

Original investigation

Declines and Plateaux in Smoking Prevalence Over Three Decades in Fiji

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Abstract

Objectives: To examine trends from 1980 to 2011 in daily tobacco smoking by sex, ethnicity, age, and urban/rural in Fiji Melanesian (i-Taukei) and Indian adults aged 25–64 years.

Methods: Unit record data from five population-based surveys ($n = 14\,528$) allowed classification of participants as: (1) never-smoker, ex-smoker, or non-daily smoker; or (2) daily smoker, reporting smoking <20 or ≥ 20 tobacco products (cigarettes/cigars/pipes) a day. Trends were examined using spline analyses.

Results: Over 1980–2011 the prevalence of reported daily tobacco smoking decreased significantly in both sexes and ethnicities, with the greatest decline during 1980–2000. Declines were from 81.7% to 27.0% in i-Taukei men; 55.3% to 26.3% in Indian men; 48.1% to 9.5% in i-Taukei women; and 13.8% to 1.3% in Indian women ($p < .0001$). Declines were consistent across all age groups in men, while there were greater declines among older age groups in women; and greater declines from higher prevalences in rural compared to urban areas in both sexes and ethnicities. Smoking ≥ 20 tobacco products per day declined significantly in i-Taukei men from 8.0% to 1.9% ($p < .0001$); there were also declines in Indian men (4.6% to 2.0%) and i-Taukei women (2.6% to 0.6%), but these were not statistically significant; and Indian women remained $<0.2\%$ throughout the period.

Conclusions: Significant declines in daily tobacco smoking have occurred in Fiji in both sexes and ethnicities during the past 30 years, which is consistent with declines in tobacco apparent consumption and household expenditure. However, prevalence remains high in men at around 27% in 2011, with plateau at this level in i-Taukei.

Implications: This is the first study to show nationally representative population trends in tobacco smoking in a developing country over such a long period (>30 years) based on empirical unit record data ($n = 14\,528$). Cardiovascular disease is a leading cause of mortality throughout the Pacific Island region. This is the first study to show evidence of substantial declines over several decades in a cardiovascular disease risk factor in a Pacific Island country, and provides important evidence for further research into the interventions and events which may have facilitated this decline.

Introduction

The Republic of Fiji Islands forms part of Melanesia in the South Pacific and comprises over 330 islands. After Papua New Guinea, Fiji has the largest population of Pacific Island countries with 837 000 at the 2007 Census. The population is composed of 56.8% i-Taukei (formerly indigenous Fijians, Fiji Melaneseans, or Fijians); 37.5% Fijians of Indian descent (formerly Indo-Fijians or Indians); and 5.7% "Others," consisting of Chinese, European, part-European, Rotuman, other Pacific Islanders, and all other nationalities.¹ Since the mid-20th century Fiji has experienced the demographic and epidemiological transitions, including declines in mortality, particularly infant and under-five deaths, and a change in major causes of death from infection and undernutrition to noncommunicable disease (NCD).^{2,3} A plateau in life expectancy has occurred since the 1990s from increases in premature adult mortality,³⁻⁵ with cardiovascular disease (CVD) mortality now the leading cause of death in Fiji increasing from around 20% of all-cause mortality in the 1960s to over 45% by 2010.⁶

The evolution of risk factor prevalence underpinning the epidemiologic transition in Fiji has been partially documented by examination of increasing secular trends in obesity and type 2 diabetes mellitus (T2DM),⁷ and blood pressure and hypertension.⁸ Another important risk factor for NCD is tobacco smoking, which significantly contributes to CVD,⁹ lung cancer, and chronic obstructive pulmonary disease.¹⁰ The present study enables assessment of population trends in daily tobacco smoking in Fiji by sex, age group, and urban/rural in Fiji Melanesian (i-Taukei) and Indian adults aged 25–64 years from five population-based cross-sectional surveys conducted in Fiji over a 32-year period (1980–2011). This is the first study to show nationally representative population trends in tobacco smoking over three decades in a developing country by age, sex, and urban/rural based on empirical unit record data; and enables examination of tobacco smoking trends in relation to known interventions and events.

Methods

Survey Selection

Surveys measuring tobacco smoking in adults aged 25–64 years in Fiji during 1950–2015 were identified through: (1) a literature search of Medline, PubMed, and Global Health; (2) an internet search for reports; and (3) direct contact with representatives from the Fiji Ministry of Health, the Fiji National Food and Nutrition Centre, the World Health Organisation (WHO), and the Secretariat for the Pacific Community. Surveys were included in this analysis if they were nationally representative at the time of the survey, or could be adjusted to the nearest previous census (by age, sex, urban/rural residency, and ethnicity) to improve representativeness and minimize selection bias, as implemented in the WHO STEPS survey methodology.¹¹ Participants aged 25–64 years from the two major ethnicities in Fiji, i-Taukei, and Fijians of Indian descent (Indians), were included in the analysis. The "Other" ethnicity was not included as it is a heterogeneous group consisting of other Pacific Islanders, Europeans, and Asians, and comprised only 6% of the total Fiji population at the 2007 Census.¹ Surveys included in analyses are: the 1980 National Diabetes and Cardiovascular Disease Survey ($n = 2058$) (unit record data supplied 2014)¹²; the National Nutrition Surveys (NNS): 1993 ($n = 1774$) and 2004 ($n = 3233$) (unit record data supplied, National Food and Nutrition Centre, 2014)^{13,14}; and

the WHO STEPS Surveys: 2002 ($n = 4982$) and 2011 ($n = 2481$) (Fiji Ministry of Health, unit record data supplied, 2014).¹¹ A combined unit record data set was constructed by concatenating these five surveys ($n = 14\ 528$).

Several tobacco smoking prevalence surveys undertaken in Fiji were not included in the present analysis because they measured only current tobacco usage as combined daily and non-daily smoking, in age groups discordant with the present analysis; youth aged 12–15 years,^{15,16} and adults 16–45 years.¹⁷

Data Collection and Categorization of Tobacco Smoking

Tobacco smoking data in all surveys were collected by individual interview at the survey site and recorded on prestructured survey forms. In the 1980 survey participants were asked if they were a: (1) nonsmoker; (2) ex-smoker; (3) currently smoking <20 cigarettes/day; (4) currently smoking 20–40 cigarettes/day; or (5) currently smoking >40 cigarettes/day. The 1993 NNS survey asked participants how many cigarettes/tobacco/cigars they consumed the previous day, with possible responses: (1) none; (2) 1 to 4; (3) 5 to 9; (4) 10 to 19; or (5) 20 or more. The WHO STEPS surveys (2002 and 2011) and the 2004 NNS survey asked participants if they currently smoked any tobacco products such as cigarettes, cigars or rolled tobacco, with three possible responses: (1) yes, daily; (2) yes, but not every day; or (3) no, not at all. Participants responding as daily smokers were then asked to report how many tobacco products they smoked per day. All five surveys enabled categorization of participants as either: (1) a never-smoker, ex-smoker, or non-daily smoker; or (2) a daily smoker. Daily smokers were further able to be classified into those who reported smoking <20 or ≥20 tobacco products a day (including cigarettes/cigars/pipes). Non-daily tobacco smoking was not able to be calculated for the 1980 and 1993 survey data.

Demographic Adjustment and Trend Analyses

In order to improve national representativeness and minimize selection bias, each survey was variously adjusted to the most recent previous census for age group and urban–rural distributions by ethnicity and sex using case weights derived from the ratio of the population proportions from the census and the survey for each stratum. This is similar to the methodology used in the WHO STEPS surveys.¹¹ Prevalence of daily tobacco smoking in each survey was calculated by sex, ethnicity, urban/rural, and age group. Since the data were not adequately described by a single curvi-linear function, linear trends in daily tobacco smoking by sex and ethnicity were estimated using spline analysis with the statistical program selecting sub-periods during 1980–2011. SAS version 9.4 was used to calculate prevalences and to fit spline linear regression trend lines (SAS Institute Inc., Cary, NC).

Results

Daily Tobacco Smoking by Sex, Ethnicity and Urban/Rural

Daily tobacco smoking declined in i-Taukei men from 81.7% (urban 67.6%; rural 88.4%) in 1980, to 27.0% (urban 20.2%; rural 33.0%) in 2011 ($p < .0001$); however, the prevalence plateaued at around 27% during 2002–2011 (Figure 1). In Indian men there was continual decline throughout 1980–2011 from 55.3% (urban 42.8%; rural 64.4%) in 1980 to 26.3% (urban 27.7%; rural 23.6%)

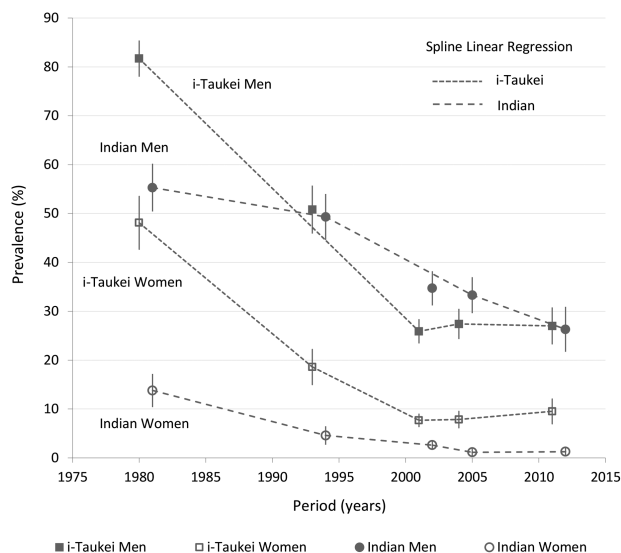


Figure 1. Prevalence of daily tobacco smoking (%), by sex and ethnicity, Fiji, 1980–2011. Prevalence data variously adjusted to the most recent previous census for age group and urban–rural distributions by ethnicity and sex, to improve representativeness; daily smoker (consumes ≥ 1 tobacco product per day); where multiple data points overlap markers have been offset on the graph to improve interpretation; vertical straight lines through the point estimate for i-Taukei men and women represents 95% statistical confidence intervals. Data points on graph are from analysis presented in Table 1. The spline analysis selected three periods for i-Taukei men: 1980–2002; 2002–2004; 2004–2011; three periods for Indian men: 1980–1993; 1993–2004; 2004–2011; and four periods for i-Taukei and Indian women: 1980–1993; 1993–2002; 2002–2004; 2004–2011.

in 2011 ($p < .0001$); with the steepest decline during 1994–2011 (Figure 1). In both ethnicities the initial prevalence in 1980 and the decline by 2011 was greater in rural than urban areas. Smoking ≥ 20 tobacco products per day declined in i-Taukei men from 8.0 to 1.9% ($p < .0001$), with the greatest decline during 1980–2002 and lesser decline to 2011; while there was also decline in Indian men from 4.6% to 2.0%, but this did not reach statistical significance (Table 1).

In i-Taukei women daily tobacco smoking declined from 48.1% (urban 31.0%; rural 54.6%) in 1980, to 9.5% (urban 7.1%; rural 11.4%) in 2011 ($p < .0001$); however, the prevalence plateaued at around 9% during 2002–2011 (Figure 1). In Indian women there was decline from 13.8% (urban 3.7%; rural 21.6%) in 1980 to 1.3% (urban 1.5%; rural 1.1%) in 2011 ($p < .0001$); with a very low prevalence of less than 3% during 2002–2011 (Figure 1). In both ethnicities the initial prevalence in 1980 and decline by 2011 was greater in rural than urban areas. Smoking ≥ 20 tobacco products per day showed no statistically significant change over 1980–2011 from initially low levels, with the prevalence in i-Taukei women declining from 2.6% to 0.6%, and remaining $< 0.2\%$ in Indian women throughout 1980–2011 (Table 1).

Trends in Daily Tobacco Smoking by Age Group, Ethnicity, and Sex

In 1980 the prevalence of daily tobacco smoking in all age groups in i-Taukei men was similar between 77% and 84%, and in Indian men between 51% and 61%. Substantial declines occurred in all ages in i-Taukei men from 1980 to 2002, after which there was a plateau during 2002–2011, except among the oldest age group (55–64 years)

where the decline continued. By 2011 the prevalence was between 16% and 31% in all age groups, with the largest decline in those 55–64 years from the highest level in 1980 (83.9%), to the lowest level in 2011 (16.0%). Among Indian men the decline was consistent throughout 1980–2011, with no evidence of a plateau, except among those 55–64 years where the prevalence remained around 32% during 2002–2011. By 2011, the prevalence was between 20% and 32% in all age groups, with the largest decline among those 35–44 years from the highest level in 1980 (60.5%) to the second lowest in 2011 (26.9%) (Table 2).

In women, all age groups among i-Taukei experienced substantial decline during 1980–2002, followed by plateau at around 9% throughout 2002–2011. In those aged 25–34 years the 1980 prevalence was lowest (36.2%) and the prevalence decline also the lowest (to 12.9% in 2011), making daily smoking prevalence in this age group the highest by 2011 (Table 3). In contrast, in Indian women aged 25–34 years the prevalence was low (1.6%) in 1980 and remained so. Prevalences were also higher in older Indian women in 1980, and consistently declined to less than 3% in all age groups by 2011.

Trends in Current Tobacco Usage as Daily and Non-daily Smoking Combined

During 2002–2011 the prevalence of current tobacco smoking declined significantly ($p < .05$) in both sexes and ethnicities from 63.0% to 52.0% in i-Taukei men; from 54.6% to 42.3% in Indian men; from 29.5% to 24.2% in i-Taukei women; and from 4.7% to 2.3% in Indian women.

Discussion

Empirical survey data for Fijians aged 25–64 years demonstrate a significant decrease in the prevalence of reported daily tobacco smoking by around 50% during the 1980s and 1990s among i-Taukei and Indian men and women. Since 2000 the prevalence has plateaued in i-Taukei men at around 27%, while decline has continued among Indian men to a similar prevalence of around 26% by 2011. Women also experienced a plateau since 2000, however, at a much lower prevalence of around 10% in i-Taukei women and 1% in Indian women. In 2011, the prevalence of daily tobacco smoking in i-Taukei and Indian women aged 25–64 years was lower than the prevalence in similar age groups of women in Australia (12% in ≥ 18 age group in 2013)¹⁸ and New Zealand (14% in ≥ 15 age group in 2014/2015).¹⁹ However, among i-Taukei and Indian men the prevalence was substantially higher compared to Australia (15% of men aged ≥ 18 years)¹⁸ and New Zealand (16% of men aged ≥ 15 years).¹⁹ Reported smoking of ≥ 20 tobacco products per day declined significantly in i-Taukei men during 1980–2002, with lesser decline to 2011; while there was no significant change among i-Taukei women or Indians (both sexes), albeit with prevalences below 6% throughout the period.

Information derived from studies conducted in the 1950s–1960s on the harmful effects of tobacco smoking^{10,20} was widely disseminated globally. The association between cigarette smoking and lung cancer identified in the 1964 US Surgeon-General's Report on smoking and health²⁰ led the Fiji Broadcasting Company to not renew its cigarette advertising contract.²¹ A Cancer Registry was formed with a report appearing in 1973, co-authored by Sir Richard Doll.²² In the early 1980s the Fiji Ministry of Health gave a directive prohibiting smoking in all patient areas of government hospitals, and in 1986 the Fiji

Table 1. Prevalence of Daily Tobacco Smoking (%), by Ethnicity and Sex, Fiji, 1980–2011^a

Year of survey	i-Taukei men			i-Taukei women						
	N (U/R)	Daily smoker (95% CI)	≥20/d (95% CI)	Urban daily smoker (95% CI)	Rural daily smoker (95% CI)	N (U/R)	Daily smoker (95% CI)	≥20/d (95% CI)	Urban daily smoker (95% CI)	Rural daily smoker (95% CI)
1980	503 (317/186)	81.7 (78.0–85.4)	7.98 (5.17–10.8)	67.6 (62.4–72.8)	88.4 (83.7–93.0)	537 (359/178)	48.1 (42.7–53.5)	2.56 (0.53–4.60)	31.0 (26.2–35.9)	54.6 (47.1–62.1)
1993	400 (128/272)	50.8 (45.9–55.8)	5.65 (3.38–7.91)	41.7 (32.9–50.4)	56.1 (50.1–62.1)	457 (170/287)	18.6 (15.0–22.3)	0.85 (0.89–1.69)	16.7 (10.9–22.5)	18.8 (14.2–23.3)
2002	1229 (498/731)	25.9 (23.4–28.4)	2.75 (1.86–3.63)	26.7 (22.7–30.7)	25.4 (22.2–28.7)	1633 (674/959)	7.68 (6.39–8.98)	0.43 (0.11–0.75)	8.15 (6.07–10.2)	7.37 (5.70–9.04)
2004	833 (276/557)	27.4 (24.3–30.6)	3.24 (2.00–4.47)	21.7 (16.5–26.8)	31.1 (27.1–35.0)	1007 (377/630)	7.85 (6.15–9.56)	0.43 (0.00–0.85)	8.44 (5.56–11.3)	7.74 (5.37–9.57)
2011	621 (332/289)	27.0 (23.2–30.8)	1.94 (0.89–2.98)	20.2 (15.6–24.9)	33.0 (27.4–38.7)	775 (506/269)	9.51 (6.96–12.1)	0.59 (0.10–1.08)	7.12 (4.60–9.64)	11.4 (7.27–15.5)
Indian men										
1980	469 (295/174)	55.3 (50.4–60.3)	4.59 (2.59–6.59)	42.8 (37.1–48.6)	64.4 (57.1–71.6)	549 (362/187)	13.8 (10.4–17.3)	0.00 (0.00–0.00)	3.66 (1.80–5.51)	21.6 (15.8–27.4)
1993	460 (159/301)	49.3 (44.6–54.1)	2.96 (1.32–4.59)	48.3 (40.4–56.2)	50.4 (44.7–56.2)	457 (171/286)	4.59 (2.70–6.48)	0.00 (0.00–0.00)	3.40 (0.89–5.91)	5.10 (2.71–7.50)
2002	790 (359/431)	34.7 (31.2–38.1)	5.14 (3.56–6.73)	29.9 (25.0–34.8)	38.9 (34.1–43.6)	1330 (687/643)	2.62 (1.77–3.47)	0.08 (0.0–0.24)	2.94 (1.69–4.20)	2.31 (1.19–3.42)
2004	658 (346/312)	33.3 (29.6–37.0)	3.31 (1.95–4.68)	28.1 (23.4–32.9)	37.6 (32.2–43.0)	735 (427/308)	1.15 (0.42–1.89)	0.13 (0.00–0.40)	1.78 (0.54–3.02)	0.54 (0.00–1.29)
2011	458 (355/103)	26.3 (21.7–30.9)	1.98 (0.57–3.39)	27.7 (22.8–32.5)	23.6 (14.9–31.8)	627 (438/189)	1.27 (0.42–2.12)	0.10 (0.00–0.31)	1.53 (0.38–2.69)	1.05 (0.00–2.52)
Women										
1980	972 (612/360)	68.0 (64.8–71.3)	6.22 (4.52–7.93)	54.8 (50.8–58.8)	75.9 (71.3–80.4)	1086 (721/365)	30.6 (27.1–34.1)	1.25 (0.25–2.25)	17.0 (14.2–19.7)	37.4 (32.4–42.2)
1993	860 (287/573)	50.0 (46.6–53.5)	4.24 (2.86–5.62)	45.3 (39.4–51.1)	53.2 (49.1–57.3)	914 (341/573)	11.3 (9.23–13.4)	0.41 (0.00–0.81)	9.66 (6.53–12.8)	11.7 (9.12–14.3)
2002	2019 (857/1162)	30.2 (28.0–32.3)	3.92 (3.02–4.82)	28.3 (25.2–31.5)	31.8 (29.0–34.7)	2963 (1361/1602)	5.23 (4.43–6.02)	0.26 (0.08–0.44)	5.35 (4.17–6.53)	5.14 (4.08–6.20)
2004	1491 (622/869)	30.3 (27.9–32.7)	3.28 (2.36–4.19)	25.6 (22.0–29.1)	33.7 (30.5–37.0)	1742 (804/938)	4.58 (3.62–5.54)	0.28 (0.03–0.54)	4.48 (3.08–5.89)	4.75 (3.42–6.08)
2011	1079 (687/392)	26.7 (23.8–29.6)	1.96 (1.10–2.81)	24.2 (20.8–27.6)	30.2 (25.5–34.9)	1402 (944/458)	5.85 (4.36–7.35)	0.37 (0.09–0.66)	4.53 (3.07–6.02)	7.17 (4.62–9.72)

CI = confidence interval; daily smoker = consumes ≥1 tobacco product per day; N = number of participants in stratum; ≥20/d = consumes ≥20 tobacco products per day; U/R = urban/rural.

^aPrevalence data variously adjusted to the most recent previous census for age group and urban–rural distributions by ethnicity and sex using case weights derived from the ratio of the population proportions from the census and the survey for each stratum to improve representativeness. Surveys included in analyses are: the 1980 National Diabetes and Cardiovascular Disease Survey¹³; the National Nutrition Surveys (NNS): 1993 and 2004^{13,14}; and the WHO STEPS Surveys: 2002 and 2011.¹¹ Unit record data supplied in 2014 for all surveys included in analysis.

Table 2. Prevalence of Daily Tobacco Smoking in Men (%), by Age-Group and Ethnicity, Fiji, 1980–2011^a

Year	25–34 y		35–44 y		45–54 y		55–64 y	
	N	Daily smoker (95% CI)	N	Daily smoker (95% CI)	N	Daily smoker (95% CI)	N	Daily smoker (95% CI)
i-Taukei men								
1980	186	83.8 (78.4–89.1)	126	81.5 (74.0–89.0)	117	76.5 (66.9–86.0)	74	83.9 (74.4–93.0)
1993	145	50.3 (42.0–58.5)	104	54.4 (44.6–64.2)	91	48.9 (38.5–59.4)	60	47.8 (34.8–60.8)
2002	349	29.7 (24.8–34.5)	377	23.6 (19.3–27.9)	289	23.6 (18.7–28.5)	214	23.7 (18.0–29.4)
2004	241	32.1 (26.1–38.1)	258	27.9 (24.0–35.3)	184	21.2 (15.2–27.2)	150	18.6 (12.3–24.9)
2011	155	28.0 (20.7–35.3)	162	27.8 (20.7–35.0)	181	31.1 (24.1–38.1)	123	16.0 (9.10–22.9)
Indian men								
1980	186	51.3 (43.4–59.2)	126	60.5 (51.4–69.7)	91	55.7 (44.6–66.8)	66	57.6 (44.1–71.2)
1993	191	46.0 (38.7–53.4)	130	52.9 (44.2–61.6)	94	49.0 (38.1–60.0)	45	54.3 (38.5–70.2)
2002	200	30.8 (24.4–37.3)	244	35.0 (28.9–41.1)	203	40.4 (33.5–47.2)	143	34.9 (26.5–43.4)
2004	209	26.3 (20.3–32.3)	193	36.5 (29.5–43.4)	169	41.5 (33.8–49.2)	87	31.0 (21.0–41.1)
2011	108	20.1 (12.3–27.9)	105	26.9 (17.7–36.2)	143	30.7 (21.1–40.2)	102	31.8 (20.9–42.7)
Men								
1980	372	65.8 (60.5–71.1)	252	70.7 (64.6–76.8)	208	66.1 (58.7–73.5)	140	72.4 (64.2–80.5)
1993	336	47.9 (42.5–53.4)	234	53.6 (41.1–60.1)	185	49.0 (41.5–56.5)	105	50.8 (40.9–60.7)
2002	549	30.2 (26.3–34.2)	621	29.4 (25.6–33.1)	492	32.0 (27.8–36.3)	357	28.9 (23.9–33.9)
2004	450	29.3 (25.1–33.6)	451	33.1 (28.6–37.6)	353	31.5 (26.5–36.5)	237	24.4 (18.6–30.2)
2011	263	24.6 (19.3–30.0)	267	27.4 (21.8–33.1)	324	30.9 (25.1–36.7)	225	23.3 (16.9–29.6)

CI = confidence interval; daily smoker = consumes ≥ 1 tobacco product per day; N = number of participants in stratum.

^aPrevalence data variously adjusted to the most recent previous census for urban–rural distributions by ethnicity and sex using case weights derived from the ratio of the population proportions from the census and the survey for each stratum to improve representativeness. Surveys included in analyses are: the 1980 National Diabetes and Cardiovascular Disease Survey¹²; the National Nutrition Surveys (NNS): 1993 and 2004^{13,14}; and the WHO STEPS Surveys: 2002 and 2011.¹¹ Unit record data supplied in 2014 for all surveys included in analysis.

Table 3. Prevalence of Daily Tobacco Smoking in Women (%), by Age-Group and Ethnicity, Fiji, 1980–2011^a

Year	25–34 y		35–44 y		45–54 y		55–64 y	
	N	Daily smoker (95% CI)	N	Daily smoker (95% CI)	N	Daily smoker (95% CI)	N	Daily smoker (95% CI)
i-Taukei women								
1980	197	36.2 (28.2–44.3)	157	53.5 (43.0–64.0)	125	60.4 (49.5–71.3)	58	58.0 (41.3–74.7)
1993	165	17.6 (11.7–23.5)	135	14.0 (8.10–19.9)	85	20.5 (11.7–29.4)	72	29.3 (17.7–40.8)
2002	549	8.20 (5.90–10.5)	514	7.40 (5.12–9.67)	345	7.23 (4.48–10.0)	225	7.47 (4.03–10.9)
2004	321	9.45 (6.21–12.7)	304	6.59 (3.78–9.40)	241	6.23 (3.15–9.30)	141	8.57 (3.87–13.3)
2011	178	12.9 (7.35–18.4)	238	8.70 (4.54–12.9)	202	6.76 (2.67–10.8)	157	6.75 (2.13–11.4)
Indian women								
1980	223	1.60 (0.00–3.80)	142	18.2 (10.5–25.9)	127	28.5 (19.2–37.7)	57	33.8 (17.8–49.8)
1993	178	0.00 (0.00–0.00)	146	4.66 (1.24–8.07)	82	9.47 (2.17–16.8)	51	20.0 (7.97–32.0)
2002	364	1.95 (0.51–3.38)	405	1.03 (0.02–2.04)	370	5.90 (3.49–8.31)	191	2.93 (0.42–5.44)
2004	222	0.35 (0.00–1.03)	215	1.30 (0.00–2.78)	200	1.83 (0.00–3.17)	98	2.05 (0.00–4.97)
2011	145	0.54 (0.00–1.62)	178	2.82 (0.34–5.31)	193	0.85 (0.00–2.04)	111	0.66 (0.00–1.97)
Women								
1980	420	17.5 (13.1–21.8)	299	35.7 (28.6–42.7)	252	44.5 (36.9–52.1)	115	47.3 (35.5–59.2)
1993	343	7.92 (5.13–10.7)	281	8.96 (5.63–12.3)	167	15.5 (9.62–21.3)	123	25.0 (16.7–33.3)
2002	913	5.26 (3.85–6.67)	919	4.22 (2.96–5.48)	715	6.56 (4.74–8.38)	416	5.36 (3.17–7.55)
2004	543	5.09 (3.33–6.85)	519	3.95 (2.35–5.56)	441	4.02 (2.21–5.82)	239	5.54 (2.67–8.40)
2011	323	7.6 (4.34–10.9)	416	6.17 (3.56–8.78)	395	3.95 (1.71–6.19)	268	3.95 (1.35–6.56)

CI = confidence interval; daily smoker = consumes ≥ 1 tobacco product per day; N = number of participants in stratum.

^aPrevalence data variously adjusted to the most recent previous census for urban–rural distributions by ethnicity and sex using case weights derived from the ratio of the population proportions from the census and the survey for each stratum to improve representativeness. Surveys included in analyses are: the 1980 National Diabetes and Cardiovascular Disease Survey¹²; the National Nutrition Surveys (NNS): 1993 and 2004^{13,14}; and the WHO STEPS Surveys: 2002 and 2011.¹¹ Unit record data supplied in 2014 for all surveys included in analysis.

Medical Association announced plans to campaign for a ban on cigarette advertising.²³ The first Tobacco Control Bill was endorsed by the Fiji Parliament in 1998 establishing a system of health warnings and banning sale of tobacco products to people less than 18 years, smoking

in public places, and tobacco sponsorship of sports²⁴; and in 2003 Fiji became the first developing country to ratify the WHO Framework Convention on Tobacco Control. While antitobacco smoking interventions during the 1980s and 1990s corresponded with a period of

decline in daily tobacco smoking, the effect of more recent interventions remains to be seen in light of the plateau that has occurred since 2000 in i-Taukei men and women. Further research is needed to understand these trends in the prevalence of daily tobacco smoking in relation to tobacco control reduction measures implemented in Fiji.

Data on trends over time in NCD risk factors such as daily tobacco smoking in a population are more informative than analysis of levels from a single cross-sectional survey. Previous attempts at comparing tobacco smoking data from cross-sectional surveys in Fiji have been hindered by differences in the survey questions used to measure tobacco smoking, and the aggregations (age/sex/ethnicity/urban–rural) employed for the presentation of tabulated results. The five surveys used in the present study differed in the way tobacco consumption was measured, with the WHO STEPS surveys (2002 and 2011) and the 2004 NNS survey asking participants if they were current smokers, either daily or not daily, before asking daily smokers how many tobacco products they smoked a day. Whereas the 1980 survey and the 1993 NNS survey asked one question on tobacco smoking which distinguished participants as being either a current nonsmoker or a current daily smoker, and the quantity of tobacco products smoked per day by current daily smokers. For this reason the present study was not able to determine across the 32-year study period from all surveys the prevalence of current smokers, including both daily and non-daily. Analysis of the 10-year period in which three surveys did collect these data (2002, 2004, and 2011) demonstrates a decline in the prevalence of current (daily and non-daily) smokers in both sexes and ethnicities between 2002 and 2011 in Fiji.^{11,13,14} The Fiji Ministry of Health plans to continue NCD risk factor surveillance, research, and evaluation through periodic nationally representative sample surveys, such as the STEPS surveys.²⁵ It is important that these surveys continue to collect consistent and comparable data on both current and daily tobacco smoking, so trends over time across multiple surveys can be determined.

Estimates of tobacco smoking prevalence in the present study are based on self-report survey data. A recent systematic review of 67 studies published between 1983 and 2006 examining the relationship between self-reported smoking, and smoking confirmed by cotinine measurement, found overall trends towards underestimation of smoking prevalence based on self-report; with the mean difference ranging from –4.8% to –9.4%, depending on the bodily fluid used to measure cotinine.²⁶ In the presence of antismoking campaigns and increased public awareness of negative health outcomes from active and passive smoking, the perception of smoking as a socially undesirable behavior could decrease a participant willingness to self-report such behavior.²⁷ However, the aforementioned study reported no trend of increasing or decreasing bias over the three decades analyzed in the review (1983–2006),²⁶ which is similar to the time period in the present study (1980–2011). An assessment of the level of potential underestimation in smoking prevalence based on self-reported data in the Fiji population, or a similar Pacific Island population, has not been undertaken.

Tobacco and cigarette consumption can also be estimated from household expenditure surveys, and data on production and trade. Estimates of household expenditure on tobacco as a percentage of total household expenditure (including cash expenditure, subsistence, and gifts) have shown a decline in Fiji since 1977 when it constituted 3.0% of total household expenditure, compared to 0.8% in 2002/2003, and 0.4% in 2008/2009.^{28–30} Per capita annual cigarette consumption figures, calculated from manufactured cigarette production and trade data between 1980 and 2000, also show continued decline. Estimated annual cigarette consumption has consistently

declined in Fiji since 1980, from 1438 cigarette sticks per capita, to 1183 in 1990, and 745 in 2000 (using the formula: cigarette production plus imports minus exports, divided by the Fijian population aged 15 years and older).³¹

It is estimated that NCD deaths constitute 80% of all-cause mortality in Fiji, with CVD responsible for 76% of all NCD deaths.²⁵ While in many developed countries the majority of deaths from CVD in the 21st century occur in older adults aged 65 years and above,³² in Fiji there is significant premature adult mortality from CVD with over half of CVD deaths occurring in adults aged 40–59 years.²⁵ The prematurity of these deaths and the implied morbidity is not only a health concern, but also an economic and development issue for Fiji.²⁵ Analysis of CVD risk factors in Fiji over the past 30 years, including hypertension,⁸ T2DM, and obesity,⁷ show consistent increases. The trends in daily tobacco smoking reported in the present study are the first to indicate a decline in a CVD risk factor in the Fiji population during the past three decades.

Population-based case-control data collected in Australia and New Zealand during 1986–1994 as part of the WHO MONICA Project indicated that episodes of a major CVD event (fatal and non-fatal) rapidly reduced within 1–3 years of smoking cessation in both sexes, and returned to a level comparable to a never-smoker within 4–6 years.³³ Similar findings were observed from population-based cohort data collected from women during 1980–2004 as part of the Nurse's Health Study which indicated a rapid reduction in CVD mortality in the first 5 years after smoking cessation.³⁴ Decline in mortality from lung cancer and chronic obstructive pulmonary disease following smoking cessation is slower. In the Nurse's Health Study a 21% lung cancer mortality reduction was observed within the first 5 years after cessation, and the mortality risk returned to parity with never-smokers after 25 years; for chronic obstructive pulmonary disease an 18% mortality reduction was observed 5–10 years after cessation, with the mortality risk reaching parity with a never-smoker after 20 years.³⁴

Potential limitations of the present study are that the 1980 survey only asked questions concerning tobacco smoking with regard to cigarettes, whereas the NNS surveys (1993 and 2004) and the WHO STEPS surveys (2002 and 2011) asked participants to report tobacco smoking with regard to cigarettes, cigars, and pipes. The expected effect of the question in the 1980 survey questionnaire would be a potential underestimation of daily tobacco smoking in 1980 in the present study, meaning that the magnitude and statistical significance of the decline we have reported from 1980 to 2011 would be somewhat higher.

This study is the first to identify trends in the prevalence of daily tobacco smoking and smoking of ≥ 20 tobacco products a day in Fiji by sex, ethnicity, age, and urban/rural using five large cross-sectional surveys over a 32-year period (1980–2011), with standard definitions and methodology for analysis. The present study indicates that significant reductions were achieved in daily tobacco consumption in the Fiji population between 1980 and 2000; with continued decline or plateau at a low prevalence to 2011 in i-Taukei women and Indians (both sexes). A plateau in the most recent decade in i-Taukei men at around 30% requires further investigation. Consistent with tobacco smoking reduction targets in the WHO NCD Global Action Plan,³⁵ Fiji has endorsed consecutive Regional Action Plans for the Tobacco Free Initiative in the Western Pacific (2010–2014; 2015–2019) with targets to reduce tobacco smoking by 10% every 5 years^{25,36}; and a Tobacco-Free Pacific Goal of less than 5% adult tobacco smoking prevalence by 2025.³⁷ While public health interventions aimed at reduction in tobacco smoking are being expanded across the

entire Fijian population,²⁵ additional interventions targeting high-risk population groups are needed to achieve these Regional targets. Comparison with Australia and New Zealand, countries considered to be world leaders in regulation of tobacco smoking, highlights the high smoking prevalence among i-Taukei and Indian men as being almost double the prevalence of recent estimates in Australia and New Zealand. NCD risk factor analyses in Fiji that consider only the entire population mask divergent sex-specific trends in the major ethnic groups.

Funding

Funding for this work was provided under the Australian Government Department of Foreign Affairs and Trade Australian Development Research Awards Scheme (Grant no: 66886).

Declaration of Interests

None declared.

Acknowledgments

We acknowledge the funding support from the National Institutes of Health for the 1980 National Diabetes and Cardiovascular Disease Survey (Grant Number DK-25446).

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