensive disease, ischaemic heart disease, and cerebrovascular disease accounted for 27% of all deaths for Hong Kong residents aged 45 years and over. As well as specific factors such as cigarette smoking, obesity, and hypercholesterolaemia there is a large amount of inconsistent

evidence regarding the importance of socioeconomic status in determining cardiovascular morbidity and mortality, especially for ischaemic heart disease.

In the United Kingdom and Germany, cardiovascular mortality has in recent years been clearly higher in the lower social classes.⁴⁻⁶ In Hong Kong the first study of geographical and socioeconomic variation in ischaemic heart disease was published in 1984.⁷ It was found that higher levels of ischaemic heart disease in men were associated with higher levels of socioeconomic status, and community studies in Hong Kong have suggested that the risk factors are similarly distributed.⁸ The 1986 by-census carried out in Hong Kong provided the data to do a more detailed analysis including deaths from cerebrovascular disease and hypertensive disease in both men and women.

Methods

Mortality data for 1985, 1986, and 1987 were obtained from the Hong Kong Census and Statistics Department. The coding of underlying causes of death was based on the 9th revision of the *International classification of disease* (ICD9, 1975). Hypertensive disease, ischaemic heart disease, and cerebrovascular disease were coded 401-405, 410-414, and 430-438 respectively. During this period, the total number of person years in Hong Kong was 12 753 500 in the population aged 15 years and over. Among the study population, there were 7726 persons dying from ischaemic heart disease, 2738 persons dying from hypertensive disease, and 9030 persons from cerebrovascular disease.

Data from the 1986 by-census were also obtained from the Hong Kong Census and Statistics Department. Personal and household data including sex, age, educational level, occupation, household income, and living conditions were summarised for 24 groups of districts for which death data were available. The population of those 24 groups of district varied from 31 000 to 680 000. They did not correspond exactly to Local Government District Board but were amalgamations of adjustment census planning units into well recognised sections of Hong Kong, Kowloon, and the New Territories.

For each district, the standardised mortality ratios of the three cardiovascular disease groups were calculated. The cause, sex, and age specific mortality rates for the whole Hong Kong population for 1985 to 1987 were used as the standard rates; the overall standardised mortality ratio was taken as 1.00.

The five variables obtainable for the districts from the by-census data were used as the most

Chinese University of Hong Kong, Faculty of Medicine, Department of Community and Family Medicine, Lek Yuen Health Centre, Shatin, NT, Hong Kong
S L Wong
S P B Donnan

Correspondence to:
Dr Wong

Accepted for publication
May 1991

important socioeconomic variables for each district. These were: percentage of professional and administrative workers; percentage of production and agricultural workers (including fishery workers); percentage of persons aged 15 and over having tertiary education; percentage of households with income equal to or greater than HK\$10 000 (US\$1 250) per month; and percentage living in private residential blocks.

Since there is no standard social class index in Hong Kong such as is used in some Western countries, factor analysis was used to combine the several socioeconomic variables in the various

districts in terms of one or two conceptually meaningful, relatively independent factors.⁹ In this study only one factor score which explained 84% of the total variance was derived; in general, a district with more residents with higher education level, higher occupational status, higher household income, and more private residential blocks will have a higher value of the factor score. The linear correlation regression technique¹⁰ was used in this paper to express the relationship between standardised mortality ratio and socioeconomic variables including factor score.

Table I Socioeconomic status in 24 districts in Hong Kong in 1986

District	% Having tertiary education	% Of professional and administrative workers	% Of agricultural and production workers	% Household income over \$10 000/month	% Living in private unit
Hong Kong					
Mid-Levels/Peak	38	44	3	73	81
Tai Hang	20	28	15	47	79
North Point	17	27	24	40	91
Pak Fu Lam	15	23	22	45	36
Wan Chai	9	16	25	24	95
Central/West/Sheung Wan	8	15	27	24	85
Aberdeen/South	7	12	40	30	25
Shau Kei Wan/Chai Wan	4	8	46	16	35
Kowloon					
Kowloon Tong	28	45	11	68	71
Tsim Sha Tsui	16	24	19	31	91
Ho Man Tin/Hung Hom	10	16	37	25	69
Yau Ma Tei/Mong Kok	7	12	41	17	93
Sham Sui Po	6	11	44	19	56
Kwun Tong	5	8	50	14	20
Kowloon City/Wong Tai Sin	4	7	49	13	20
New Territories					
Tsuen Wan	8	15	46	22	70
Sai Kung	9	16	41	33	9
Islands	7	14	37	32	4
Shatin	8	15	42	21	19
Yuen Long	4	8	55	14	19
Tai Po	3	7	54	10	20
Fanling/Sheung Sui	3	7	55	13	7
Kwai Chung	3	6	58	13	14
Tuen Mun	3	7	59	14	8

Table II Correlation coefficient for the districts between log standardised mortality ratios of three diseases and six socioeconomic variables

Variables	Cerebrovascular disease		Ischaemic heart disease		Hypertensive disease	
	Men	Women	Men	Women	Men	Women
% Having tertiary education	-0.35	-0.32	0.54*	0.28	-0.27	-0.11
% Professional and administrative workers	-0.26	-0.24	0.53†	0.24	-0.22	-0.14
% Agricultural and production workers	0.01	0.06	-0.72†	-0.43*	0.27	0.27
% Household income ≥\$10 000/month	-0.25	-0.17	0.50*	0.25	-0.33	-0.28
% Living in private unit	0.0	-0.14	0.68†	0.47*	-0.10	-0.04
Factor score	-0.22	-0.20	0.64†	0.35	-0.26	-0.19

Significantly different from zero: * $p < 0.05$; † $p < 0.01$

Table III Standardised mortality ratios (SMR) for ischaemic heart disease, cerebrovascular disease, and hypertensive disease related to factor scores in quartiles

	Men				Women			
	1	2	3	4	1	2	3	4
Ischaemic heart disease								
SMR ^a	1.40	1.09	0.91	0.89	1.23	1.02	0.94	0.96
Range ^b	0.99-1.73	0.96-1.30	0.82-1.19	0.63-1.02	0.76-1.47	0.77-1.27	0.82-1.35	0.46-1.23
Cerebrovascular disease								
SMR ^a	0.93	1.02	0.99	1.01	0.96	0.96	1.03	0.98
Range ^b	0.63-1.21	0.88-1.19	0.94-1.25	0.61-1.18	0.64-1.15	0.86-1.19	0.95-1.62	0.70-1.08
Hypertensive disease								
SMR ^a	0.94	1.02	0.92	1.11	0.82	0.97	0.95	1.15
Range ^b	0.57-1.16	0.58-1.18	0.69-1.17	0.82-1.46	0.38-1.38	0.67-1.33	0.40-1.05	0.74-1.43

^a Weighted mean SMR = total observed deaths ÷ total expected deaths

^b Lowest and highest SMRs among the six districts in the quartiles

Results

Table I shows the socioeconomic variables in the 24 groups of districts, ranked within the three main geographical areas of Hong Kong. The eight districts in Hong Kong Islands include the four with the highest socioeconomic levels. The nine New Territories districts, still developing areas, include the five with the lowest socioeconomic levels.

Table II shows the correlation coefficients between the district standardised mortality ratios for ischaemic heart disease, cerebrovascular disease, and hypertensive disease, and the socioeconomic variables and factor scores. All variables except the percentage of agricultural and production workers were *positively* correlated with the standardised mortality ratios of ischaemic heart disease. Whilst the trends were similar for both men and women, the coefficients were all statistically significant for the men but only two for the women. None of the correlation coefficients were significant at the $p = 0.05$ level for either cerebrovascular disease or hypertensive disease. However, the trends exhibited in these two sets of coefficients were noticeably different from those for ischaemic heart disease; the direction of association was the *opposite* in every case, so it seems that lower socioeconomic status was associated with higher risks of men from cerebrovascular disease and hypertensive disease.

For ischaemic heart disease, the correlation coefficient between the factor scores and the standardised mortality ratios for men was 0.64 ($p < 0.01$) and for women 0.35 ($p < 0.10$).

Table III shows the standardised mortality ratios calculated with the districts grouped in four quartiles of factor scores. The six highest socioeconomic status districts are in the first quartile. For men, six out of seven districts and for women, four out of six districts with ratios for ischaemic heart disease significantly higher than 1.00 were in the two upper quartiles, while the

districts with ratios significantly lower than 1.00 were all in the lower district quartiles in both men and women. There was a clear trend towards a higher ratio in higher quartiles of factor scores for both men and women ($\chi^2=96.5$ for men and $\chi^2=21.5$ for women). For cerebrovascular disease and hypertensive disease, there were no such trends ($\chi^2=0.85$ and 2.64 respectively) for men; but for women, the trend of hypertensive diseases was opposite to that of ischaemic heart disease ($\chi^2=5.23$, $p<0.05$).

Discussion

Factor analysis is a multivariate method which aims to explain relationships among several correlated variables in terms of a few independent factors. In this study, a single factor can explain 84% of total variance. This suggests that the five variables are congruent and this new "factor" may be used as a new single, surrogate measure instead of the five variables. Clearly the factor score is easier to interpret. Hence, it seems appropriate to use the factor analysis technique to study the combined impact of the variables on standardised mortality ratio.

The regression coefficients between the five socioeconomic variables, factor score and the natural logarithm of standardised mortality ratio for ischaemic heart disease in each district was significantly different from zero and showed that in Hong Kong in 1985–1987, higher levels of socioeconomic status were associated with higher mortality from ischaemic heart disease in men. This result is consistent with the conclusion of Lam's earlier paper and is in contrast to the picture in England and Wales and the Federal Republic of Germany.

In discussing the reasons for the results, we must consider whether these results reflect the true facts in Hong Kong today or are only due to diagnostic bias between the wealthy and poor classes. For example, there would be more regular medical care in the wealthy, which might increase the chance that sudden or unexplained death would be attributed to previously diagnosed heart disease rather than to stroke. But on the other hand, the in hospital fatality rate for the higher socioeconomic groups may be lower than that for the lower socioeconomic groups, because of better

diagnosis, prevention and treatment of ischaemic heart disease. However, Hong Kong is an urbanised area, and sick people even in poor classes can be admitted into the government clinics, hospitals, or government assisted hospitals, which usually have intensive care units. According to 1980–1982 data, the proportion of deaths occurring in hospitals was 80% of all deaths and 99.9% of death certificates were signed by medical practitioners. Therefore the trends in the standardised mortality ratios for ischaemic heart disease between higher and lower socioeconomic groups cannot wholly be explained by such biases. Other evidence from our colleagues suggests that the lifestyle among the affluent population in Hong Kong exposes men and, to a lesser extent, women to a higher level of known risk factors for ischaemic heart disease, in particular diet, lack of exercise, stress, and cigarette smoking.

Preventive measures for ischaemic heart disease in Hong Kong need to be focused on the relatively well off districts and individuals, while preventive activity related to hypertension and stroke needs to be more widely directed.

The authors thank the Census and Statistics Department, Hong Kong Government, for providing the census and mortality data.

- 1 Kleevens JWJ. Cardiovascular diseases in Hong Kong. *J Hong Kong Soc Community Med* 1982; 13: 25–36.
- 2 Woo KS. Epidemiology of ischaemic heart disease and coronary risk factors in Hong Kong. *J Hong Kong Med Assoc* 1984; 36: 73–82.
- 3 Woo KS, Donnan SPB. Epidemiology of coronary arterial disease in Chinese. *Int J Cardiol* 1989; 24: 83–93.
- 4 West RR, Lowe CR. Mortality from ischaemic heart disease—inter-town variation and its association with climate in England and Wales. *Int J Epidemiol* 1976; 5: 195–200.
- 5 Helmert U, Herman B, Joeckel K-H, Greiser E, Madans J. Social class and risk factors for coronary heart disease in the Federal Republic of Germany. Results of the baseline survey of the German Cardiovascular Prevention Study (GCP). *J Epidemiol Community Health* 1989; 43: 37–42.
- 6 Marmot M. Socioeconomic determinants of CHD mortality. *Int J Epidemiol* 1989; 18: (suppl 1): S196–202.
- 7 Lam YM, Lau EMC, Donnan SPB. Geographical and socioeconomic variations in ischaemic heart disease in men in Hong Kong. *Ann Acad Med* 1984; 13: 211–5.
- 8 Donnan SPB. *Health risks, fitness and quality of life in adults in Hong Kong*. Hong Kong: The Chinese University of Hong Kong, 1988: 69–86.
- 9 Kleinbaum DG, Kupper LL. *Applied regression analysis and other multivariable methods*. North Scituate, MA, USA: Duxbury Press, 1978: 376–413.
- 10 Pocock SJ, Cook DG, Shaper AG. Analysing geographic variation in cardiovascular mortality: methods and results. *J R Stat Soc A* 1982; 45: 313–41.