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## RESEARCH COMMUNICATION

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# Smoking-related Cancers in Maori and non-Maori in New Zealand, 1974-1993: Fewer Bladder Cancers among Maori

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### Abstract

Smoking is, and long has been, more prevalent among Maori than non-Maori in New Zealand. Lung cancer, but not other smoking-related cancers, is known to be markedly more common among Maori than non-Maori. Incidence and mortality data from the New Zealand Cancer Registry for cancers of the mouth/pharynx, oesophagus, pancreas, larynx, kidney and bladder, as well as lung/pleura, during the period 1974 to 1993 were analysed by sex to determine whether the rates of each of these smoking-related cancers were higher in Maori than in non-Maori. Truncated (35-64 yr) age-standardized incidence rates for 1974-93 were significantly higher in Maori than non-Maori for cancers of the pancreas, lung/pleura and kidney (both sexes), mouth/pharynx and oesophagus (males only). There was no difference between the Maori and non-Maori rates for cancer of the larynx, and bladder cancer incidence was significantly lower in Maori than non-Maori. Mortality rates followed a similar pattern as those for incidence for cancers of the pancreas, larynx, lung/pleura and kidney (both sexes) and bladder (males only). The pattern predicted by the higher prevalence of smoking in Maori than non-Maori was borne out for all smoking-related cancers except bladder and laryngeal cancer. Under-enumeration through lower access to health services may have contributed to the lower than expected rates of bladder cancer in Maori, but a role for a genetically or lifestyle related protective effect is suggested.

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**Key words:** smoking-related cancer, incidence, mortality, New Zealand, Maori

### Introduction

Smoking tobacco was not part of the pre-European Maori way of life but, after its introduction by Captain James Cook and other early European explorers, traders, sealers, whalers, missionaries and settlers, it rapidly became popular and has been a cultural norm for Maori for over 150 years (Broughton, 1996). In New Zealand in 1989 a greater proportion of Maori (men: 76%, women: 73%) than non-Maori (men: 56%; women: 48%) had ever smoked regularly (Mann et al, 1991). That smoking had been more common among Maori than non-Maori in earlier periods is attested by their higher rates (per 100,000) of lung cancer (eg. Maori: males 99.7, females 72.9; non-Maori: males 46.5, females 18.2 in 1988-92)

(Parkin et al, 1997). One would expect that the rates of other smoking-related cancers might be higher in Maori but for these cancers - mouth/pharynx, oesophagus, pancreas, larynx, kidney and bladder - other risk factors also are relevant.

Alcohol has been causally related to cancers of the oral cavity, pharynx, larynx and oesophagus (IARC, 1988) and a synergistic effect with tobacco smoking has been demonstrated (Jensen et al, 1996). With regard to pancreatic cancer it is considered that any aetiological role for alcohol is likely to be among heavy drinkers and of importance only in smokers (Anderson et al, 1996). In the 1989 national survey alcohol was drunk daily by a smaller proportion of Maori (men: 1%, women: 3%) than of non-Maori (men:

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18%, women: 8%) (Mann et al, 1991). However, those Maori who do consume alcohol tend to drink more heavily than do non-Maori (Ministry of Health, 1999). As with cancer of the lung, dietary factors, particularly consumption of fruit and vegetables, appear to be protective against the appearance of cancers of the upper aerodigestive tract (Cheng and Day, 1996; Marshall and Boyle, 1996; Riboli et al, 1996; Ziegler et al, 1996). In the 1997 National Nutrition Survey, at least 5-6 servings of fruit and vegetables per day were consumed by fewer Maori (men: 29%, women: 44%) than Caucasian New Zealanders (men: 35%, women: 55%) (personal communication, Life in New Zealand Research Unit, 7/1/00; unpublished data from survey described in Russell et al, 1999).

Tobacco smoking is now an accepted risk factor for cancer of the renal parenchyma (McLaughlin et al, 1995; Doll, 1996) although the association is weaker than for renal pelvic and bladder cancers (IARC, 1986). Obesity, as measured by body mass index (BMI), is the only other common risk factor unequivocally associated with cancer of the renal parenchyma (Mellemegaard et al, 1995). In 1989 obesity was more widespread among Maori with 29% of males and 27% of females having a BMI of >30 compared with 9% and 12% of non-Maori men and women (Mann et al, 1991).

With the decline in importance of occupational exposures, smoking now is the only major risk factor for bladder cancer except where schistosomiasis, Balkan nephropathy, analgesic abuse or arsenic contamination of drinking water is prevalent (Silverman et al, 1996). None of these is common in New Zealand which also has little heavy or chemical industry.

Nearly all tobacco smoked in New Zealand is flue-cured; chewing tobacco, never common, has been virtually unknown since the second World War.

We have analysed patterns in incidence and mortality of smoking-related cancers in New Zealand (NZ) for the 20-year period 1974-93 to test the assumption that they are more common in Maori than non-Maori.

## Materials and Methods

Notification to the New Zealand Cancer Registry of all patients with cancer admitted to public and private hospitals was voluntary but comprehensive until July 1994 when legislation came into effect, making cancer notification by hospitals and pathology laboratories a statutory requirement. The system in practice before 1994, primarily dependent on hospital admission and discharge records, missed some cancers treated in outpatient practice or in the private sector (Elwood, 1992).

From the Registry we obtained the numbers of new registrations of, and deaths from, cancers of the mouth/pharynx (ICD-9 141-149, excluding nasopharynx 147), oesophagus (ICD-9 150), pancreas (ICD-9 157), larynx (ICD-9 161), lung/pleura (ICD-9 162, 163), bladder (ICD-9 188) and kidney (ICD-9 189) by sex, 5-year age group (0-4, ...80-84, 85+ yr) and ethnic group (Maori, non-Maori) for each year from 1974 to 1993, the most recent 20-year period for

which data cross-classified by a consistent categorization of ethnic group was available. Cancer of the pleura was included with lung as it is possible that there was misclassification between these two sites in the early days of cancer registration. Benign papillomas of the bladder have not been registered in New Zealand. Squamous cell carcinomas comprised about 2% of bladder cancers.

Estimated resident populations by sex and 5-year age group for Maori and for non-Maori, obtained from Statistics New Zealand (NZ Health Information Service, 1998), were used as denominators in the calculation of incidence and mortality rates which were age-standardized to the 'world' population (Parkin et al, 1997). Truncated rates restricted to the age groups 35-64 years were used to avoid possible bias arising from under-utilization of health services, or their differential use between Maori and non-Maori, among older age groups.

In 1981 the New Zealand population comprised approximately 280,000 Maori (a Polynesian people whose ancestors migrated to New Zealand about 1,000 years ago) and 2.9 million non-Maori (Muir et al, 1987), chiefly of European descent, the vast majority from the British Isles. In this analysis the third major population group comprising Pacific Island people (chiefly Polynesians who have migrated in recent years; 89,000 in 1981 [2.8% of the total population]; Muir et al, 1987) have been considered together with non-Maori of European or other descent. The median age of Pacific Island people was 17 years compared with 15 years for Maori and 27 years for other New Zealanders.

## Results

Truncated (35-64 years) age-standardized incidence rates of smoking-related cancers in Maori and non-Maori in New Zealand during 1974-1993 are given in Table 1. Rates were significantly higher in Maori than non-Maori for cancers of the pancreas, lung/pleura and kidney (both sexes), and mouth/pharynx and oesophagus (males only). Bladder cancer incidence was significantly lower in Maori than non-Maori and no difference between the two ethnic groups was seen for cancer of the larynx. Only for female laryngeal cancer was the rate based on fewer than 10 cases.

Mortality rates, presented in Table 2, followed a similar pattern as those for incidence in respect of cancers of the pancreas, larynx, lung/pleura and kidney (both sexes), and bladder (males only). However, in contrast to the incidence, mortality for cancer of the mouth/pharynx was lower in Maori than non-Maori males, and male oesophageal cancer mortality was not different between the two groups. In Maori women mortality rates for cancers of the mouth/pharynx, oesophagus, larynx and bladder were based on 10 cases or fewer.

Incidence rates (per 100,000) for the two ten-year periods 1974-83 and 1984-93 were similar within each sex/ethnic group category for most cancer sites (data not shown). The exceptions were: (i) lung cancer, for which there was the expected decline in men (Maori: 172.3 (95% confidence interval 166.5-178.0) falling to 157.9 (153.3-162.6); non-

**Table 1. Truncated (35-64 yr) Age-standardized Incidence Rates of Smoking-related Cancers in Maori and non-Maori, New Zealand, 1974-1993**

Site (ICD-9)	N	Male		Female			
		Maori Rate <sup>1</sup> (95% CI <sup>2</sup> )	Non-Maori Rate (95% CI)	Maori Rate (95% CI)	Non-Maori Rate (95% CI)		
Mouth/pharynx (141-149 excluding 147)	64	12.3 (11.6-13.0)	1080 11.3(11.2-11.5)	29	4.94 (4.54-5.35)	455	4.76 (4.66-4.86)
Oesophagus (150)	53	11.5 (10.8-12.2)	668 6.99 (6.87-7.11)	13	2.82 (2.48-3.17)	260	2.66 (2.59-2.74)
Pancreas (157)	53	9.75 (9.15-10.4)	517 5.40 (5.29-5.50)	30	5.99 (5.50-6.48)	321	3.30 (3.21-3.38)
Larynx (161)	37	7.09 (6.56-7.61)	675 7.04 (6.93-7.16)	5	1.01(0.81-1.22)	84	0.86 (0.82-0.90)
Lung and pleura (162, 163)	817	164.1 (161.6-166.7)	6752 70.0 (69.7-70.4)	588	112.2 (110.1-114.3)	2553	26.4 (26.2-26.7)
Bladder (188)	42	8.32 (7.75-8.89)	1497 15.6 (15.5-15.8)	23	4.31 (3.91-4.71)	472	4.84 (4.74-4.93)
Kidney (189)	83	15.7 (14.9-16.4)	1106 11.6 (11.5-11.8)	37	6.61 (6.12-7.09)	541	5.63 (5.52-5.74)

<sup>1</sup> Age-standardized to the 'world' standard population (per 100,000)<sup>2</sup> 95% confidence interval**Table 2. Truncated (35-64 yr) Age-standardized Mortality Rates of Smoking-related Cancers in Maori and non-Maori, New Zealand, 1974-1993**

Site (ICD-9)	N	Male		Female			
		Maori Rate <sup>1</sup> (95% CI <sup>2</sup> )	Non-Maori Rate (95% CI)	Maori Rate (95% CI)	Non-Maori Rate (95% CI)		
Mouth/pharynx	24	4.55 (4.13-4.96)	496 5.16 (5.06-5.26)	10	1.71 (1.47-1.95)	146	1.50 (1.45-1.56)
Oesophagus (150)	32	6.70 (6.17-7.23)	633 6.63 (6.51-6.74)	9	1.75 (1.49-2.01)	200	2.05 (1.98-2.11)
Pancreas (157)	75	14.5 (13.7-15.2)	863 9.02 (8.88-9.15)	34	6.58 (6.08-7.09)	537	5.56 (5.46-5.67)
Larynx (161)	11	2.13 (1.84-2.42)	234 2.42 (2.35-2.49)	3	0.66 (0.49-0.83)	35	0.36 (0.33-0.39)
Lung and pleura (162, 163)	516	104.1 (102.0-106.1)	5696 59.1 (58.7-59.4)	383	73.8 (72.2-75.5)	2107	21.8 (21.6-22.0)
Bladder (188)	14	2.66 (2.34-2.98)	347 3.59 (3.51-3.68)	8	1.43 (1.21-1.66)	111	1.14 (1.09-1.19)
Kidney (189)	39	7.57 (7.02-8.11)	544 5.71 (5.61-5.82)	15	2.75 (2.43-3.06)	213	2.19 (2.13-2.26)

<sup>1</sup> Age-standardized to the 'world' standard population (per 100,000)<sup>2</sup> 95% confidence interval

Maori: 77.9 (77.1-78.7) to 62.7 (62.0-63.4) and increase in women (Maori: 103.3 (98.0-107.7) rising to 119.0 (115.1-123.0); non-Maori: 24.5 (24.0-24.9) to 28.3 (27.8-28.8)); and (ii) bladder cancer which fell in men (Maori: 10.3 (8.9-11.7) to 6.9 (5.9-7.9); non-Maori 17.4 (17.0-17.8) to 14.0 (13.7-14.3)) but not in women.

## Discussion

This analysis of national truncated (35-64 years) rates has confirmed a generally higher rate of smoking-related cancers, other than cancers of the bladder and larynx, in Maori than in non-Maori New Zealanders. The excess was greater for cancer of the lung (Maori/non-Maori rate ratio between 2

and 4) than for cancers of the mouth/pharynx, pancreas, kidney and oesophagus (males only) (Maori/non-Maori rate ratio between 1.1 and 1.8). With respect to those cancers for which both alcohol and tobacco are risk factors, only some (mouth/pharynx, pancreas, oesophagus (males) but not larynx or oesophagus (female)) show a higher incidence in Maori.

Of these cancers, the aetiological fraction attributable to 'ever smoking tobacco regularly' (based on data derived from north American, western European, Scandinavian and Australian sources) is clearly highest in lung cancer (m: 84%; f: 77%) followed by cancers of the larynx (m: 73%; f: 66%), mouth/pharynx (m: 57%; f: 51%), renal pelvis (m: 55%; f: 48%), oesophagus (m: 54%; f: 46%), bladder (m: 43%; f: 36%), renal parenchyma (m: 28%; f: 21%) and pancreas (m:

24%; f: 19%) (English et al, 1995).

There is no immediately obvious explanation for the lower incidence and mortality rates of bladder cancer in Maori than non-Maori. We have considered several possibilities, namely, mismatch between numerator and denominator in the calculation of rates, incomplete enumeration, and a number of biologically based explanations – genetically or environmentally determined protective factors or the absence in Maori of exposure to a necessary non-tobacco genotoxin.

An unknown but large proportion of persons who regard themselves as Maori have some European ancestry (Reid and Robson, 1998; J. Broughton; personal communication, 7/2/00). Denominator data for published cancer rates have been derived from the five-yearly national population census in which, up to and including that in 1981, Maori were defined as those with half or more Maori ancestry (Department of Statistics, 1988). From the census in 1986 the question relating to ethnic origin changed to allow people to identify themselves using one or more racial group. Identification only as Maori has been taken as the closest equivalent of the former category 'half or more Maori ancestry' (Pomare et al, 1995). Cancer registration (providing the numerator) has been based on notifications from hospitals, where medical documentation of ethnic origin uses a form of question suggesting cultural affiliation (ie. self-identification) (Brown, 1983). Mismatch between classification at cancer registration and the census will bias age-adjusted rates. However, as this is unlikely to affect patients with bladder cancer to a different extent than those with other smoking-related cancers, this source of bias cannot explain contrasting patterns of distribution between Maori and non-Maori.

Although there may be a lesser usage of health services by Maori than non-Maori for some conditions, Maori patients with cancer are admitted to public hospitals at least as frequently as non-Maori cancer patients (Pomare et al, 1995). Few Maori have private health insurance (Ruakerre, 1998; J. Broughton; personal communication, 7/2/00). As cancer notifications are principally from public hospitals, under-enumeration is unlikely to be a major factor distorting cancer rates in Maori. Even if under-enumeration had occurred to a greater extent for bladder, and possibly laryngeal, cancer than for other cancers, the mortality rates also show a deficit of bladder cancer (males only) but of no other smoking-related cancers in Maori.

A parallel situation exists in Hawaii where male bladder cancer in 1988-92 (incidence per 100,000; all ages) was significantly less common in Polynesian Hawaiians (3.9, based on 16 cases) than in the Caucasian population (24.2) despite higher rates of lung cancer (72.3 cf 59.6, respectively) (Parkin et al, 1997). For this analysis, non-Maori included Pacific Island people who are chiefly Polynesians and therefore racially more similar to Maori than New Zealanders of European descent. However, as the proportion of Pacific Island people was small and their age relatively young, the results would not be affected by grouping them with non-Maori.

That Maori are protected against the carcinogenic effects of tobacco on the bladder may be due either to a genetic factor or to an as yet unrecognised protective aspect of the Maori lifestyle. Differences in bladder cancer incidence between ethnic groups with similar smoking habits (eg. US whites, African Americans and Japanese Americans in Los Angeles) have been accounted for, at least in part, by polymorphisms in genes controlling the metabolism of aromatic amines (Feigelson et al, 1996). Acetylator phenotype is the most clearly identified and extensively studied of the genetic polymorphisms influencing susceptibility to bladder cancer. As this appears to modify risk of bladder cancer more in Caucasians than Asians, other genetic or environmental factors must play a significant role. Genetic polymorphisms in the relevant metabolic pathways have not been examined in Maori.

The protective effect of consumption of fruit and vegetables has been explored in relation to bladder cancer. Of seven studies that were published in English between 1979 and 1994 and considered various types and measures of fruit and vegetable consumption, six found relative risk estimates of between 0.5 and 0.7 for the highest versus the lowest consumption level (La Vecchia and Negri, 1996). Another possible protective factor – volume of fluid drunk – was examined in the Health Professionals Follow-up Study, a relative risk of 0.5 being found for the highest quintile of total daily fluid intake (>2531 ml per day) compared with the lowest quintile (<1290 ml per day) (Michaud et al, 1999). However, other studies have not confirmed this reduction in risk (eg. Cantor et al, 1987; Slattery et al, 1988).

With regard to cancers of the aero-digestive tract, Maori show a distinct excess only for cancer of the oesophagus in males (incidence but not mortality). This observation may be accounted for by gastric cancer being more common in Maori (Dockerty et al, 1991), as adenocarcinomas of the gastro-oesophageal junction, possibly of gastric origin, may be registered as oesophageal. The lack, in Maori, of any excess of laryngeal cancer, and the relatively small excess of cancers of the mouth/pharynx, may be attributed to their low prevalence of regular alcohol consumption or different drinking habits.

The patterns of incidence of, and mortality from, tobacco-related cancers in Maori and non-Maori New Zealanders emphasize the importance of as yet unidentified co-factors, possibly genetic or related to lifestyle, which determine the carcinogenesis of tobacco at various sites.

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