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Cardiovascular diseases and diabetes mellitus in Fiji: analysis of mortality, morbidity and risk factors

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Mortality and hospital admissions due to cardiovascular diseases and diabetes mellitus have been increasing in Fiji steadily over the past 20 years. These diseases were present more frequently in the Indian than the Melanesian population of Fiji, but recently the steepest rise in prevalence rates occurred among the Melanesian population. The underlying conditions that contributed most to increasing mortality and morbidity were hypertension and diabetes mellitus. In 1978, the proportional mortality from diabetes mellitus was 6.0% (9.0% in persons aged ⩾ 40 years), and that from cardiovascular diseases was 30.3% (39% in those aged ⩾ 40 years). Ischaemic heart disease was the main cause of mortality and morbidity among the Indian population. This analysis of mortality and morbidity data is supported by the findings of a population survey, which showed that the prevalence rates of diabetes and hypertension in 1980 among urban Melanesians were similar to those among Indians. Urbanization and a modern life-style seem to play an important role in determining the disease pattern in Fiji, which is following the patterns in many industrial countries.

Epidemiological studies confirm that the incidence of chronic noncommunicable diseases, such as diabetes mellitus and ischaemic heart disease, have been increasing markedly in many developing countries, especially in the urbanized populations, in recent years (*1-4*). Previously, in countries with available data, it had been found that there was a linear correlation between crude mortality rates from cardiovascular diseases (CVD) and per capita national income (*5*, *6*). Although that correlation is no longer tenable for the industrial countries, it still holds in many other countries where modernization in a traditional society has brought rapid changes in the people's environment and way of life, and in the social and economic aspects of society. Fiji is such a country where considerable progress and changes have taken place in the decade since independence in 1970. During the same period, cardiovascular diseases have emerged as the major and still increasing public health problem in this country.

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In the 1960-61 period, cardiovascular diseases accounted for 15-18% of all deaths for the population aged 5 years and above in Fiji. The proportional mortality for infectious and parasitic diseases, and for diseases of the respiratory and alimentary systems was similar. Thus, five groups of causes of death accounted for approximately 70% of the total mortality in 1960-61, the percentage distribution among them being fairly close (Table 1). In 1978-79 also there were five groups of causes to account for approximately 70% of all deaths, but it was found that the proportion due to cardiovascular diseases had nearly doubled in less than twenty years.

While some developed countries have recently experienced a declining trend in mortality from cardiovascular diseases, probably caused by the adoption of a more healthy way of life and improved medical care, the major emphasis on the health problems of Pacific countries has been related to the communicable diseases. The health care resources allocated to noncommunicable diseases have been mainly on the curative side so that, for instance, in Fiji the hospital services can now be reached by virtually every patient with acute problems resulting from diabetes mellitus, ischaemic heart disease or other cardiovascular diseases.

This paper describes the magnitude and nature of diabetes mellitus and cardiovascular diseases in the predominantly biracial population of Fiji based on the data from vital statistics and hospital records. The

Table 1. The major causes of mortality in the population aged ⩾ 5 years, in Fiji, in 1960–61 and 1978–79[a]

Cause of death	Proportional mortality (%) in			
	1960	1961	1978	1979
Cardiovascular diseases	18	15	30	32
Infective and parasitic diseases	16	17	–	9
Respiratory diseases	16	13	10	13
Disease of alimentary system	13	14	–	7
Perinatal diseases	7	9	8	–
Endocrine, nutritional and metabolic diseases			7	–
Neoplasms			6	9
Others[b]	30	30	30	30
Total	100	100	100	100

[a] Based on Ministry of Health Annual Report, Government Press, Suva, Fiji.

[b] Includes non-certified deaths.

findings are discussed in the light of the possible risk factors for these diseases; this information is necessary for future planning and implementation of prevention and control activities against these diseases.

MATERIALS AND METHODS

Country and population

Fiji is located in the southwest Pacific, approximately halfway between Australia and Hawaii. Although there are some 350 islands, only about 100 are permanently inhabited, 95% of the population living on the two main islands, Viti Levu (85%), the site of the survey, and Vanua Levu (10%). The total population is around 600 000, with approximately 43% Melanesians and 52% of Indian origin.

The capital, Suva, has a population of about 65 000 which is almost completely urbanized, whereas life in the rural areas is still relatively traditional and based on subsistence agriculture, and with sugar and copra production as the main occupation for the rural population.

Historical and socioeconomic background. In 1874 Fiji became a British Crown Colony, and in 1879 the first indentured labourers arrived from India to work in the cotton, sugar, and copra plantations. When the indenture system ended in 1916, some 64 000 Indians had arrived and 40 000 chose to stay on after their work contracts expired. Later, other Indian settlers came, principally as merchants. By 1970, more than 90% of the Indian population had been born in Fiji.

The sugar industry, which manages the country's main export crop, has depended on the Indians, first as indentured labourers and lately as tenant farmers. Today the Indian-origin population exerts a powerful influence in the professions and in the sugar and tourist industries, as well as commerce. The Melanesians in the towns tend to be employed in the civil service or the labour force and an increasing number are entering the professions.

Mortality

The causes of deaths, stratified by age, sex and race, have been collected by the Health Statistics Office in the Ministry of Health. Preliminary data were available for the years 1977–80. As some of the data were still incomplete, data from the years 1978 and 1980 only were used for the present study. The data from 1971, 1975 and 1980 were used for a separate analysis in which the mortality rates from diabetes mellitus and various forms of cardiovascular disease were computed, taking into account both race and age. As only 70% of the 3272 deaths in 1978 and 72% of the 3712 deaths in 1980 were certified by a medical doctor, the causes of deaths being coded according to the International Classification of Diseases (ICD) 1975 (Ninth Revision), the reliability and validity of the mortality data, especially with regard to the final conclusions are reduced.

Morbidity

Data on hospital admissions between 1960 and 1979 were obtained from the annual reports of the Ministry of Health. The age-, sex- and race-specific morbidity rates were calculated, based on the 1966 and 1976 censuses. Cause-specific admission data, by race, were available for the whole period, while those by age and sex were obtainable only from 1973. For each patient admitted, a diagnosis was provided by a doctor, which was coded according to the ICD (using the Seventh Revision (1955) for data from 1960 to 1976 and the Ninth Revision (1975) for data from 1977 onwards). However, as there is some uncertainty about the correctness of the hospital diagnoses and, to some extent, the causes of death also, changes in the diagnostic criteria having occurred in Fiji as in other countries too, there may be some problems in the interpretation of the data.

The hospital admission ratios for the period 1960–78 (or 1973–78) were computed from the hospital admission rates per 100 000 population using the 1960 rate (or the 1973 rate) of the respective subgroup (age, race, sex) as the baseline standard. Thus, each ratio gives the percentage change within the subgroups compared to the baseline level.

Table 2. Number of deaths and mortality rates for diabetes, cardiovascular diseases, and all diseases in Fiji in 1978, by sex, race, and age

	Diabetes		Cardiovascular diseases		All diseases	
	No. of deaths	Mortality rate[a]	No. of deaths	Mortality rate[a]	No. of deaths	Mortality rate[a]
Sex:						
Male	95	30.7	630	207.8	1921	622.8
Female	90	29.7	363	117.5	1351	505.4
Race:						
Melanesian	52	19.1	378	138.7	1473	541.3
Indian	131	42.7	546	177.9	1610	524.9
Other	2	216.7	69	211.5	129	582.3
Age group (years):						
20–39	15	4.1	116	31.5	439	119.2
40–49	36	72.1	117	234.2	338	676.6
50–59	57	159.4	245	765.8	517	1616.0
60+	89	333.3	422	1590.5	1155	4325.8
All ages	195	31.9	993	162.3	3272	535.1
⩾ 40 years	180	165.7	784	721.6	2010	1850.0

[a] Rate per 1000 000 population.

RESULTS

Mortality

The overall mortality rate in men was 23% higher than that in women (Table 2). This difference was partly explained by the difference in CVD mortality, which caused 18% of this overall difference. The mortality rates for diabetes mellitus were similar for both men and women.

According to race, the diabetes mellitus mortality rate was twice as high among the Indians as in Melanesians. The CVD mortality rate was also higher in Indians than Melanesians but was highest among people of "other" races (Europeans, Chinese, Polynesians, etc.). The proportional increase in mortality rate with increasing age was greatest for diabetes mellitus, then the cardiovascular diseases, and least in "all" diseases. Of the increase in deaths between the age groups 40–49 and 50–59 years, the majority (83%) were due to diabetes or cardiovascular diseases, while between age groups 50–59 and 60+ years these two groups of diseases accounted for 33% of the increased mortality.

Diabetes mellitus and cardiovascular diseases caused 37.7% of all deaths in men and 33.4% in women (Table 3). The proportional mortality (i.e.,

Table 3. Percentage proportional mortality[a] from diabetes, cardiovascular diseases, and other causes in Fiji in 1978, by sex, race and age

	Diabetes mellitus	Cardio-vascular diseases	Other causes	Total
Sex:				
Male	4.9	32.8	62.3	100
Female	6.7	26.7	66.4	100
Race:				
Melanesian	3.5	25.7	70.8	100
Indian	8.1	33.9	58.0	100
Other	1.1	36.5	62.4	100
Age group (years):				
20–39	3.4	26.4	70.2	100
40–49	10.7	34.6	54.7	100
50–59	9.9	47.4	42.7	100
60+	7.7	36.5	55.8	100
All ages	6.0	30.3	63.7	100
⩾ 40 years	9.0	39.0	52.0	100

[a] Percentage of all deaths which occurred in each category.

percentage of all deaths) from diabetes was higher in women than men, whereas that from cardiovascular diseases was higher in men. Among the Indian population, the proportional mortality from diabetes and cardiovascular diseases was 42%. The proportional mortality from diabetes was highest in the age groups 40–49 years, declining after that gradually; 9% of all deaths after 40 years of age were identified to be exclusively due to diabetes. Mortality from cardiovascular diseases was highest (47.4%) in the age group 50–59 years and of all deaths that occurred in this age group, as much as 57.3% were due to diabetes or cardiovascular diseases. Of all deaths after 40 years of age, almost half (48.0%) were caused by diabetes or cardiovascular diseases. These two groups of diseases, as the underlying cause of death, occurred as frequently in the 40–59 years age group as in persons aged 60 years and over.

Table 4 gives the CVD and diabetes mortality rates by age for both races separately and for all races combined for the years 1971, 1975 and 1980. The mortality from ischaemic heart disease increased in a similar way between 1971 and 1980 in the three age groups in both races. Deaths from hypertension and stroke were combined in this Table because the numbers were small; among Melanesians, the rate increased during the 1970s mainly in the age group 60+ years, whereas among Indians the increase was also found in the age group 40–59 years. The increases during the 1970s in the age group-specific CVD mortality rates did not differ much between the two races. The diabetes-related death rates remained low in persons below 40 years and there were no such deaths reported in this age group before 1975. The diabetes death rates increased in both age groups 40–59 and 60+ years between 1971 and 1980, but among the Melanesians relatively small numbers were involved, which makes further conclusions difficult.

The data from the year 1980 show that while ischaemic heart disease was the main type of cardiovascular disease that led to death in males, "other heart disease" (mainly valvular diseases and cardiac

Table 4. Mortality rates (per 100 000 population) for cardiovascular diseases and diabetes mellitus by race, age, and year (both sexes combined)

Disease group and year	Mortality rate (per 100 000) by race and age groups (years)								
	Melanesian			Indian			All races combined		
	20–39	40–59	60+	20–39	40–59	60+	20–39	40–59	60+
Ischaemic heart disease:[a]									
1971	2	66	83	11	198	477	6	128	259
1975	7	93	96	19	209	351	14	149	208
1980	6	77	182	16	233	634	11	150	358
Hypertension and cerebrovascular disease:[b]									
1971	2	66	190	6	111	551	5	87	322
1975	8	61	204	10	143	421	10	104	336
1980	6	65	307	6	155	849	6	106	483
All cardiovascular diseases:[c]									
1971	18	200	466	32	400	1309	27	292	807
1975	34	228	509	45	464	1194	41	344	789
1980	36	240	740	37	459	1932	36	338	1162
Diabetes mellitus:									
1971	–	3	75	–	41	208	–	23	117
1975	3	37	36	11	87	251	7	60	118
1980	1	36	142	8	143	693	4	86	320

[a] ICD 410–414

[b] ICD 401–405 and 430–438.

[c] ICD 390–459.

failure) and stroke were the common cardiovascular causes of death in women (Table 5). With regard to the proportion of deaths due to hypertension, there was little variation in relation to sex, race or age, except for a lower figure in the youngest age group, 20–39 years. Deaths from ischaemic heart disease accounted for more than 40% of all CVD deaths in Indians and in "other races", whereas "other heart diseases" and stroke were the more common cardiovascular causes of death in the Melanesian population.

The contribution of ischaemic heart disease to total mortality was highest (48%) in the age group 40–49 years. "Other heart disease" caused 40% of CVD deaths in the age group 20–39 years, indicating that rheumatic heart disease deaths must have been included in this category. Based on these mortality statistics, ischaemic heart disease seems to present the greatest problem. While it caused a total of 284 deaths in 1980, there were 221 deaths exclusively due to hypertension; however, a considerable proportion of the 112 deaths from stroke, part of the 284 deaths from ischaemic heart disease, and some of the 254 deaths due to "other heart diseases" (such as "cardiac failure") were certainly related to high blood pressure.

Morbidity

An increase in the number of hospitals and hospital beds is a factor which may cause variation in hospital utilization for certain diseases like diabetes and cardiovascular disease. In 1978, the overall number of hospital admissions had increased by 2.7 times compared with the number in 1960 (Table 6). While the proportion of admissions accounted for by Indians over this period did not vary appreciably, there was an increase from 30.4% to 40% in the proportion of patients admitted who were Melanesian; there was also a reduction in the proportion of admissions classified as "other" race.

Table 7 shows the number of hospital admissions due to diabetes and various cardiovascular diseases in Fiji between 1960 and 1979. The number of ad-

Table 5. Proportion of various cardiovascular disease groups[a] among all cardiovascular diseases as causes of death in Fiji in 1980, by age, race and sex

	Hypertension (%)	Ischaemic heart disease (%)	Other heart disease (%)	Cerebrovascular disease (%)	Deaths from all cardiovascular diseases[b]	
					No	%
Sex:						
Male	22.8	35.5	24.1	9.4	614	100
Female	24.1	21.3	34.2	17.4	310	100
Race:						
Melanesian	20.7	26.7	40.4	15.5	329	100
Indian	25.9	40.7	20.0	11.2	525	100
Other	21.2	42.3	30.8	3.8	52	100
Age group (years):						
20–39	16.1	37.3	40.3	6.0	67	100
40–49	22.7	48.0	23.3	8.0	150	100
50–59	25.6	40.6	23.2	8.7	207	100
60+	25.2	30.3	26.2	14.7	449	100
⩾ 40 years	24.8	28.9	24.9	12.3	806	100
Number of deaths in each disease category[c]	221	284	254	112	924	100

[a] ICD code numbers, 1975 (Ninth) Revision, are as follows (in parentheses): hypertension (401–405), ischaemic heart disease (410–414), other heart disease (420–429), and cerebrovascular disease (430–438).

[b] This includes all categories of cardiovascular diseases; the four subcategories presented in this Table do not therefore add up to 100%.

[c] Only cases aged ⩾ 5 years were included in the subcategories.

Table 6. Admissions to all hospitals in Fiji, by race, between 1960 and 1978

Year	Number of admissions	Proportion by race (%)		
		Melanesian	Indian	Other
1960	19 542	30.4	56.6	13.0
1964	31 388	39.4	50.3	10.3
1968	33 984	40.7	50.4	8.9
1972	43 729	41.3	51.1	7.6
1974	46 643	43.5	50.1	6.4
1978	50 700	40.0	54.3	5.7

missions due to rheumatic heart disease varied from year to year, with a 47% increase between the numbers admitted in 1960 and 1979; this appears as a 4% reduction if the general increase in hospital admissions during this period is taken into account (i.e., by comparing the proportion of hospital admissions due to rheumatic heart disease in 1960 and 1979). As a whole, between 1960 and 1979 the CVD admissions into hospitals increased by 7.5 times and the admissions due to diabetes by 3.2 times. The increase in the total number of hospital admissions may explain part of this increase, but after correction for changes in all hospital admissions over the respective years there were still marked differences in the CVD and diabetes admissions as a proportion of all hospital admissions during this period.

The greatest increase was due to ischaemic heart disease, the proportion of which (to all CVD admissions) was 27.5% in 1960, 28.9% in 1974, and 41.3% in 1979. There were also notable increases in the number of admissions due to hypertension and stroke (cerebrovascular disease). The proportion of rheumatic heart disease cases to all CVD admissions dropped from 28% in 1960 to 5% in 1979. The number of admissions due to diabetes and cardiovascular diseases was 4935 in 1979, which was 9.7% of all admissions. This is only slightly less than that due to respiratory diseases, the leading cause for hospital admissions in Fiji.

Detailed analysis of the cases of ischaemic heart disease and diabetes admitted to hospital, in terms of age-, sex-, and race-specific rates, revealed a steady increase in the admission rates among both Indians and Melanesians for diabetes and mainly among Indians for ischaemic heart disease (Fig. 1). The admission rates, by age and sex, for diabetes showed a similar upward trend among men and women. Except in the youngest age groups (15-39 years), there was a clear upward trend in all age groups (Fig. 2). The admission rate for ischaemic heart disease was higher in males than in females in 1973, at the beginning of the study period, and this was maintained throughout the period. A similar upward trend from 1971 to 1979 in the admission rates for diabetes and ischaemic heart disease in the age groups over 40 years was observed.

Table 7. Number of hospital admissions and their proportions (out of all admissions, per 1000) due to various cardiovascular diseases and diabetes mellitus in Fiji between 1960 and 1979

Disease group	Year										Difference between 1960 and 1979	
	1960		1964		1969		1974		1979			
	No.	Proportion	No.	Proportion	No.	Proportion	No.	Proportion	No.	Proportion	Percentage change	Proportion
Chronic rheumatic heart disease	129	6.6	169	5.4	84	2.5	116	2.4	190	3.7	47	−4
Hypertensive heart disease	157	8.0	119	3.8	280	8.2	512	11.0	887	17.5	465	119
Cerebrovascular disease	53	2.7	75	2.4	142	4.2	289	6.2	344	6.8	549	152
Ischaemic heart disease	127	6.6	144	4.6	362	10.7	617	13.2	1620	32.0	1176	385
All cardiovascular diseases mentioned above	466	23.8	607	19.3	1293	38.1	2131	45.8	3916	77.2	750	224
Diabetes mellitus	241	12.3	363	11.6	550	16.2	738	15.8	1019	20.1	321	63

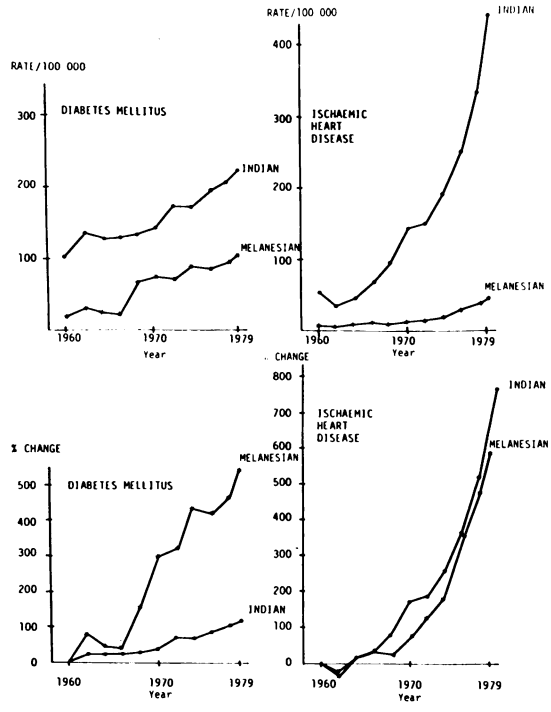

Fig. 1. Trends in hospital admission rates (per 100 000 population and as percentage change) for diabetes mellitus and ischaemic heart disease in Fiji, 1960–79, by race (all ages and both sexes combined).

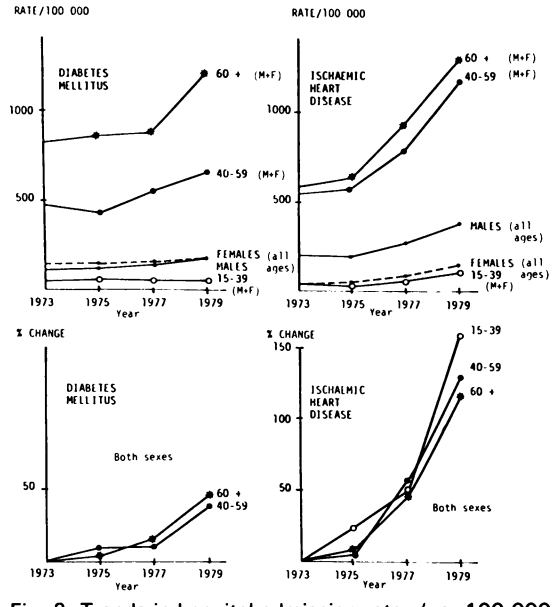

Fig. 2. Trends in hospital admission rates (per 100 000 population and as percentage change) for diabetes mellitus and ischaemic heart disease in Fiji, 1960–79, by age and sex (all ethnic groups combined).

The relative changes in the admission rates in each ethnic group are also illustrated by the admission ratios, which compare the situation in the beginning of the period (either 1960 or 1973) with that in the following years, using the 1960 rate (or 1973 rate) as the baseline standard. The percentage increase in admission ratios for diabetes was greater among Melanesians than in Indians, while the increase in the rates for ischaemic heart disease was similar in both ethnic groups (Fig. 1).

The relative changes between 1973 and 1979 in the admission rates for both diabetes and ischaemic heart disease in each age group were similar. The increasing trend was the same in the 40–59 years and in the over 60 years age groups (Fig. 2).

Risk factors for CVD

Two case-control studies on the risk-factor status in patients admitted to hospital because of clinical myocardial infarction have been carried out. The first study was conducted in 1969–72 (*7*) and the second in 1979–81.[a] The data from these two studies indicate some changes in the prevalence of hypothetical coronary risk factors. The patients admitted to hospital with myocardial infarction in 1979–81 had a higher frequency of family history of ischaemic heart disease, hypertension, smoking, diabetes mellitus, and sedentary physical activity than those myocardial infarction patients admitted in 1969–72. The frequency of raised serum cholesterol levels was not significantly different between both groups of infarction patients (Table 8).

A survey of cardiovascular diseases and diabetes carried out in Fiji in 1980 has provided essential baseline prevalence figures for hypertension and diabetes.[b] The prevalence of hypertension was higher in urban than rural areas (Table 9); the lowest prevalence was among the rural Melanesians, and the highest was in Lakeba (outside of the main islands of Fiji) where the population has anthropological links with the Polynesian population of Tonga. This survey also revealed a very high prevalence of diabetes mellitus. Based on the recent WHO criteria (*15*), the prevalence of diabetes was 11.7% among Indians in both urban and rural areas, whereas there were much lower rates and a clear rural–urban difference among the Melanesians. People of both races in Fiji suffer from type II diabetes almost entirely. These diabetic preva-

[a] RAM, P., NAIDU, V. & NASEROA, J. *Myocardial infarction in Fiji in 1979–81. A case review.* (Unpublished, 1982).

[b] ZIMMET, P. & SLOMAN, G. *Prevention and control of diabetes and cardiovascular diseases in Fiji.* Manila, WHO Regional Office for the Western Pacific, 1980. (Unpublished report ICP/CVD/001).

Table 8. Prevalence of various hypothetical risk factors in clinical cases of myocardial infarction admitted to hospital in Fiji in 1969–72 and in 1979–81

Risk factor	Number of cases in	
	1969–72[a] (*n* = 300)	1979–81[b] (*n* = 269)
Family history of ischaemic heart disease	7	24
Hypertension	21	35
Smoking	56	67
Diabetes mellitus	18	25
High serum cholesterol	49	35
Physical activity by:		
Heavy manual workers	27	10
Light manual workers	13	14
Sedentary workers	27	68
Others and unknown	33	8

[a] Data from B. Pathik & P. Ram, 1974 (ref. 7).

[b] Data from P. Ram, V. Naidu, & J. Naseroa (personal communication, 1982).

lence rates in Fiji Indians are one of the highest in the world literature, following those of the Micronesian Nauruans and the Pima Indians (*3*).

The serum cholesterol levels, however, were relatively low in this survey, compared with mean levels in the industrialized nations, i.e., they were in the range 4.8–5.2 mmol/l in the various subgroups. There was no clear difference in the mean serum cholesterol values between males and females.

Smoking. Accurate statistics on smoking are difficult to obtain, but there are a small number of people who smoke home-grown tobacco. A local cigarette factory was opened in 1956, and since the early 1960s tobacco has been grown in two areas in Fiji. It is estimated that 20–25% of the adult population (males and females together) smoke an average of 12 cigarettes daily. The livelihood of 10 000 persons is dependent on the tobacco industry. Cigarette sales have increased considerably since 1956, as shown below:

Year	*No. of cigarettes sold* ($\times 10^6$)
1956	150
1960	255
1966	295
1971	320
1976	470
1981	559

This increase in cigarette sales since 1956 amounts to 273%, during which period the population increased by 88%.

Physical activity. There appears to be a trend towards less physical activity in the community, as indicated by two measurable indices, i.e., the number of kilometres of roads and the number of registered vehicles. The former increased by 103% (1625 km in 1960, 3300 km in 1980) and the latter by 497% (7932 in 1960, 47 301 in 1980) (data from Government Press of Fiji, 1981). The vehicles included those used primarily for transport (private cars 525%, taxis 181%, buses 196%, and motor cycles 8900%) and those for agricultural purposes (tractors 339%). The population increase in this period was 62%. Diabetes prevalence rates were higher in both Indian and

Table 9. Percentage prevalence rates[a] of diabetes mellitus and hypertension in 1980 in various study areas in Fiji, by race

Ethnic group	No. examined	Prevalence of diabetes (%)			Prevalence of hypertension[b] (%)		
		IGT[c]	DM[c]	IGT + DM	Males	Females	Both sexes
Melanesians:							
Rural	477	7.1	1.1	8.2	2.0	8.4	5.1
Urban	863	10.4	5.4	15.8	7.6	9.2	8.4
Lakeba	430	4.7	5.7	10.4	10.6	9.5	9.9
Indians:							
Rural	452	9.9	11.7	21.6	7.2	5.8	6.7
Urban	846	10.4	11.8	22.2	8.8	8.4	8.6

[a] Age standardized to 1976 Fiji census.

[b] Systolic pressure at least 160 mmHg (21.3 kPa) and/or diastolic pressure at least 95 mmHg (12.7 kPa).

[c] IGT = impaired glucose tolerance; DM = diabetes mellitus.

Melanesian males with a sedentary occupation, compared to those with heavy physical activity (*4*).

Urban drift. In the last 25 years there has been a marked trend towards urbanization and a modern life-style with the associated social and health consequences. In 1956, there were 63 309 (18%) people living in urban and periurban areas; the percentage of urban dwellers increased to 33.4% in 1966, 37.2% in 1976, and 39.7% (258 250) in 1981. In other words, two out of every five citizens are now living in urban or periurban areas. The effect of urban drift is most marked in the capital city of Suva and its suburbs, the population of which increased from 37 381 in 1956 to 144 366 in 1981 (an increase of 286%), while the population of the whole country increased by 88% during this period.

DISCUSSION

The data presented above show that diabetes and cardiovascular diseases are major public health problems in Fiji today. In the following respects the death rates in the adult population of Fiji resemble those in many developed countries: the male to female ratio is approximately 3:1 for deaths from ischaemic heart disease; the excess mortality from cardiovascular diseases not only affects old persons, but has a relatively greater toll among the middle-aged (40–59 years age group), thus causing serious social and economic problems; and thirdly, ischaemic heart disease is the most important single cause of death within the CVD group. It has not been possible to study the mortality variations during the preceding decades because limited data are available and the numbers per year are so small that comparisons between the years are difficult to interpret precisely.

Previously studies in Fiji have shown that hypertension, diabetes mellitus, high serum cholesterol, and smoking are common findings in patients with acute myocardial infarction (*7*, *8*).[c] The epidemiological survey carried out in 1980 to assess the prevalence of diabetes, cardiovascular diseases, and their risk factors confirmed that an unhealthy life-style has become more common in the country with the involvement of several CVD risk factors in early adulthood. As a result, the benefits of an increased life expectancy from the decreasing infant and childhood mortality are being lost. A prospective study should now be carried out to provide information regarding both the etiological factors and the true incidence of diabetes and cardiovascular diseases in Fiji.

The accuracy of the diagnoses in the death certificates is always a very problematic issue. It has, however, been shown that despite random variation due to insufficient data, the diagnosis in a large series gives a satisfactory overall picture. There are several reasons to believe that the results presented in this article do not overemphasize CVD mortality. If some cases among the "medically non-certified" group were missed, the true figures of deaths from diabetes and cardiovascular disease would be even higher. The majority of deaths were medically certified and a few cases of non-certified deaths were classified as diabetes and CVD. A recent study on sudden deaths in Fiji indicates that as many as 65% of such cases are related to ischaemic heart disease (*9*). Also, hospitals in Fiji have been investigating and treating more patients with diabetes and cardiovascular diseases as a result of improved diagnosis, which may be one reason for the mortality changes observed. However, this does not solve the problem of making further improvements in the accuracy of the diagnoses and the stated causes of death in death certificates.

Much of the mortality from noncommunicable diseases in Fiji is related to two major disorders: hypertension and diabetes. There are approximately 600 CVD deaths annually among the population aged 20–59 years, most of which could be considered to be a consequence of hypertension and diabetes. It is likely that more than half of these premature deaths could have been saved by preventing or controlling diabetes and hypertension.

Previous epidemiological studies have shown that blood pressure levels are similar among both races, or the Melanesians might even have higher levels (*10*). Thus it was not surprising to see that the mortality rates follow the same pattern. Since the serum cholesterol levels do not seem to be different between the races, it is possible that the different diabetes rates may contribute to some extent towards the high mortality from ischaemic heart disease among Indians. Unfortunately, there are so far no reliable data about the clinical manifestations of diabetes mellitus in relation to possible racial differences. The best possibility to obtain this information would be a longitudinal follow-up of the 1980 survey sample. The follow-up study could also give an answer to the question, "how much does diabetes really contribute to CVD mortality in Fiji?", because unfortunately this cannot be studied with information from the basic death certificates. Racial differences in the prevalence and risk factors of diabetes and cardiovascular diseases were studied in the 1980 survey and will be reported in detail elsewhere.

Hospital admissions due to diabetes and CVD (except rheumatic heart disease) have increased dramatically during the past 20 years. Admissions relating to diabetes have increased linearly during the period and followed the pattern of overall hospital admissions in the country. At the same time, CVD ad-

[c] PATEL, R. *Acute myocardial infarction in Fiji. Review of 100 patients admitted to Lautoka Hospital.* (Unpublished, 1981).

missions have increased exponentially, especially during the 1970s.

Most remarkable is the situation with regard to the trend in the admissions for ischaemic heart disease. A careful analysis of this change is needed but we are able to make here only certain inferences because of limitations in the data, unknown diagnostic criteria, etc. We know that the age structure of the population in Fiji is changing, infant and childhood mortality is decreasing, and thus the proportion of middle-aged and elderly age groups in the population is increasing. A fall in morbidity and mortality in childhood will naturally lead to increasing numbers of diseased persons and deaths as the full limits of the advantage of this fall are taken up. Our results show, however, that the increased admission rates for ischaemic heart disease could not be explained only by aging of the population, since these admission rates increased in the same way in various age groups from 1973 to 1979.

The increase in the diabetes prevalence rates was seen only in the age groups over 40 years (*11*). Regarding diabetes admissions, there were changes in both the diagnostic criteria and also the policy for admissions in the main hospitals during the period of study; previously, many uncomplicated cases were admitted to hospital, whereas at present the major concern is with diabetic complications which are rare in persons under the age of 40 years. The prevalence rates of diabetes seem to increase linearly among both races, but in fact the relative increase among Melanesians is much steeper than among Indians. A part of the increase could be explained by the changing age structure, e.g., the population is living longer, especially among the Indians.

A recent autopsy study (*9*) indicated that atherosclerosis was about equally common in both races. Clinical ischaemic heart disease and presence of atherosclerosis may be related but are not the same thing; it is known that the majority of people over 40 years of age have atherosclerotic lesions of some degree in their coronary arteries (*12*).

In 1979 there were 1620 admissions with ischaemic heart disease. If we assume that each patient with this disease makes, on the average, annually two (in-patient) visits to hospital and that about 10% of these patients had been wrongly diagnosed, it follows that the 1620 admissions in 1979 could be accounted for by 730 patients. The number of deaths from ischaemic heart disease recorded in 1980 in Fiji was 304, which is about 42% of 730. In another study, it was reported that 50% of all acute myocardial infarction patients die during the one year following the attack (*13*).

Thus, it is probable that the most recent figures for hospital admissions and deaths from ischaemic heart disease reflect the real situation in Fiji. The reason for the marked increase in these hospital admissions from one year to another, even between 1977 and 1980, which cannot be seen in the preliminary mortality statistics, is unclear. This may be due to a reservoir of such patients who, for one reason or another, did not in past years use the hospital services, although coronary heart disease was common at that time. On the other hand, changes in diagnostic fashions are certain to be reflected in the reported hospital admission rates.

The results presented here show that the hospital admission rates for rheumatic heart disease have clearly been declining, but there are limitations in these data. Nevertheless, efforts to prevent and control rheumatic fever and rheumatic heart disease in Fiji must continue. Such efforts have been found feasible and effective in many other countries.

In the past, the hospital-oriented approach did not prove to be effective in controlling cardiovascular diseases and diabetes in other countries. Careful planning of health services and rational use of the existing resources in a preventive approach are needed. At present in Fiji, approximately 5000 hospital admissions are due to diabetes and cardiovascular diseases every year. However, only limited preventive measures have been implemented so far. Reallocation of the existing resources is required because it is the only cost-effective solution to the problem. The curative approach has other drawbacks in Fiji where the follow-up and health education of patients are poorly organized. There is also a high degree of non-compliance among patients to follow the recommended treatment. On the other hand, there is great interest in prevention in various sectors of society in Fiji, including the health sector at all levels. This is a promising development because it is known that these diseases are preventable even at the community level (*14*).

RÉSUMÉ

LES MALADIES CARDIO-VASCULAIRES ET LE DIABÈTE SUCRÉ À FIDJI: ANALYSE DE LA MORTALITÉ, DE LA MORBIDITÉ ET DES FACTEURS DE RISQUE

Dans les populations urbaines des îles du Pacifique, le diabète sucré, l'hypertension et les maladies cardio-vasculaires ont atteint les proportions d'une épidémie. Il a été difficile jusqu'à présent d'obtenir des renseignements

fiables sur l'incidence de ces maladies et les taux de mortalité qui leur sont imputables dans le Pacifique.

Fidji est un pays du Pacifique où les statistiques démographiques et les dossiers hospitaliers peuvent être considérés comme suffisamment fiables pour permettre une analyse longitudinale. Néanmoins, il n'a pas toujours été possible de vérifier les données.

La population de Fidji appartient essentiellement à deux groupes ethniques: les Indiens (52%) et les Mélanésiens (43%). La population totale représente presque 600 000 habitants, dont 95% vivent sur les deux îles principales.

La mortalité imputable aux maladies cardio-vasculaires a pratiquement doublé depuis 20 ans. En 1978, elle était de 30,3% pour tous les âges et de 47,4% pour le groupe d'âge de 50 à 59 ans. Le taux de mortalité par maladies cardio-vasculaires était plus élevé chez les Indiens que chez les Mélanésiens dans tous les groupes d'âge. Les principales causes de mortalité par maladies cardio-vasculaires étaient les cardiopathies ischémiques chez les Indiens et d'autres cardiopathies chez les Mélanésiens (essentiellement cardiopathies valvulaires et insuffisance cardiaque).

La part des cardiopathies ischémiques dans la mortalité imputable aux maladies cardio-vasculaires est supérieure dans le groupe d'âge de 40 à 49 ans (48%) et plus élevée chez les hommes (35,5%) que chez les femmes (21,3%). Entre 1971 et 1980, les taux de mortalité par cardiopathies ischémiques ont augmenté de manière analogue dans les deux races et dans les différents groupes d'âge (20–39, 40–59, 60+).

En 1978, le taux de mortalité due au diabète sucré était deux fois plus élevé chez les Indiens que chez les Mélanésiens. Le taux de mortalité imputable au diabète, de 6%, atteint un pic de 10,7% pour le groupe d'âge de 40 à 49 ans.

Le nombre total d'admissions dans les hôpitaux a été multiplié par 2,7 entre 1960 et 1979. Pour la même période, les admissions pour maladies cardio-vasculaires ont été multipliées par 7,5 et les admissions pour diabète par 3,2. L'augmentation la plus marquée a été celle des admissions pour cardiopathies ischémiques (dont le nombre a été multiplié par 11,8).

Les taux d'admissions pour cardiopathies ischémiques et pour diabète ont augmenté entre 1973 et 1979, chez les hommes comme chez les femmes, dans les groupes d'âge de 40 à 59 ans et de 60 ans et plus. L'augmentation relative du taux d'admissions pour diabète a été plus marquée chez les Mélanésiens que chez les Indiens, alors que l'augmentation des admissions pour cardiopathies ischémiques a été la même dans les deux groupes ethniques.

L'enquête sur le diabète et les maladies cardio-vasculaires réalisée à Fidji en 1980 a montré que la prévalence du diabète était très élevée chez les Indiens (11,7%) mais aussi relativement élevée chez les Mélanésiens des villes (5,4%). La prévalence de l'hypertension est analogue pour les deux groupes ethniques et pour les deux sexes. La mortalité par maladies non transmissibles est essentiellement imputable à ces deux affections: l'hypertension et le diabète. Sur près de 600 décès survenus dans la population fidjienne âgée de 20 à 59 ans, plus de la moitié auraient sans doute pu être évités par la prévention du diabète et de l'hypertension.

Malgré les limites de ce type d'analyse rétrospective, notamment en ce qui concerne les admissions hospitalières, il est évident qu'à Fidji, le traitement des maladies cardio-vasculaires et du diabète mobilise une proportion croissante des services de santé, et en particulier des services hospitaliers. Aussi une planification attentive et une réorientation des services de santé dans le sens de la prévention et de la lutte contre ces maladies non transmissibles chroniques sont-elles nécessaires.

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