STANDARDISED MORTALITY RATIOS FOR SOME SELECTED CAUSES AMONG THE MAIN ETHNIC AND CHINESE DIALECT GROUPS IN SINGAPORE, 1970

K. C. Lun
H. P. Lee

SYNOPSIS

A study of the mortality patterns among the main ethnic and Chinese dialect groups in Singapore can provide useful clues for the identification of high-risk groups and the formulation of aetiological hypotheses. This study, based on the data in 1970 (the year of the last census), is presented in the form of standardised mortality ratios (SMRs).

The Chinese recorded significantly high SMRs for tuberculosis and cancer. The Malay had significantly high SMRs for rheumatic fever/heart disease, diabetes mellitus, hypertensive disease and perinatal mortality. The Indians had significantly high SMRs for diabetes mellitus, hypertensive disease, ischaemic heart disease and liver cirrhosis.

There did not seem to be any interesting variation among the main Chinese dialect groups in the diseases studied. A discussion of the findings, especially in the light of other morbidity information, is presented.

INTRODUCTION

Mortality data usually constitute one of the more readily available sources of health information in many countries. On the other hand, there are some important limitations. They are biassed towards the more fatal conditions, which need not be a good reflection of the overall disease pattern of the community. Many countries still depend on non-medical personnel to certify deaths - 18.6% of deaths were thus certified in Singapore in 1970 (Singapore Government) (1). The present system of classification based on the underlying cause of death often does not present a clear picture of mortality experience, especially in multi-disease situations.

Nevertheless, variations in mortality indices between groups can be usefully studied to provide clues for the identification of high-risk groups and the formulation of aetiological hypotheses. If the limitations as mentioned above can be assumed to apply to all the groups concerned, then whatever variations in patterns, if adjusted for age and sex, should provide sufficient grounds for further research.

While the Singapore Department of Statistics produces an annual report on deaths registered in Singapore, the data presented cover only broad groups with a minimum of cross-tabulations. To date, there are no known reports on finer breakdowns into specific causes by ethnic and Chinese dialect groups. This paper seeks to present standardised mortality ratios (SMRs) for some selected causes by the main ethnic and Chinese dialect groups.

Department of Social Medicine and Public Health
National University of Singapore

K. C. Lun, B.Sc., Ph.D. (Birm)
Sr Lecturer

H. P. Lee, MBBS, M.Sc. (P.H.), Singapore
Sr Lecturer

MATERIAL AND METHOD

As the relevant population figures for the main ethnic and Chinese dialect groups according to age are available only for census years, this study is confined to the data from the 1970 census, the last one taken in Singapore. The distribution of the 1970 population by ethnic and Chinese dialect group is given as follows:-

Ethnic group	Dialect group	Singapore Population, 1970	
		Number	Percentage
Chinese	Hokkien	666,944	32.2
	Teochew	352,971	17.0
	Cantonese	268,548	13.0
	Others	291,403	14.0
Malays		311,379	15.0
Indians		145,169	7.0
Other ethnic groups		38,093	1.8
All ethnic groups		2,074,507	100.0

Ethnic and Chinese dialect groupings are generally well documented. Entries in death certificates are usually checked against the National Registration Identity Card (N.R.I.C.) of the deceased, which has to be surrendered to Registrar's Office before a death certificate is issued. Children of inter-racial marriages are classified according to the father's grouping. In view of their smaller numbers, Malays and Indians are not sub-divided into their dialect groups for this study.

Age is checked against the birth-date, which is also stated in the identity card. For the purpose of this analysis, a 5-year age groups are used.

The raw data were processed and analysed on a Hewlett-Packard 3000 Computer using the Statistical Package for Social Sciences (SPSS). Analyses were based on underlying causes of death, and the causes selected for study were considered the more important ones in Singapore.

The Standardised Mortality Ratio (SMR) is the index to be presented in this study. It is easy to read and interprete, and can be understood by the general readership. Basically, this special form of age-standardisation (or adjustment) is a ratio given by:

$$\frac{\text{Deaths observed in a group in one year}}{\text{Deaths expected in a group at age-specific mortality experience of standard population in the same year}} \times 100\ \%$$

In this study, the standard population taken is the total Singapore population and for each cause of death studied, the age-specific rates for Singapore are applied to the various groups. In this way, a whole series of "deaths expected" are generated for each cause in each ethnic and Chinese dialect group.

A standardised mortality ratio of 100% would indicate that the mortality experience for that group is no different from the experience of the overall population, after having taken the influence of age into account. Assuming that the original data were reasonably accurate, any ratio above 100% would suggest increased mortality risk, the reasons for which would have to come from other specially designed studies. Where numbers are sufficiently large, an appropriate test based on the X^2 (1 degree of freedom) would suffice. For smaller numbers of deaths, the observed and expected values are taken to follow the Poisson distribution. Tests of significance are based on the table of confidence limits as worked out by Bailar and Ederer (1964) (2).

It must be noted, however, that comparisons can only be made between groups within the same disease classification. SMRs for a variety of diseases cannot be arrayed, even within the same ethnic or dialect group as the 'standard rates' are different for different causes of death. While the actual value of the ratio gives an indication of mortality risk, it is the variation between groups that will be the main contributions of this paper.

RESULTS

In 1970, there were 10,712 deaths, giving a crude death rate of 5.2 per 1000. Tables 1 - 4 present the number of deaths and the SMRs for selected causes, by sex and ethnic/dialect group.

All causes

Among the males, the SMRs for the three main ethnic groups are around the 100% baseline, with the Indians at the highest (108%). The female Malays and Indians have much higher SMRs at 151% and 126% respectively.

For the Chinese dialect groups, all the groups in both sexes hover below the 100% mark.

SMRs by ethnic groups

When the SMRs are compared among the three major ethnic groups for each cause of death, sharp contrasts are seen for different diseases. In the Tables given, the group with the highest SMR for each cause Is underlined. SMRs which fall outside the 95% confidence limits around 100 are marked with an asterisk.

Among the males (Table 1), the following findings are noted:

(a) The diseases in which the Chinese recorded highest SMRs are:
   (i) tuberculosis (116%)) also significantly
   (ii) cancer (118%),)>100 ($p < 0.05$)
   (iii) peptic ulcer (112%),
   (iv) nephritis/nephrosis (111%),
   (v) congenital anomalies (105%),
   (vi) motor-vehicle accidents (106%).

(b) The diseases in which Malays had highest SMRs are:
   (i) rheumatic fever/heart disease (171%),
   (ii) pneumonia (109%),
   (iii) bronchitis, emphysema and asthma (111%),
   (iv) perinatal mortality (163%).

It must be noted that for diabetes mellitus and hypertensive disease, the SMRs for Malays are high (above 200%, $p < 0.05$), although overshadowed by the Indian group. The SMR for suicides is significantly very low (23%) compared to the other two groups.

(c) The diseases in which Indian recorded highest SMRs include:
   (i) infective and parasitic diseases (108%),
   (ii) diabetes mellitus)
   (256%),)

TABLE 1
SINGAPORE : Number of deaths and standardised mortality ratios (SMR) for some selected causes among males, by main ethnic groups

CAUSE	Chinese		Malay		Indian	
	No. deaths	SMR (%)	No. deaths	SMR (%)	No. deaths	SMR (%)
All causes	4831	99	783	105	591	108
Infect. & para. dis	681	102	90	88	81	108
TB - all forms	277	116*	21	58*	13	49*
Cancers - all sites	843	118*	38	35*	42	52*
Diabetes mellitus	25	65*	12	204*	11	256*
Rheum. fever & heart dis	17	89	5	171*	3	139
Hypertensive dis	101	70*	46	210*	34	212*
Isch. heart dis	324	77*	66	102	125	264*
Cerebrovasc. dis	409	101	47	76	59	130
Pneumonia	478	103	77	109	33	64*
Bronch., emph. & asthma	185	105	30	111	12	61
Peptic ulcer	68	112	5	54	5	74
Liver cirrhosis	60	90	9	88	15	201*
Nephritis & nephrosis	51	111	7	99	2	39
Cong. anomalies	46	105	7	105	4	82
Perinatal mortality	192	94	51	163*	19	83
M/V accidents	70	106	7	69	7	95
Other accidents	107	93	18	102	15	116
Suicides & self inf. inj.	62	108	2	23*	8	124

Note: Highest ratio for each cause underlined.
*SMR significantly different from 100% ($p<0.05$).

(iii) hypertensive disease (212%),
(iv) ischaemic heart disease (264%),
(v) liver cirrhosis (201%),
) significantly >100, ($p<0.05$)
(vi) cerebrovascular disease (130%),
(vii) other accidents (116%),
(viii) suicides and self-inflicted injuries (124%).

Among the females (Table 2), some of the SMRs have been derived from small numbers of subjects, especially in the older age groups for Malays and Indians. The findings are thus less stable. The only disease to show the highest SMR in the Chinese female group is cancer (103%).

The group which shows highest SMRs in the most number of diseases is the Indian female group. The diseases are very similar to those seen for the males.

SMRs by Chinese dialect groups

In most of the diseases studied, there are only minor variations among the three main dialect groups.

Among the males (Table 3), the following important differences are noted:

(a) Hokkiens have markedly higher SMRs for tuberculosis (128%), liver cirrhosis (120%) and congenital anomalies (139%).
(b) Hokkiens and Teochews both have almost similar SMRs for cancer, rheumatic fever/heart disease and hypertensive disease. In both dialect groups, the SMRs for cancer are significantly greater than 100, p 0.05.
(c) Teochews have the highest SMR for peptic ulcer (139%).
(d) Cantonese generally have lower SMRs for most causes, compared to the other two groups. The only two important exceptions are for bronchitis, emphysema and asthma (133%) and suicides (151%).

Among the females (Table 4) the differences among the three dialect groups are not marked for any particular disease. The main findings are as follows:

(a) Hokkiens have relatively higher SMRs for diabetes mellitus (136%), and rheumatic fever/heart disease (125%).
(b) Teochews have higher SMR for tuberculosis (123%), liver cirrhosis (121%) and nephritis/nephrosis (122%).
(c) Teochews and Cantonese both have high SMRs for suicides.
(d) Cantonese also have higher SMRs for ischaemic heart disease (121%), and bronchitis, emphysema and asthma (119%).

TABLE 2
SINGAPORE : Number of deaths and standarised mortality ratios (SMR) for some selected causes among females, by main ethnic groups

CAUSE	Chinese		Malay		Indian	
	No. deaths	SMR (%)	No. deaths	SMR (%)	No. deaths	SMR (%)
All causes	3448	93	654	151	167	126
Infect. & para. dis	286	93	42	117	23	208*
TB - all forms	59	101	5	73	4	190
Cancers - all sites	516	103	42	71	17	94
Diabetes mellitus	40	96	4	82	3	201
Rheum. fever & heart dis	19	94	4	168	1	137
Hypertensive dis	109	92	26	187*	4	94
Isch. heart dis	207	95	21	82	11	140
Cerebrovasc. dis	414	97	70	140*	12	78
Pneumonia	377	95	70	150*	14	98
Bronch., emph. & asthma	92	89	26	215*	3	81
Peptic ulcer	26	81	10	265*	2	172
Liver cirrhosis	17	91	2	92	3	448
Nephritis & nephrosis	59	94	10	136	4	177
Cong. anomalies	41	79	13	215*	5	269
Perinatal mortality	126	80*	39	211*	16	282*
M/V accidents	16	111	—	—	1	192
Other accidents	24	95	5	168	1	110
Suicides & self inf. inj.	43	106	—	—	3	205

Note: Highest ratio for each cause underlined.
*SMR significantly different from 100% ($p<0.05$).

TABLE 3
SINGAPORE : Number of deaths and standardised mortality ratios (SMR) for some selected causes among males, by main Chinese dialect groups

CAUSE	Hokkien		Teochew		Cantonese	
	No. deaths	SMR (%)	No. deaths	SMR (%)	No. deaths	SMR (%)
All causes	1823	103	1066	97	843	94
Infect. & para. dis	272	113	149	99	110	90
TB - all forms	111	128*	58	108	43	98
Cancers - all sites	325	126*	208	129*	127	97
Diabetes mellitus	7	50	6	69	4	57
Rheum. fever & heart dis	8	115	5	116	4	57
Hypertensive dis	36	69	22	68	12	46*
Isch. heart dis	122	80*	63	66*	60	77
Cerebrovasc. dis	132	90	97	107	78	105
Pneumonia	186	111	99	95	78	92
Bronch., emph. & asthma	73	114	40	101	43	133
Peptic ulcer	25	114	19	139	9	81
Liver cirrhosis	29	120	12	80	7	57
Nephritis & nephrosis	19	114	11	106	9	106
Cong. anomalies	22	139	4	41	4	50
Perinatal mortality	79	107	31	67*	34	91
M/V accidents	23	96	13	88	13	107
Other accidents	39	94	26	100	19	90
Suicides & self inf. inj.	18	86	15	116	16	151

Note: Highest ratio for each cause underlined.
*SMR significantly different from 100% ($p<0.05$)

TABLE 4
SINGAPORE : Number of deaths and standarised mortality ratios (SMR) for some selected causes among females, by main Chinese dialect groups

CAUSE	Hokkien		Teochew		Cantonese	
	No. deaths	SMR (%)	No. deaths	SMR (%)	No. deaths	SMR (%)
All causes	1272	97	692	84	967	98
Infect. & para. dis	119	109	55	81	61	74
TB - all forms	24	116	16	123	16	102
Cancers - all sites	189	106	111	99	136	101
Diabetes mellitus	20	136	7	76	7	63
Rheum. fever & heart dis	9	125	4	89	4	73
Hypertensive dis	40	95	21	80	33	104
Isch. heart dis	71	91	42	87	71	121
Cerebrovasc. dis	135	89	92	97	122	106
Pneumonia	157	111	70	79	87	81
Bronch., emph. & asthma	34	93	16	70	33	119
Peptic ulcer	12	105	5	70	7	81
Liver cirrhosis	4	60	5	121	4	80
Nephritis & nephrosis	15	67*	17	122	16	95
Cong. anomalies	18	98	7	61	7	50
Perinatal mortality	48	86	30	86	18	43*
M/V accidents	6	117	2	63	4	104
Other accidents	11	122	2	35	7	103
Suicides & self inf. inj.	13	90	11	112	13	119

Note: Highest ratio for each cause underlined.
*SMR significantly different from 100% ($p < 0.05$).

DISCUSSION

Ethnic variations in mortality experiences may reflect differences in genetic profiles or in life-styles and social habits, or a combination of both. Such clues are vital in stimulating pertinent research into disease causation and risk factor identification.

On the whole, the Malay and Indian communities have higher mortality risks when compared to the overall population. They also seem to share some important causes of death.

Infective and parasitic diseases include a whole host of conditions which are mainly environmental in causation. They include pneumonia, which is a common cause of death among the elderly. Indians and Malays also have higher risks of dying from rheumatic fever/heart disease, which are also related to the infective process. This is confirmed by the findings of the Singapore Streptococcus Study Group, which reported higher incidence of rheumatic fever/ heart disease among Indians and Malays (3).

Indians have been known to have a higher risk of developing diabetes mellitus and ischaemic heart disease. From autopsy studies, Danaraj et al (1959) pointed out the predominance of Indians dying from ischaemic heart disease as opposed to the Chinese (4). Muir (1960) went on further to implicate Indian Muslims as being the group-at-risk within the Indian community (5). A more recent study of pre-hospital deaths also showed the relative predominance of Indians dying from this cause (Chao, 1973) (6).

Diabetes mellitus is also a disease more likely to occur in Indians. There is probably a genetic predisposition together with some dietary factors (Cheah et al, 1975; 1978) (7, 8).

In both sexes, Indians also have the highest SMRs for suicides. This was also the finding of Chia (1976), who, in a study of coroner's cases, reported that Indians had the highest suicide rates for both sexes, followed by the Chinese, and then the Malays with very low rates (9). The Indians also have higher risks of dying from liver cirrhosis. Shanmugaratnam (1961), in a study of necropsies, also reported a higher prevalence of liver cirrhosis compared to the Chinese (10).

The causes in which the Chinese showed higher SMRs are cancers and motor-vehicle accidents. The predominance of Chinese in cancers of all sites have also been shown in studies of histological examinations (Muir et al, 1971) (11), and population-based registration (Shanmugaratnam, 1973) (12). More will be discussed in another paper specially on cancer mortality.

As for traffic accidents, the present study found that Chinese and Indians both have high risks compared to the very low rates for Malays. Chen (1969)

reported much higher death rates from traffic accidents among Indians instead of Chinese (13). That study was for an earlier period 1961-65, and the rates were not adjusted for age. Nevertheless, the remarkably low rates for Malays is noted in both reports.

Among the Chinese dialect groups, the Hokkiens seem to have slightly higher mortality risks compared to Teochews and Cantonese. It is to be noted that the Hokkien males share similar mortality risks for some diseases (e.g. cancer, rheumatic fever/heart disease, and hypertensive disease) with the Teochews.

The only known reference on Chinese dialect group variations in disease distribution is one on cancer incidence in Singapore. There it was also reported that the Hokkiens and Teochews seemed to have roughly similar patterns in cancer incidence, and reference was made to the close proximity of their 'origins' in Southern China (11). With the passage of time, as inter-dialect marriages increase and the socio-cultural milieu becomes more homogeneous, such differences in morbidity and mortality experiences may well fade into history.

As a statutarily collected information, death statistics will continue to play a useful role in monitoring the health of a community. This study has shown interesting variations in mortality risks among the main ethnic and Chinese dialect groups. Some of the findings have been substantiated by morbidity studies while others seem to agree with clinical impressions. There is, therefore, an urgent need to study and document such variations before the lines of divisions between groups become hazy as the trend of inter-racial and inter-dialect marriages increases. In 1970, out of 12,300 marriages contracted and registered in Singapore, 400 (3.3%) were between partners of different ethnic groups (1). With time, cultures, life styles and habits will also merge to obliterate much of the distinction between the main ethnic and dialect groups.

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REFERENCES

1. Singapore Government: Report on the registration of births and deaths and marriages, 1970.
2. Bailar JC, Ederer F: Significance factors for the ratio of a Poisson Variable to its expectation. Biometrics 1964; 20: 339-343. (Quoted in: Office of Population Censuses and Surveys: Occupational mortality 1970-72, decennial supplement. London: H.M.S.O. 1978; p. 14-15).
3. Singapore Ministry of Health. Streptococcus Study Group: Rheumatic fever in Singapore, 1971-74.
4. Danaraj TJ, Acker MS, Danaraj W, Wong HO, Tan BY: Ethnic group differences in coronary heart disease in Singapore: an analysis of necropsy records. Amer Heart J; 58: 516-526, 1959.
5. Muir CS: Coronary heart disease in seven racial groups in Singapore. Brit Heart J; 22: 45-53, 1960.
6. Chao TC: Pre-hospital deaths due to ischaemic heart dises in Singapore. Singapore Med J; 14: 294-297, 1973.
7. Cheah JS, Tambyah JA, Mitra NR: Prevalence of diabetes mellitus among the ethnic groups in Singapore. Trop Geogr Med; 27: 14-16, 1975.
8. Cheah JS, Lui KF, Yeo P, Tan BY, Tan YT, Ng YK: Diabetes mellitus in Singapore. results of a country-wide population survey. Ann Acad Med S'pore; 7: 135-145, 1978.
9. Chia BH: Suicides in Singapore. M.D. Thesis. University of Singapore 1976.
10. Shanmugaratnam K: Liver cancer and cirrhosis in Singapore. Acta Un Int Cancer, 17: 898-902, 1961.
11. Muir CS, Shanmugaratnam K, Tan KK: Incidence rates for microscopically diagnosed cancer in the Singapore population, 1960-64. Singapore Med J, 12: 323-332, 1971.
12. Shanmugaratnam K: Cancer in Singapore - ethnic and dialect group variations in cancer incidence. Singapore Med J, 14: 69-81, 1973.
13. Chen AJ: Recent trend of deaths from unnatural causes (accidents, suicides and homicides) in Singapore, 1961-65. Singapore Med J, 10: 72-82, 1969.