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Marital state, alcohol consumption, and liability to myocardial infarction, stroke, diabetes mellitus, or hypertension in men from Gothenburg

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Abstract

Data from the Swedish personal number system were used to examine rates of admissions to hospital, particularly with myocardial infarction, stroke, diabetes mellitus, or hypertension, in relation to marital state and histories of admission with alcoholism in 77 843 men from Gothenburg born in 1911-40. The number of admissions to hospital with the four diseases varied with marital state and history of admission with alcoholism, but by considering each subset from the total group it was possible to show that among alcoholic men no material variation in the number of admissions was evident. By contrast, among the non-alcoholic men those who were married were particularly prone to myocardial infarction but less likely to be admitted with stroke or diabetes mellitus than the unmarried or divorced men.

The data show the value of common personal and health statistical numbering systems in generating epidemiological information beyond that obtainable from aggregated data without a record linkage technique.

Introduction

In 1947 every person living in Sweden was assigned a personal identity number in the county of registration. These numbers are used for general administrative purposes, including health, social security, education, and taxation, and they have been used, for instance, to generate marital state life tables to examine the proportions of married, never married, and divorced people in the population.¹ The system provides a possible tool for epidemiological

research, thus the diseases suffered by people defined by specific personal or other characteristics could be examined or, by contrast, those with particular patterns of disease could have antecedent factors reviewed. Personal numbers are also used to compile health statistics describing the numbers of patients admitted to hospital with various conditions, causes of death in those dying, and for other purposes such as cancer registration. They have not hitherto been used to study patterns of disease occurring at different times in different people or to link those patterns to specific events.

By such linkage it should be possible to determine whether there are clusters of diseases that affect people, and some insight could be gained into the events that preceded the development of the disease. We have made tables to show that the number of admissions to hospital varies considerably with marital state and that at least some of the variations are associated with admissions with alcohol related diseases, and we have gone on to explore differences in rates of diabetes, stroke, hypertension, and myocardial infarction according to marital state.

Subjects and methods

We examined the pattern of each disease from middle aged men and women in Gothenburg, which has a total population of 430 000. Census data obtained in November 1969 were used to select for special consideration all 87 176 men living in Gothenburg at the time of the census who were born from 1911 to 1940. The census tapes derived were then used to follow morbidity and mortality as judged by general admissions to hospitals of all these people. Migrants entering the city after 1969 were not considered. From the 87 176 men primarily included we excluded 8539 immigrants and from the remainder 794 widowers, leaving 77 843 married, single, or divorced native born men.

Whenever a person was admitted to the Gothenburg university hospital the diagnoses recorded at discharge or death were noted, but information on death certificates was not included. A main and up to three accessory diagnoses were collected on each occasion and episodes accumulated over the years 1970-9 for each person, thus allowing not only 10 year prevalence data but also linked data about any disease in each person to be accumulated. To preserve confidentiality each personal identity number was removed from data sets as soon as information about that person had been assembled. The Gothenburg university hospital and its two minor associated district hospitals are part of the national social service system. Until 1980 it was the

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only public hospital system in the city, and entry is freely available, according to medical need, to all people who usually attend directly as self referrals. The data set did not, however, include information about sudden deaths in the community or about disease that did not require admission to hospital. The prevalence data, therefore, may not necessarily be comparable with those obtained by other methods elsewhere.

We considered in general all non-malignant conditions that were recorded on at least 100 occasions in the main population studied. We selected for special attention a group of conditions that one of us (BL) has shown elsewhere to be particularly associated with admission for psychiatric alcoholic illnesses—that is, cirrhosis, pancreatitis, epilepsy, peptic ulcer, and general admission to hospital with alcoholism.² We then considered how often such diagnoses were recorded in relation to stroke and myocardial infarction, together with the general predisposing conditions of diabetes mellitus and hypertension. The significance of differences was tested by χ^2 with continuity correction when appropriate, using two tails.

Results

Initial consideration of data obtained about the 34 334 men born in Sweden in 1911-22 indicated that the chances of admission to hospital and premature death, defined as death from any cause occurring from the ages of 50 to 59 in the group at risk, varied according to marital state. Table I shows that divorced men were over 50% more likely than married men to be admitted to hospital, while there was only a slight increase in the chances of unmarried men being admitted compared with married men. The chances

of injury, and facial fractures) related to alcoholism as well as others such as stroke, pneumonia, and tuberculosis. Table III shows data collected for the 34 334 men born in 1911-22 and for the 43 509 men born in 1923-40 and compares the observed and expected frequencies of stroke and myocardial infarction according to marital state, together with data for the number of general predisposing conditions, hypertension and diabetes mellitus, for alcoholism itself, and for four conditions often considered to be associated, at least in part, with alcoholism—cirrhosis, pancreatitis, peptic ulcer, and epilepsy. Highly significant differences were detectable according to marital state ($p \leq 0.001$) in the number of cases of diabetes, alcoholism, cirrhosis, pancreatitis, and epilepsy with less significant but consistent differences for stroke, general trends being towards more cases in the divorced men, fewer in the married men, and intermediate values in those who never married. By contrast no clear pattern was discernible for peptic ulcer, and the number of admissions with myocardial infarction was lowest in men who never married and differed little, if at all, in married and divorced men for the 1911-22 cohort who provided the bulk of the admissions.

To examine the interrelations between alcoholism, marital state, and the occurrence of stroke, myocardial infarction, hypertension, and diabetes mellitus we compiled a further table (table IV) setting out the numbers from the 1911-22 cohort of married, never married, and divorced men with the four diseases separated according to whether an admission with alcoholism had also been recorded. Using these figures we could determine expected rates in two distinct ways. Horizontal comparisons allow the calculation of expected rates by marital state but separately in the alcoholic and in the non-alcoholic men (Expected 1 with lower case superscript letters) for all four diseases; while vertical comparisons allow the calculation of expected

TABLE I—No (%) of men from Gothenburg born in 1911-22 admitted to hospital, dying prematurely, or diagnosed as alcoholics according to marital state

	No (%) married (n=27 596)	No (%) never married (n=3691)	Relative risk*	No (%) divorced (n=3047)	Relative risk*	χ^2 For heterogeneity (df=2)†
Admitted to hospital	14 120 (51.2)	1947 (52.8)	1.07	1891 (62.1)	1.56	130.9
Dying prematurely	1348 (4.9)	372 (10.1)	2.18	422 (13.8)	3.13	481.3
Diagnosed alcoholics	363 (1.3)	248 (6.7)	5.40	378 (12.4)	10.59	1418.8
Alcoholics dying prematurely	46 (0.2)	42 (1.1)	6.89	72 (2.4)	11.92	325.7

*Compared with risk in married men.
† $p < 0.001$ for all cases.

TABLE II—Rates of admission according to marital state and general diseases for men born in 1911-22

	ICD No	No (%) married (n=27 596)	No (%) never married (n=3691)	No (%) divorced (n=3047)	χ^2 For heterogeneity (df=2)	p Value
Tuberculosis	010-019	194 (0.70)	57 (1.54)	52 (1.70)	52.3	<0.001
Viral disease	055-079	269 (0.97)	31 (0.84)	37 (1.21)	2.5	NS
Diabetes	250	653 (3.37)	136 (3.68)	104 (3.41)	31.1	<0.001
Alcoholism	291-303	363 (1.32)	248 (6.72)	378 (12.41)	1424.2	<0.001
Epilepsy	345	103 (0.37)	54 (1.44)	54 (1.77)	136.6	<0.001
Glaucoma	375	137 (0.50)	20 (0.54)	15 (0.49)	0.1	NS
Hypertension	400-404	844 (3.06)	122 (3.31)	97 (3.18)	0.7	NS
Myocardial infarction	410, 412	1919 (6.95)	199 (5.39)	206 (6.76)	12.6	<0.01
Angina	413	605 (2.19)	42 (1.13)	118 (3.87)	58.1	<0.001
Stroke	430-438	786 (2.84)	123 (3.33)	120 (3.94)	12.8	<0.01
Varicose veins	454-455	1219 (4.42)	151 (4.09)	118 (3.87)	0.7	NS
Pneumonia	480-486	569 (2.06)	117 (3.17)	145 (4.76)	94.4	<0.001
Asthma	493	228 (0.83)	31 (0.84)	41 (1.35)	8.6	<0.05
Peptic ulcer	502	475 (1.72)	69 (1.87)	52 (1.71)	0.4	NS
Cirrhosis	571	196 (0.71)	69 (1.87)	98 (3.22)	190.8	<0.001
Gall stones	574	784 (2.84)	66 (1.79)	66 (2.17)	17.1	<0.001
Pancreatitis	577	189 (0.68)	45 (1.22)	87 (2.85)	143.2	<0.001
Urolithiasis	592	562 (2.03)	45 (1.22)	46 (1.51)	14.4	<0.001
Arthritis	712	130 (0.47)	14 (0.38)	21 (0.69)	3.6	NS
Head injury	800-801;850-851	248 (0.90)	107 (2.90)	127 (4.17)	278.7	<0.001
Facial fracture	802	108 (0.39)	46 (1.25)	57 (1.87)	289.0	<0.001

of premature death were over three times greater for divorced than for married men, and they were increased intermediately in unmarried men. In addition, the chances of diagnosing alcoholism and of alcoholic men dying prematurely rose progressively according to marital state, the risk being greatest for divorced men and least for married men.

Table II shows the numbers and percentages of each diagnosis made under individual headings for 21 non-malignant conditions for which at least 100 admissions were noted in married men. Higher rates were recorded in 15 of the 21 conditions in divorced men and in 14 of the conditions in never married men, compared with those who were married. These included conditions directly (cirrhosis or pancreatitis) or indirectly (epilepsy, head

numbers of alcoholic men by diagnostic category and marital state determined by reference to findings in non-alcoholic men (Expected 2 with upper case superscript letters).

When alcoholic men were considered by themselves there were no significant differences in the observed and expected numbers of admissions with myocardial infarction (Expected 1^{abc}), stroke (Expected 1^{def}), hypertension (Expected 1^{ghi}), or diabetes (Expected 1^{kl}) between married, never married, and divorced men. When the non-alcoholic men were considered by themselves marital state was, by contrast with the findings in alcoholic men, still associated with variations in frequency of the disease. Thus married non-alcoholic men were significantly more likely to be

admitted to hospital with myocardial infarction than never married or divorced men (Expected 1^{mno}; $p < 0.01$) and slightly more likely to be admitted with hypertension (Expected 1^{uv}) but were significantly less likely to be admitted with diabetes (Expected 1^{wxy}; $p < 0.01$) and slightly less likely to be admitted with stroke (Expected 1^{pqr}). By contrast, comparison of the numbers of admissions with each of these four diseases in alcoholic and non-alcoholic men in each of the groups of marital state taken by themselves showed that observed figures were greater than expected, whether for married (Expected 2^{abcd}), never married (Expected 2^{efgh}), or divorced men

TABLE V—Observed No of alcoholic men from Gothenburg born in 1911-22 with admissions for myocardial infarction, stroke, hypertension, or diabetes mellitus compared with expected No of non-alcoholic men after weighting for marital state

	Observed No	Expected No	Ratio
Myocardial infarction	102	60.8	1.68
Stroke	85	30.3	2.80
Hypertension	51	28.7	1.78
Diabetes	77	27.3	2.82

TABLE III—No of men born in 1911-22 or in 1923-40 in Gothenburg admitted to hospital with set conditions

	Period of birth	No married	Observed/expected frequency of disease	No never married	Observed/expected frequency of disease	No divorced	Observed/expected frequency of disease	p Value
Myocardial infarction	1911-22	1919	1.03	199	0.80	206	1.00	<0.01
	1923-40	424	1.02	81	0.83	52	1.23	<0.1
Stroke	1911-22	786	0.95	123	1.11	120	1.31	<0.01
	1923-40	213	0.94	54	1.03	34	1.48	0.05
Hypertension	1911-22	844	0.99	122	1.07	97	1.03	NS
	1923-40	353	0.99	83	0.99	42	1.15	NS
Diabetes	1911-22	653	0.90	136	1.40	114	1.42	<0.001
	1923-40	261	0.86	93	1.32	50	1.63	<0.001
Alcoholism	1911-22	363	0.46	248	2.33	378	4.31	<0.001
	1923-40	475	0.50	426	1.91	375	3.86	<0.001
Cirrhosis	1911-22	196	0.67	69	1.77	98	3.04	<0.001
	1923-40	126	0.64	67	1.46	70	3.50	<0.001
Pancreatitis	1911-22	189	0.81	45	1.44	57	2.21	<0.001
	1923-40	201	0.70	110	1.64	73	2.50	<0.001
Peptic ulcer	1911-22	475	0.99	69	1.08	52	0.98	NS
	1923-40	397	0.96	94	0.97	62	1.47	<0.01
Epilepsy	1911-22	103	0.61	54	2.38	54	2.88	<0.001
	1923-40	101	0.64	61	1.66	62	1.47	<0.001
Total No of men	1911-22	27 596		3691		3047		
	1923-40	32 601		7596		3312		

TABLE IV—No of men from Gothenburg born in 1911-22 admitted to hospital with myocardial infarction, stroke, hypertension, or diabetes mellitus separated according to marital state and histories of admission with alcoholism

	Married		Never married		Divorced	
	Observed	Expected 1	Observed	Expected 1	Observed	Expected 1
<i>Alcoholic men*</i>						
Myocardial infarction	34	37.4 ^a	26	25.6 ^b	42	39.0 ^c
Expected 2	26.7 ^A		13.4 ^E		25.5 ^I	
Stroke	35	31.2 ^d	22	21.3 ^e	28	32.5 ^f
Expected 2	10.4 ^B		8.3 ^F		14.9 ^J	
Hypertension	20	18.7 ^g	15	12.8 ^h	16	19.5 ⁱ
Expected 2	11.1 ^C		8.2 ^G		10.8 ^K	
Diabetes	27	28.3 ^j	22	1.3 ^k	28	29.4 ^l
Expected 2	8.6 ^D		9.1 ^H		12.9 ^L	
Initial total No	363		248		378	
<i>Non-alcoholic men†</i>						
Myocardial infarction	1885	1814.7 ^m	173	229.5 ⁿ	164	177.8 ^o
Stroke	751	771.0 ^p	101	97.5 ^q	92	75.5 ^r
Hypertension	824	818.3 ^s	107	103.5 ^t	71	80.2 ^v
Diabetes	626	666.4 ^w	114	84.3 ^x	76	65.3 ^y
Initial total No	27 233		3443		2669	

Expected 1: Expected No of unmarried or divorced men by diagnostic category determined separately by reference to findings in married men (horizontal comparisons, lower case superscript letters).

Expected 2: Expected No of alcoholic men by diagnostic category determined separately for married, unmarried, or divorced men by reference to findings in non-alcoholic men (vertical comparisons, upper case superscript).

χ^2 For distributional heterogeneity according to marital state.

^a $\chi^2 = 3.3$, $df = 6$; $p > 0.2$.

^b $\chi^2 = 37.8$, $df = 6$; $p > 0.01$.

(Expected 2^{ijkl}). Scrutiny of these data also suggested that the excesses of observed over expected figures were consistently greater for stroke and diabetes (roughly threefold) than for myocardial infarction and hypertension (roughly twofold), although all differences were significant ($p < 0.01$ for excesses of observed over expected values in alcoholic men for all four diseases).

This trend was brought out by combining the data for all groups of marital state in alcoholic men, a manoeuvre that was permissible because variations in the frequency of each disease were not discernible according to marital state in the alcoholic men, and comparing these figures with the observed frequency of the same diseases in the non-alcoholic men. Because marital state in non-alcoholic men considered by themselves was associated with changes in the frequency of disease we weighted the proportions of men

included in the non-alcoholic group to match the numbers of married, never married, and divorced men in the alcoholic group.

Table V shows that although the chances of admission were increased for myocardial infarction, stroke, hypertension, and diabetes mellitus, they were greatest for stroke and diabetes and least for myocardial infarction and hypertension. To test whether these differences might be expected consistently we applied the same technique to data for the cohort of men born in 1923-40 ($n = 43 509$). Table VI shows that in these men when alcoholics were considered by themselves there were, as in the 1911-22 cohort, no significant differences in the observed and expected numbers of admissions between married, never married, and divorced men for myocardial infarction (Expected 1^{abc}), stroke (Expected 1^{def}), hypertension (Expected 1^{ghi}), or diabetes (Expected 1^{kl}). Again as in the 1911-22 cohort

when the non-alcoholic men were considered by themselves there was a significant excess of married men admitted with diagnoses of myocardial infarction (Expected 1^m; $p < 0.05$), a modest excess of married men admitted with high blood pressure (Expected 1^m), and a deficit of married men admitted with diabetes mellitus (Expected 1^m), but with, if anything, more rather than less married patients admitted with stroke.

Although in the 1911-22 cohort, when marital state was considered independently, there were consistent excesses of admissions in alcoholic compared with non-alcoholic men for all four diseases and all three marital states, in the 1923-40 cohort the same excess was discernible only for diabetes mellitus (Expected 2^m; $p < 0.01$). Numbers of alcoholic men with the various diseases were small and overall trends were therefore brought out again by combining data for all marital states in the alcoholic men and comparing the figures with those obtained in non-alcoholic men after weighing the numbers of non-alcoholic men to match the numbers of married, never married, and divorced men in the alcoholic group. Table VII shows that the chances of admission were increased only for stroke and diabetes mellitus, the pair of diseases in which the risk was increased to the greatest degree in the alcoholic men of the 1911-22 cohort, but with no change for myocardial infarction and even a decrease for hypertension.

Records of personal identity numbers were transferred to magnetic tape in 1967, and county registers were maintained, as in the past, containing a person's name, identity number, date and place of birth, registration locality, and address as well as marital state. Almost all Swedish archives are sorted using this information. People entering the country are given a number derived basically in the same manner as the numbers derived for those born there, using date of birth as part of the code, and anyone leaving and re-entering the country retains their initial identification.

In each community changes in the population are noted weekly so that there is, in effect, a continuing census. Tables are compiled that detail the age and sex structure of the population, the numbers of immigrants, and the marital state of the population, and similar tables are compiled for those dying together with their recorded causes of death. Diagnoses of disease were formulated by medical staff caring for patients and then coded systematically using the *International Classification of Diseases*, 1965 revision, which was introduced into the hospital in 1969. Generated data were examined

TABLE VI—No of men from Gothenburg born in 1923-40 admitted to hospital with myocardial infarction, stroke, hypertension, or diabetes mellitus separated according to marital state and histories of admission with alcoholism

	Married		Never married		Divorced	
	Observed	Expected 1	Observed	Expected 1	Observed	Expected 1
	<i>Alcoholic men*</i>					
Myocardial infarction	20	15.6 ^a	11	14.0 ^b	11	12.3 ^c
Expected 2	18.2 ^A		11.9 ^E		15.3 ^I	
Stroke	14	13.4 ^d	14	12.0 ^e	8	10.6 ^f
Expected 2	9.2 ^B		7.9 ^F		10.0 ^J	
Hypertension	12	11.2 ^g	10	10.0 ^h	8	8.8 ⁱ
Expected 2	15.2 ^C		12.2 ^G		12.4 ^K	
Diabetes	29	25.3 ^j	21	22.7 ^k	18	20.0 ^l
Expected 2	11.2 ^D		13.7 ^H		14.7 ^L	
Initial total No	475		426		375	
	<i>Non-alcoholic men†</i>					
Myocardial infarction	404	380.6 ^m	70	88.9 ⁿ	41	46.0 ^o
Stroke	199	195.6 ^p	40	45.7 ^q	26	23.6 ^r
Hypertension	341	330.9 ^s	73	77.3 ^t	34	37.9 ^u
Diabetes	232	248.5 ^v	72	58.0 ^w	32	30.0 ^x
Initial total No	32 126		7170		2937	

Expected 1: Expected No of unmarried or divorced men by diagnostic category determined separately by reference to findings in married men (horizontal comparisons, lower case superscript letters).

Expected 2: Expected No of alcoholic men by diagnostic category determined separately for married, unmarried, or divorced men by reference to findings in non-alcoholic men (vertical comparisons, upper case superscript).

χ^2 : For distributional heterogeneity according to marital state.

^a $\chi^2 = 4.0$, $df = 6$; $p > 0.2$.

^b $\chi^2 = 12.6$, $df = 6$; $p > 0.05$.

TABLE VII—Observed No of alcoholic men from Gothenburg born in 1923-40 with admissions for myocardial infarction, stroke, hypertension, or diabetes mellitus compared with expected No for marital state

	Observed No	Expected No	Ratio
Myocardial infarction	42	42.3	0.99
Stroke	36	23.5	1.53
Hypertension	30	37.9	0.79
Diabetes	68	32.3	2.11

Discussion

The data collected during this large study showed that marital state is either directly or indirectly associated with differences in the chances of admission to hospital with various diseases, particularly of the cardiovascular system, and also the chances of dying prematurely. In addition, the chances of a diagnosis of alcoholism and of such alcoholic men dying prematurely were increased in men who had never married and considerably increased in divorced men. Before examining the conclusions that may be drawn from the data in more detail, several questions must be answered about their validity. We need to be sure that each man had a unique identifying number, thus allowing vital and health statistics to be accurately and completely collected, and to consider possible biases that might arise in the formulation of diagnoses of disease.

regularly to determine whether there were errors in the demographic information—when, for instance, disease was attributed to a member of the study group when the sufferer was in fact outside the age range or was not resident in 1969 in the Gothenburg area.

We have no means of knowing how consistently any criteria were used in placing patients in any diagnostic category, but it is hard to see how any specific biases might have arisen that would have materially influenced patterns of data. Never married and divorced men living on their own might be more likely to need care in hospital than married men who had a partner at home to care for them during an illness such as pneumonia or asthma, but clearly such an explanation would not account for an increased chance of premature death in never married and divorced men. It also cannot explain reverse trends when rates of admission were greater in the married than the unmarried men, for instance with myocardial infarction, and it is unlikely to account for high rates of admission in unmarried men with, for instance, epilepsy.

Further examination of the data is facilitated by the size of the population studied. This was a total population of over 80 000 men, many times larger than conventional prospectively collected population sets. It was possible to divide dichotomously to allow separate consideration of alcoholic and non-alcoholic men by marital state and disease. Such analysis suggests that, at least when considering stroke, myocardial infarction, hypertension, and diabetes, differential rates of admission among married, never married, and

divorced men are abolished when those with admissions associated with alcoholism are considered by themselves. By contrast, in those without admissions associated with alcoholism, married men were particularly likely to have admissions associated with myocardial infarction, and to a lesser extent with hypertension, but were less likely than the never married and divorced men to be admitted with diabetes, with no consistent pattern observed for stroke in the two cohorts studied.

Generally, therefore, two sets of factors, one related to marital state and the other associated with alcoholism, seem to affect the incidence of these diseases. By standardising for marital state it was possible to show that in both the cohort born in 1911-22 and that born in 1923-40 alcoholism was particularly associated with stroke and diabetes. Effects associated with myocardial infarction and hypertension were less clear, none being found in the younger cohort, but as age increased an increased incidence of both diseases was detectable.

Data obtained in Australia,³ Sweden,⁴ the United Kingdom,⁵ the United States of America,^{6,8} and Yugoslavia⁹ have generally confirmed that those who consume alcohol are less likely to be admitted to hospital with or to die from coronary heart disease than abstainers. There is less uniformity about the perceived consequence of heavy drinking. In Chicago heavy alcohol consumption was associated inter alia with heavy cigarette smoking and hypertension, and heavy drinkers had increased mortality from cardiovascular disease (ICD undefined) and coronary heart disease (ICD undefined) than lighter (non-problem) drinkers.¹⁰ In Gothenburg itself the 1913 study,⁴ an analysis of risk factors for myocardial infarction in 973 subjects born in 1913, suggested that problem drinkers were more likely to develop myocardial infarction and die from it than those without problems related to alcohol. A similar trend towards increased morbidity or mortality, or both, from cardiovascular disease, and particularly coronary heart disease, with heavy alcohol consumption has been noted in Puerto Rico,¹¹ Auckland,¹² and San Francisco.⁸ In Puerto Rico a "J shaped" relation was noted between alcohol consumption and angina pectoris, non-fatal myocardial infarction, and non-sudden death from coronary heart disease.¹¹ It should be noted, however, that other data, from Yugoslavia⁹ and Hawaii,¹³ seem to suggest a simple inverse relation between the amount of alcohol consumed and the risk of coronary heart disease.

Alcohol consumption has also been associated with a tendency towards raised blood pressure,^{10 14-16} and data from several but not all sources suggest an association with stroke. An increased incidence of stroke, particularly haemorrhagic stroke was noted in consumers of alcohol in Hawaii,¹⁷ and stroke was more common in consumers than in abstainers in San Francisco¹⁸ and Yugoslavia.¹⁵ Furthermore, in Chicago mortality from cardiovascular disease in general, and from coronary heart disease in particular, was raised in problem drinkers.¹⁰ By contrast, in Busselton, western Australia, stroke was not particularly associated with alcohol consumption, although the numbers of cases available for analysis were probably small.³ Multivariate and other analyses suggest that associations of disease with alcohol consumption cannot be more than partially explained by relations with other risk factors, particularly smoking.^{3 10 11 17} Our data are therefore in agreement with the general run of information in suggesting that problem drinkers are more likely to be admitted to hospital with stroke than others. Our data also suggest that older men who are problem drinkers may be at increased risk of coronary heart disease while younger men are not. This pattern conforms with observations in the Puerto Rico heart health programme, suggesting that older men who drank heavily were at increased risk of death from non-sudden coronary heart disease but younger men were not.

The reasons underlying the differential rates of admission according to marital state for the four main diseases we have studied

are unknown. Obviously they could be related in whole or part to other risk factors, such as weight or serum cholesterol concentrations, for coronary heart disease. In addition, it may be that differential rates of admission according to marital state in those without diagnosed alcoholism still reflect a tendency for divorced and never married men to be, on average, rather heavier drinkers or perhaps smokers than married men. However this may be, the existence of the difference suggests that in the assessment of the contribution of individual risk factors during multivariate analysis marital state should be included.

Data systems that link information about personal characteristics and health have been neglected. The substantial numbers of people about whom information has been collected in such systems means that even within subsets there remain what are by ordinary standards large numbers of people, allowing the examination of differences or associations for what would ordinarily be rare diseases. Thus within the population of Gothenburg a considerable clustering of disease within the group of patients with multiple sclerosis was observable.¹⁹ The method therefore has the potential to act as a valuable resource in generating epidemiological hypotheses.

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Correction

Screening for Down's syndrome in the North East Thames region

An error occurred in this paper by Dr Victoria Murday and Dr Joan Slack (9 November, p 1315). In the seventh paragraph of the discussion the second sentence should have read: "Overall, the distortion of the maternal age distribution in the Barking, Havering, and Brentwood district would account for a deficit of at least one baby with Down's syndrome in the year 1982-3 . . ."