

Divergent mortality trends by ethnicity in Fiji

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Fiji has been experiencing the demographic and epidemiological transitions for some time with declines in mortality and fertility, and changes in major causes of death from under-nutrition and communicable disease to non-communicable disease (NCD) and injury.^{1,2} During the epidemiological transition, many Anglo-Celtic and northern European countries, as well as Australia and New Zealand, experienced real increases in age-specific mortality from NCDs – especially cardiovascular disease (CVD)^{3,4} and injury – that were of sufficient magnitude to slow, plateau or even reverse improvement in life expectancy (LE).⁵⁻⁷ A reduction in population risk factors and mortality from CVD, and consequent declines in premature adult mortality, have produced significant

increases in LE since 1970 in Australia and New Zealand.⁶⁻¹⁰

Fiji is a multi-ethnic society composed of i-Taukei, formerly indigenous Fijians, Fiji Melanesians, or Fijians (56.8%); Fijians of Indian descent, formerly Indo-Fijians or Indians (37.5%); and 'Others', consisting of Chinese, European, part-European, Rotuman, other Pacific Islanders and all other nationalities (5.7%); with a population at the 2007 Census of 837,271.¹¹ NCDs such as CVD and diabetes have been documented as public health concerns since the 1970s.^{12,13} A stagnation in LE has been demonstrated in Fiji since the 1980s, and the relatively low infant mortality rate (IMR), considerable adult mortality, and increasing proportional mortality from CVD suggest this is largely due to chronic NCDs.^{1,14}

Abstract

Objective: To examine trends in infant mortality rate (IMR), adult mortality and life expectancy (LE) in the two major Fijian ethnic groups since 1975.

Methods: Estimates of IMR, adult mortality (15–59 years) and LE by ethnicity are calculated from previously unreported Fiji Ministry of Health data and extracted from published sources.

Results: Over 1975–2008: IMR decreased from 33 to 20 deaths/1,000 live births in i-Taukei (Fiji Melanesians); and 38 to 18 in Fijians of Indian descent. Increased adult male mortality among i-Taukei and decline among Fijians of Indian descent led to an equal probability of dying in 2007 of 29%; while in female adults the probability trended upwards in i-Taukei to 25%, and declined in Fijians of Indian descent to 17%. Life expectancy in both ethnicities increased until 1985 (to 64 years for males; 68 for females) then forming a plateau in males of both ethnicities, and Fijian females of Indian descent, but declining in i-Taukei females to 66 years in 2007.

Conclusions: Despite IMR declines over 1975–2008, LE for i-Taukei and Fijians of Indian descent has not increased since 1985, and has actually decreased in i-Taukei women, consistent with trends in adult mortality (15–59 years). Mortality analyses in Fiji that consider the entire population mask divergent trends in the major ethnic groups. This situation is most likely a consequence of non-communicable disease mortality, requiring further assessment and a strengthened response.

Key words: infant mortality, adult mortality, life expectancy, Fiji, non-communicable disease

Aust NZ J Public Health. 2013; 37:509-15
doi: 10.1111/1753-6405.12116

Submitted: March 2013

Revision requested: June 2013

Accepted: July 2013

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This study expands on the Carter et al.¹ analysis of population-wide mortality trends in Fiji, published in 2011, by examining ethnic-specific trends and differences in IMR, adult mortality (15–59 years) and LE since 1975 in the two major ethnic groups in Fiji, compared to Australia and New Zealand. Priority groups are established (by age, sex and ethnicity) for further investigation of cause of death and strengthening of prevention and control responses.

Methods

Data Collection

IMR, adult mortality (probability of dying 15–59 years or $_{45}q_{15}$), and LE at birth (e_0) for i-Taukei and Fijians of Indian descent are obtained from three sources: (1) unpublished death recording data from the Fiji Ministry of Health (MoH) for 1997–2008 (unit records) segmented into triennia; (2) previous analysis of MoH data by the South Pacific Commission (SPC) for 1981–1983;^{15,16} and (3) estimates from Fiji Censuses (1976, 1986, 1996).^{17–19} Census estimates of under-five mortality (${}_5q_0$) are calculated by a combination of indirect estimation using the children ever born and surviving technique, supplemented by direct estimation from questions concerning the date of birth and survival of the most recent child born (partial birth history); and estimates of IMR are derived from under-five mortality.^{17–19} A previous review of mortality in Fiji demonstrated that these are the most reliable sources of data.^{1,14} Mortality estimates by ethnicity have not been released from the most recent Fiji Census in 2007. Comparative mortality rates from 1970 for Australia and New Zealand are based on data from the Australian Bureau of Statistics²⁰ and Statistics New Zealand,²¹ aggregated over triennia to reduce stochastic variation.

Analysis

IMR is calculated from MoH death recording by dividing deaths <1 year by MoH registered births for the same period, with data grouped into triennia to reduce stochastic variation. An exponential trend is fitted to the IMRs derived from vital registration^{15,16} and Censuses.^{17–19}

The Brass Growth Balance method²² using age group 37–74 years as selected for optimal age trims and fit to local data²³ is employed to assess completeness of enumeration by ethnicity. A previous study of Fiji mortality for all ethnicities combined (over three triennia 1996–2004) using this method indicated a completeness of ≥95% (except for females 2002–2004 of 85%).¹ In the present analysis, completeness for i-Taukei (both sexes) based on the Brass method is ≥95% (except for males 2003–05 of 92%). The Brass analysis²² for Fijians of Indian descent produced implausible results (66% completeness), probably due to violation of the closed population assumption as a consequence of the considerable out-migration of this ethnic group over the period of study. The population of Fijians of Indian descent declined by 7.4% over 1996–2007, while the population of i-Taukei increased by 20.1%.²⁴ It is reasonable to assume that completeness of death registration in Fijians of Indian descent was comparable to i-Taukei, and no adjustments to the recorded death data are undertaken. The ‘Others’ ethnicity category is not analysed in the current study as it is very diverse and constituted only 5.7% of the total Fijian population at the 2007 Census.¹¹

Adult mortality (15–59 years), expressed as the probability (%) of dying during this period ($_{45}q_{15}$), is calculated from one less the multiplication of the life table probabilities of surviving (${}_np_x$) between ages x and $x+n$, as a percentage. That is:

55–59

$_{45}q_{15} = [1 - \prod ({}_np_x)] * 100$ where n is the age interval (5 years) and x is the age range.

15–19

Table 1: Infant mortality, adult mortality and life expectancy by ethnicity in Fiji.

Period (years)	Infant mortality		Adult mortality				Life expectancy			
	i-Taukei		Indians		i-Taukei		Indians		i-Taukei	
	M/F	M/F	M	F	M	F	M	F	M	F
1976 ^a	33	38	27	22	29	25	61	64	60	62
1982 ^{b,c}	25	29	27	21	37	26	63	65	60	64
1986 ^a	20	22	25	21	32	21	65	69	65	69
1995–97 ^a	26	19	26	20	29	19	65	68	64	69
1996–98 ^c	20	21	25	21	33	20	65	67	63	69
1999–2001 ^c	22	25	25	22	33	18	65	67	63	69
2002–04 ^c	19	17	26	23	31	18	65	67	64	69
2005–08 ^c	20	18	28	25	29	17	65	66	64	70

Notes:

a Indirect demographic estimates from censuses

b Adjusted data (SPC)

c MoH death data

Infant Mortality: rate (per 1,000 live births)

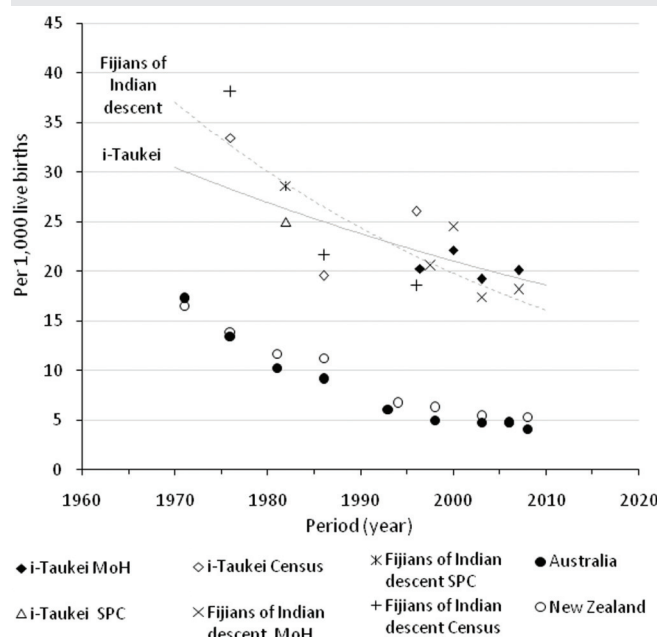
SPC: Secretariat of the Pacific Community; Adult Mortality: (15–59 years) probability of dying (%); MoH: Ministry of Health, Fiji;

Life Expectancy: at birth. M: male; F: female.; Indians: Fijians of Indian Descent

Adult mortality ($_{45}q_{15}$) by sex for i-Taukei and Fijians of Indian descent, and for Australia and New Zealand, is plotted for 1970–2009. A regression using a quadratic function is fitted to smoothed data (based on a two point average of estimates – not shown) to display secular trends for i-Taukei and Fijians of Indian descent.

Ethnic specific life tables and LE at birth are obtained from previous demographic analyses of Census data^{17–19} based on child mortality (see above) and adult mortality calculated using the Orphanhood technique. Ethnic specific life tables are calculated²²

Figure 1: Infant mortality rate by ethnicity in Fiji, and Australia and New Zealand, 1975–2008.



Notes:

MoH: Ministry of Health

Source: Australia²⁰; New Zealand²¹; SPC: Secretariat of the Pacific Community¹⁵
Census: 1976¹⁷; 1986¹⁸; 1996¹⁹

from MoH vital registration recorded deaths from 1995, and were previously calculated from adjusted vital registration data in the mid 1980s,¹⁶ with denominator populations obtained from SPC.²⁵ A quadratic regression is fitted, using life expectancy data by sex from all sources for i-Taukei and Fijians of Indian descent, to display secular trends compared to Australia and New Zealand.

Results

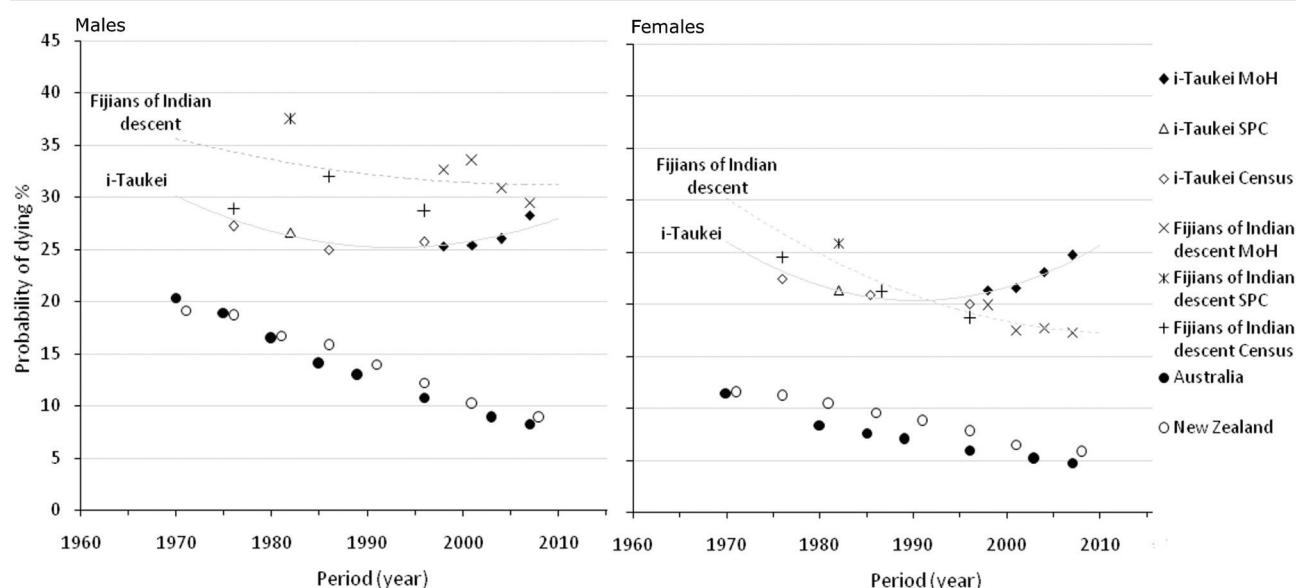
Infant mortality

IMR decreased over 1976–2007 from 33 to 20 deaths per 1,000 live births in i-Taukei and from 38 to 18 deaths/1,000 in Fijians of Indian descent, with the previously lower IMR for i-Taukei exceeding the IMR among Fijians of Indian descent since 2000. Australia and New Zealand IMR declined over a similar period from 17 to 5 deaths/1,000 (Figure 1); however, there has been little change over the past decade.

Adult mortality

Adult mortality (15–59 years) in male i-Taukei has not declined since 1975. The recent decline in male mortality among Fijians of Indian descent coupled with increasing male mortality among i-Taukei resulted in equivalent probabilities of dying in 2007 of 29% for both ethnicities (Figure 2). Adult mortality in female i-Taukei has trended upwards since 1995 to reach 25% in 2007, while the trend in Fijian females of Indian descent progressively declined from 25% to 17% over 1976–2007. In Australia and New Zealand, adult mortality declined over a similar period from 19% to 9% in males and from 11% to 5% in females (Figures 2 and 3). While there is the expected sex differential in adult mortality of Fijians of Indian descent, the sex differential in i-Taukei is rapidly narrowing because of increases in female mortality (Figure 2).

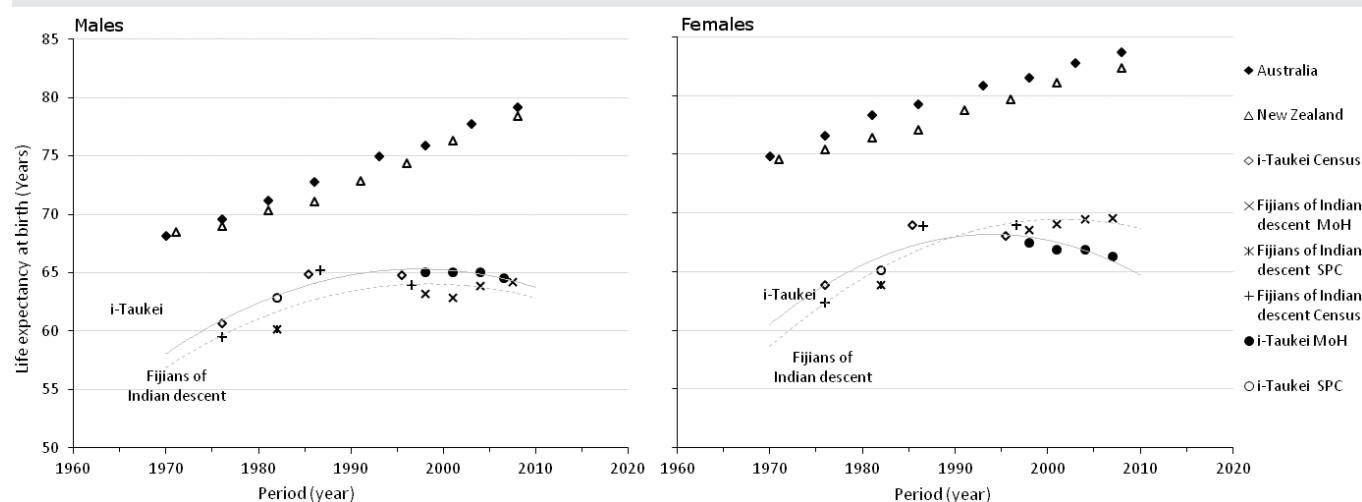
Figure 2: Adult (15–59 years) mortality by ethnicity in Fiji, and Australia and New Zealand, 1975–2008.



Notes:

MoH: Ministry of Health

Source: Australia²⁰; New Zealand²¹; SPC: Secretariat of the Pacific Community¹⁶; Census: 1976¹⁷; 1986¹⁸; 1996¹⁹

Figure 3: Life expectancy at birth by ethnicity in Fiji, and Australia and New Zealand, 1975–2008.**Notes:**

MoH: Ministry of Health

Source: Australia²⁰; New Zealand²¹; SPC: Secretariat of the Pacific Community¹⁶; Census: 1976¹⁷; 1986¹⁸; 1996¹⁹**Life expectancy**

LE at birth for both ethnicities increased between 1976 and 1985, reaching 64 years for males and 68 years for females. It then reached plateaus in males (both ethnicities) and Fijian females of Indian descent, and progressively declined in female i-Taukei (to 66 years in 2007) in line with increases in adult mortality. In Australia and New Zealand, over a similar period, LE at birth increased from 69 to 79 years in males and from 76 to 83 years in females (Figure 3).

Discussion

Despite consistent decline in IMR during 1975–2007, LE in i-Taukei and Fijians of Indian descent did not increase after 1985, and decreased in i-Taukei women. Trends in adult mortality (15–59 years) for both sexes and ethnic groups showed decline until the 1980s, after which mortality in i-Taukei increased – especially in females – and mortality in Fijians of Indian descent stagnated in males, but continued to decline in females. The findings in this study are consistent with a previous report of mortality in Fiji for all ethnicities, which showed stagnation in LE at a relatively low IMR, and significant adult mortality in both sexes,^{1,14} and more recent modelled estimates of IMR for all ethnicities.²⁶ This study adds important information on the diversity of mortality and LE trends by ethnic group in Fiji, particularly: the steeper IMR decline in Fijians of Indian descent compared to i-Taukei; increasing adult mortality trends in i-Taukei, especially females; and flattening in LE trends for both ethnicities.

Measures of mortality in i-Taukei and Fijians of Indian descent used in this study are obtained from two sources: previously unpublished data derived from unit record mortality for 1996–2008 from the Fiji MoH; and published reports on mortality from 1970–2008 by local and international agencies. The sources of mortality by ethnicity are considerably fewer than those available

for mortality of all ethnicities in Fiji.^{1,14} Caution must be taken when interpreting data obtained from locations where data quality may be questionable. Previous review of mortality sources has established that Fiji MoH death registration data for 1996–2008 is mostly 95% complete;^{1,14} previous assessment of MoH death registration was conducted according to the Brass method and is consistent with other estimates. The demographic analyses of the 1976, 1986 and 1996 Censuses can be considered as credible sources of mortality data.^{1,14}

Considerable out-migration of Fijians of Indian descent over the period of study would explain the implausibly low estimates for completeness of registration (average 66%) for this ethnicity from the Brass calculations²² that assume a closed population. It is not tenable to adjust mortality upwards for Fijians of Indian descent based on calculations involving such an obvious violation of an assumption of the method, and there is no evident reason why deaths of Fijians of Indian descent would be differentially under-ascertained by the MoH data system. Differential out-migration by socioeconomic group of Fijians of Indian descent may affect the aggregate mortality of non-migrants. While the more educated and affluent have greater opportunity to migrate, the duration of the epidemic of cardiovascular disease and diabetes in Fiji would suggest that all socioeconomic groups are involved, and it is unlikely that out-migration of a more susceptible group would explain the recent modest decline in adult mortality of Fijians of Indian descent. None of these issues affect the findings related to i-Taukei.

Studies of IMR in Fiji from the latter half of the 20th century noted a clear – though diminishing – ethnic differential in IMR, with higher IMR in Fijians of Indian descent.^{17,27–29} Factors suggested to be associated with this ethnic differential included: 6% of i-Taukei babies being born at a low birth weight (LBW), defined as <2,500 grams, in 1970 compared to approximately 25% of Fijian babies of Indian descent;³⁰ and longer periods of breastfeeding in i-Taukei, with median duration of 10.4 months compared with 5.2 months

among Fijians of Indian descent in 1974.³¹ Comparison of the 1993 and 2004 Fiji National Nutrition Surveys show the proportion of LBW newborns in i-Taukei increased from 4.2% to 7.7%, while during the same period it decreased from 21.2% to 18.8% in Fijian newborns of Indian descent.³² Comparison of breastfeeding trends in the 1993 and 2004 surveys identify an increase among Fijians of Indian descent from 4.1 to 6.7 months, while among i-Taukei the duration of breastfeeding remained constant at around 9 months.³² Recent trends in LBW and breastfeeding practices by ethnicity are consistent with IMR findings in the present study.

The extent of adult mortality (15–59 years) in Fiji strongly suggests that premature death from NCDs is a major public health issue among i-Taukei and Fijians of Indian descent, and is contributing to stagnation and declines in LE at birth. NCDs have been documented as a leading cause of morbidity and mortality in Fiji for the past three decades^{29,33–35} with proportional mortality (PM) from CVD increasing from below 20% of deaths in 1960 to more than 44% in 2010.^{1,14} The PM for communicable diseases during a similar period showed no significant trend fluctuating between 5–12%.^{1,14} For 2010, the top three reported causes of mortality in Fiji were diseases of the circulatory system (44%); endocrine, nutritional and metabolic diseases (13%); and neoplasms (10%).³⁵

Variation exists between i-Taukei and Fijians of Indian descent concerning the period in which NCDs emerged as a leading cause of morbidity and mortality. Hospital admission data collected by the MoH indicated that throughout the 1960s and 1970s the three leading causes for hospitalisations in i-Taukei were infections and parasitic diseases, conditions originating in the perinatal period and diseases of the respiratory system.³⁶ By comparison, among Fijians of Indian descent diseases of the circulatory system had become the second leading cause for hospital admissions by 1975, with diseases of the respiratory system and communicable diseases no longer leading causes by the late 1970s.³⁶

Ethnic differentials in NCD prevalence in Fiji have been documented in numerous surveys and studies since the 1960s.^{33,37–42} The first diabetic survey was undertaken in Fiji in 1964–65 of 1,000 i-Taukei adults and the same number of Fijians of Indian descent in the urban setting, and 410 hospital admissions. The survey indicated that diabetes prevalence in both sexes combined was higher in Fijians of Indian descent (5.7%) compared to i-Taukei (0.6%).³⁹ Fifteen years later, the Fiji National Diabetes and Cardiovascular diseases survey in 1980 reported that while diabetes prevalence by ethnicity in both sexes combined remained distinctly higher in Fijians of Indian descent, the rate of increase over time was greatest in i-Taukei. Comparison of the 1965 and 1980 surveys identified an increase in diabetes prevalence of around three-fold in Fijians of Indian descent and 25-fold in i-Taukei.³³ A similar pattern was noted in relation to CVD, which had a higher death rate (per 100,000 population, all ages) in Fijians of Indian descent than i-Taukei throughout the 1970s, although there was a greater rate of increase during 1970–80 among i-Taukei (plus 42%) compared with Fijians of Indian descent (plus 32%).³³

A changing way of life, associated with urbanisation and modernisation, has been identified as a major factor contributing to the rise in NCD morbidity and mortality in Fiji, due to associated changes in exercise, diet and consumption patterns, including tobacco use.^{37,40,43–45} The proportion of the Fijian population living in urban areas increased over the past two decades from 38% at the 1986 Census to 51% at the 2007 Census.^{11,18} Epidemiological studies conducted in Fiji since the 1960s have identified that these changes are associated with considerable prevalence of NCDs and their associated risk factors in the urban population, such as high salt intake, physical inactivity, atherogenic dyslipidemia, obesity, hypertension and diabetes.^{2,41,45–47}

An analysis of NCD risk factors in Fiji by ethnicity this century³⁴ identified higher prevalences among the i-Taukei population compared with Fijians of Indian descent, which is consistent with increasing mortality trends in i-Taukei adults (15–59 years). The 2002 Fiji STEPS survey reported that for most NCD risk factors examined there was a higher prevalence amongst i-Taukei compared with Fijians of Indian descent,³⁴ with the largest ethnic differences in tobacco use (current smokers: i-Taukei 45%; Fijians of Indian descent 24%) and alcohol consumption (proportion of current drinkers who binge drink: i-Taukei 89%; Fijians of Indian descent 61%). The i-Taukei population also had a higher prevalence of obesity (almost double that of Fijians of Indian descent) and hypertension (21% in i-Taukei, 16% in Fijians of Indian descent). NCD and risk factors more prevalent in Fijians of Indian descent than i-Taukei were insufficient physical activity participation averaged over work, transport and leisure (i-Taukei 42%; Fijians of Indian descent 51%), and diabetes prevalence (i-Taukei 12%; Fijians of Indian descent 21%).³⁴

The 2002 Fiji STEPS Survey³⁴ also identified gender differentials in NCD risk factors, with tobacco and alcohol consumption and elevated blood cholesterol higher among males of both ethnicities than females. Prevalence of diabetes was comparable between genders in Fijians of Indian descent (22.1% in males, 20.2% in females), while among i-Taukei the female rate (14.8%) was almost double that of males (8.3%). For both ethnicities, prevalence of obesity (BMI ≥ 29.9) was more than three times greater in females (32% in i-Taukei; 15.8% in Fijians of Indian descent), compared to males (11.3% in i-Taukei, 5.9% in Fijians of Indian descent).³⁴

In addition to LE in Fiji (males and females),¹ a plateau – and in some cases, a decline – in life expectancy (at birth) between 60–69 years over the last two decades is also observable in the Cook Islands (males),^{48,49} Tonga (males),^{50,51} and Kiribati (females);^{52,53} and between 50–59 years in Kiribati males^{52,53} and Nauru (males and females).⁵⁴ In these countries, premature adult mortality from NCD and injury appear to play important roles.^{1,54,55}

Pacific people in New Zealand (n=266,000) at the 2006 Census⁵⁶ (based on self-designated ethnicity) were: Samoan (49%); Cook Island Maori (22%); Tongan (19%); Niuean (8%), Fijian (4%); and others. Religious affiliation suggests that those of self-designated Fijian ethnicity are overwhelmingly Fiji Melanesians (i-Taukei).⁵⁷

Life expectancy (at birth) in 2006 of Pacific people in New Zealand was 74 years for males and 79 for females –more than four years lower than that of the NZ population.⁵⁸ All age mortality (age-standardised) in Pacific people were intermediate between Maori and European/others from 2000–04 data, with 10–14% annual decline (less than other major ethnic groups) from 1981–84.⁵⁹ Pacific Islanders have been described as ‘statistically invisible’ in Australia, because many have migrated from or through New Zealand, and are identified in Australian Census data as New Zealanders.⁶⁰ Further, many people self-identifying as of Indian origin were born in Fiji and do not identify as Pacific Islander.

While developed countries such as Australia and New Zealand have experienced a declining trend in mortality from NCDs through changes in diet, tobacco smoking, and improved medical care,^{8,9} trends in NCDs and their associated risk factors in Fiji continue to increase.^{1,35} This study identifies – through examination of sex and ethnic differentials in premature adult mortality – that i-Taukei, especially females, may be the highest risk group for NCDs in Fiji. While public health interventions aimed at prevention and control of NCDs are being expanded across the entire Fijian population,⁶¹ additional interventions targeting i-Taukei may be necessary. Mortality analyses in Fiji that consider the entire population only mask divergent trends in the major ethnic groups.

Acknowledgements

The authors would like to thank Iris Wainiqolo from the College of Medicine, Nursing & Health Sciences, Fiji National University, and Naomi Jayaratne and Claire Mowry from the School of Population Health, University of Queensland, for their contribution in gathering data from published sources to that were analysed in this article.

Funding

Funding for this work was provided under an AusAID Australian Development Research Award (Grant no: 44738).

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