

# Adult morbidity and mortality due to tobacco smoking in the Northern Territory 1986–1995

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**Cover**

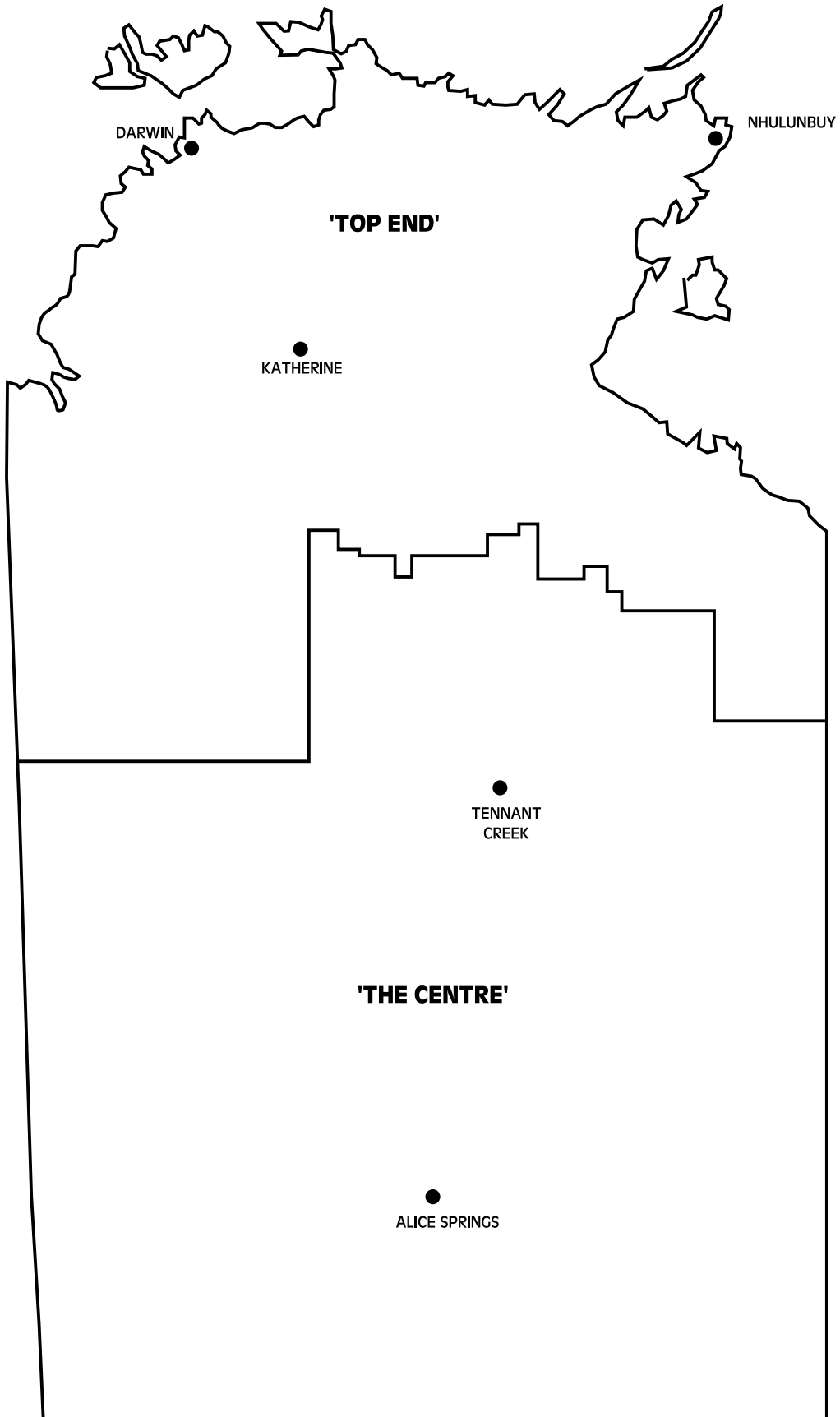
The poster used in the design of the cover of this report was drawn by Haliana Austral. Late in 1997, a 'Health Week' was held at Milikapiti, a remote Aboriginal community in the Northern Territory. Tobacco and smoking were the main focus of the week and education sessions were held in the schools. At the end of the week the children were asked to draw a picture about the effects of smoking and one of these pictures was selected for the cover. Other pictures have been used to produce a poster for health promotion programs in schools and communities.

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# Regions of the Northern Territory



## Summary

Cigarette smoking is a major risk factor for the development of many diseases and conditions. The Northern Territory has the highest smoking rates of any state or territory in Australia. This study aims to quantify the effect of smoking on mortality and hospital morbidity among residents of the Northern Territory for the period 1986–1995.

Using the aetiological fraction method, this study found that 3% of hospital admissions and 20% of deaths of Northern Territory adults were directly attributable to smoking. Aboriginal people have higher rates of smoking than non-Aboriginal people and it was therefore not surprising that they had higher age-specific and age-adjusted rates of hospital admissions and deaths due to smoking. Higher rates of smoking attributable hospital admissions and deaths for Aboriginal people in the Top End reflect the fact that they smoke at substantially higher rates than do Aboriginal residents of The Centre region of the Northern Territory.

Chronic obstructive pulmonary disease, ischaemic heart disease and lung cancer are the three most common smoking related conditions resulting in hospitalisation or death of both Aboriginal and non-Aboriginal people.

The amount of morbidity and mortality attributed to smoking in this report is likely to be underestimated. This is due to issues such as the correct assignment of Indigenous status, the use of pooled relative risks for the Aboriginal population, and the movement of Northern Territory residents interstate when diagnosed with a terminal illness.

It is envisaged that the findings of this study will be useful in assisting health promotion efforts to reduce the number of Aboriginal and non-Aboriginal people who smoke in the Northern Territory and consequently lead to a reduction in the amount of preventable morbidity and mortality in the community.

# Introduction

Cigarette smoking is probably the single major cause of ill-health and premature death in Australia. It is an important factor in the development of many diseases and conditions, and affects people of all ages. For example, smoking increases the risk of low birthweight among infants whose mothers smoke during pregnancy (US DHSS 1989), increases asthma and allergic reactions among teenage smokers (Townsend *et al.* 1991), and increases the risk of premature death from heart disease, stroke, lung cancer and chronic lung disease among adults (Winstanley *et al.* 1995).

Residents of the Northern Territory have the highest rates of smoking in Australia (ABS, 1997), and may therefore also have a higher risk of suffering from smoking related diseases or conditions. Analyses of mortality indicate that Territorians have the highest death rate of any state or territory in Australia. (AIHW 1996). The considerable differences in the health status of Aboriginal peoples compared with that of other Territorians have been amply demonstrated in previous reports (Plant *et al.* 1995; Markey *et al.* 1996; ABS 1997). Much, but not all, of the difference between Territorians and other Australians can be attributed to the high proportion of Aboriginal people living in the Northern Territory compared with elsewhere in Australia. Non-Aboriginal male Territorians have a higher death rate compared with non-Aboriginal males living in the other states of Australia (Plant *et al.* 1995).

There is little doubt that risk factors such as cigarette smoking play an important role in the poor health status of Territorians. There is, however, little information available on the impact of smoking on the residents of the Northern Territory. This report, which is an attempt to remedy this situation, presents estimates of the numbers, rates and proportions of adult hospital admissions and adult deaths that can be attributed to smoking in the Northern Territory. The method used in this report is the aetiological fraction method described by English *et al.* (1995).

Non-Aboriginal people in the Northern Territory tend to smoke at similar rates regardless of which region they live in. Data from surveys conducted in the late 1980s and in 1994 indicated that Aboriginal residents of the Top End (Darwin, East Arnhem and Katherine districts) had substantially higher smoking rates than those who live in The Centre (Barkly and Alice Springs districts). As a result, information on the impact of smoking on Aboriginal and non-Aboriginal people is presented separately for residents of the Top End and The Centre.

It is envisaged that the availability of information on smoking related illness and deaths in the Northern Territory will assist the health promotion efforts aimed at reducing the prevalence of smoking in the population.

This report consists of five chapters. The first chapter provides details of the aetiological fraction method described by English *et al.* and used in preparing this report, as well as the data sources for mortality, hospital admissions and smoking prevalence. An overview of mortality, morbidity and smoking in the Northern Territory is presented in the second chapter which contains both an analysis of the latest available mortality and hospitalisation data and a review of published literature. The results of the study are presented in two chapters. Chapter three presents estimates of deaths attributable to smoking and chapter four includes estimates of the numbers of hospital admissions attributable to smoking. The results of the analyses are discussed in chapter five. An appendix containing detailed tables of the condition specific relative risks, smoking rates and results is also included.

# 1. Data sources and methods

## 1.1 Data sources

### 1.1.1 Mortality data

Data on deaths of Territorians were obtained, through the Australian Bureau of Statistics (ABS), from information collected by the Northern Territory Registrar of Births, Deaths and Marriages. The information contained in this dataset does not include information that can be used to identify any individual but includes date of death, Indigenous status, usual place of residence and the underlying cause of death. This dataset does not contain information on Northern Territory residents who died interstate.

Information on Indigenous status of deceased persons is usually provided by the person registering the death. The quality of the information depends on the closeness of the relationship between the deceased and the person registering the death. Prior to 1988 information on the Indigenous status of the deceased was not included on the death certificate in the Northern Territory. However, Indigenous status was inferred for all deceased persons for the period 1979–1988 as part of work undertaken in the Epidemiology Branch of Territory Health Services on the basis of information on the death certificate such as an Aboriginal name or residence in an Aboriginal community, place of birth, place of death and burial and names of parents (Plant *et al.* 1995).

The cause of death is supplied by a medical practitioner or coroner and pertains to the disease or event which initiated the process which led directly to death. The causes of death are coded at the ABS using the Ninth Revision of the International Classification of Diseases (ICD–9) (ABS 1996). The mortality analyses in this report are by year of death, not by year of registration. As there is usually a delay between the date of death and the date of registration of the death (especially for deaths that occur late in the year), about five to ten percent of deaths every year are usually included in the data for the following year. Although 1996 deaths data were available at the time of analysis, deaths occurring late in this year may not be registered until 1997 and would not have been included in this report. As this may have affected the estimations and comparison of rates over time, trends in death rates presented in the overview of mortality in the Northern Territory refer to the period 1986 to 1995. Only adults whose usual place of residence was the Northern Territory have been included in this work. For the purposes of this report, an adult has been defined as a person who had reached at least 15 years of age.

### 1.1.2 Hospital morbidity data

Information on admissions to hospital is often used as a proxy measure to describe the health status of a population. A limitation of admissions data is that they only provide information on health problems serious enough to require hospitalisation. In this project, admission to hospital (hospital morbidity data) was used to estimate morbidity among the Aboriginal and non-Aboriginal populations of the Northern Territory. Each admission to hospital is recorded in the hospital morbidity dataset as a separate episode. Therefore, it is likely that the data contains individuals who were admitted to hospital on more than one occasion for one or more conditions.

There are five public hospitals and one private hospital in the Northern Territory. The hospital morbidity dataset only contains information on admissions to the five public hospitals which are located in the Top End (Darwin, Nhulunbuy and Katherine) and The Centre regions (Tennant Creek and Alice Springs). Data on admissions to the one private hospital in the Northern Territory were not available for analysis. The public hospital morbidity data have been analysed for two different periods, 1986–1988 and 1993–1995, because of incomplete data for the intervening period 1989–1992.

The dataset contains basic demographic information on all patients. The primary reason for a patient's admission is obtained at the time of discharge from hospital. The principal diagnosis is classified by hospital coders according to the ICD–9. The hospital morbidity dataset also contains information on up to nine other conditions (co-morbidities) that may have been present or diagnosed during the patient's stay in hospital, as well as the duration of the patient's stay.

The quality of information on Indigenous status in the hospital morbidity dataset can vary substantially. This is because the information may be provided directly by the patient, by a person accompanying the patient, or inferred by the admissions clerk.

Information on the usual place of residence of individuals admitted to hospital was used to determine whether people resided in the Top End or in The Centre. Where information on usual place of residence was missing, region was derived from hospital location codes. Individuals admitted to the Royal Darwin Hospital, Katherine Hospital or Gove District Hospital were included in the analysis of residents of the Top End. Individuals admitted to the Alice Springs Hospital or Tennant Creek Hospital were included in the analysis of residents of The Centre.

Although admission to hospital often reflects the severity of diseases or conditions, there are occasions when people admitted to hospital may not be ill. These include admissions for normal childbirth (ICD-9 Codes 650.0–651.2) and for procedures coded under the rubric ‘Supplementary classification of factors influencing health status and contact with health services (ICD-9 Codes V01-V82)’. An example of these conditions includes admissions associated with activities such as organ donation or admission for accompanying a sick person. These conditions clearly do not provide useful information about the level of morbidity in a population and to include them in the total number of admissions due to ill-health would result in an underestimate of the proportion of morbidity that can be attributed to smoking. These conditions were therefore excluded from the analysis for this report.

The hospital admission data were only analysed for adults who were usual residents of the Northern Territory. For the purposes of the report, an adult was defined as a person aged 15 years and over at the time of admission to hospital.

### ***1.1.3 Smoking data***

Information on the prevalence of smoking in the Northern Territory is mostly available from surveys carried out by the Australian Bureau of Statistics (ABS) and Territory Health Services.

ABS surveys conducted in 1986, 1990 and 1994 as part of monthly population surveys provide information about the smoking patterns of urban-based residents of the Northern Territory. Although the published results from these surveys do not distinguish between Aboriginal and non-Aboriginal people, these results most likely reflect the smoking pattern of non-Aboriginal people as they make up the majority of people living in the urban areas of the Northern Territory.

The major sources of information on smoking in Aboriginal populations are a comprehensive survey of drug use patterns conducted in 1986 among Northern Territory Aboriginal Communities (Watson, Fleming and Alexander 1988) and the 1994 National Aboriginal and Torres Strait Islander Survey (NATSIS) (ABS 1995).

The Watson survey collected information on drug use from 1,764 Aboriginal people aged 15 years and over living in major communities, town camps, cattle stations and outstations. The survey was conducted in the Top End between April and May 1986 and in The Centre between May and October 1987. The data from this survey were used in this report and are presented in the Appendix (Tables A2 and A3).

The 1994 NATSIS was the first national survey seeking information on the social, demographic, economic and health status of Indigenous people aged 13 years and over. Although data from this survey were available in a published form, the age and sex breakdowns were not suitable for the analysis conducted for this report.

In an attempt to identify other sources of information on smoking prevalence, several researchers and other health practitioners were contacted to determine if any other surveys have been carried out in Aboriginal communities. Several small community surveys had been conducted in the Top End but the small sample sizes meant that the results could not be generalised to the Aboriginal community as a whole. Nonetheless, these surveys yielded smoking rates very similar to those published in the 1986–87 Watson report (unpublished data, Territory Health Services). This suggests that the rates documented in the Watson report are likely to have remained fairly stable over the past ten years.

## 1.2 Methods

### 1.2.1 Aetiological fraction method

The method used to calculate the numbers and proportions of adult hospital admissions and deaths that can be attributed to smoking is known as the aetiological fraction (or attributable risk) method, and has been fully described in a report published by the Commonwealth Department of Human Services and Health (English *et al.* 1995). This method requires information on the prevalence of smoking in the population, the relative risk of smokers developing a particular disease or condition, and the number of events for that particular disease or condition.

English *et al.* (1995) estimated the relative risks for a large number of diseases and conditions. This was done after an extensive review of the literature on epidemiological studies which examined the relationship between smoking and various conditions. Most of these studies were conducted in populations with characteristics similar to those of the non-Aboriginal population of Australia. The calculation of the relative risks was done by meta-analysis involving the pooling of relative risks from individual studies.

As many of the studies that they reviewed did not provide details of the risk for people of different ages or for males and females separately, the majority of the relative risks presented in their report are not age or sex specific. These therefore assume that the excess risk for smokers is the same across age and sex. They were, however, able to produce age and sex specific relative risks for several specific conditions such as lung cancer and stroke. This was possible because of the relatively large number of studies on the relationship between smoking and these specific conditions. A detailed list of the relative risks for the different conditions examined in this report is presented in the appendix to this report (Table A1).

The aetiological fraction method can be summarised mathematically as:

$$AF = \frac{p_e(IRR - 1)}{p_e(IRR - 1) + 1}$$

where

AF = Aetiological fraction

$p_e$  = Proportion of smokers in a population

IRR = Relative risk of developing a disease or condition

The relative risk measures the excess risk in smokers compared with non-smokers by using the ratio of the incidence of the condition in smokers compared with the incidence in non-smokers. For example, the relative risk of lung cancer in males who smoke was estimated to be 13, that is, male smokers are 13 times more likely to develop lung cancer compared with males who do not smoke.

The method involves multiplying the total number of events (deaths or hospital admissions) by the aetiological fraction to determine how many of these events could be attributed to tobacco smoking, and how many were due to factors other than tobacco smoking.

This method does not identify individual cases which can be attributed to smoking, but provides an estimate of the proportion of all cases that can be attributed to smoking.



### Example of the aetiological fraction method of estimating the proportion of lung cancer deaths attributable to tobacco smoking

#### Example

Using a relative risk of 13 for developing lung cancer from smoking and a smoking rate of 40% (i.e. a proportion of .40) the aetiological fraction method would yield the following result:

$$\begin{aligned} \text{AF} &= \{(0.40(13-1)) / \{(0.40(13-1)+1)\}} \\ &= 0.8275 \end{aligned}$$

That is, 83% of new cases of lung cancer in that population could be attributed to smoking, and 17% of new cases of lung cancer in that population would be due to factors other than cigarette smoking.

### 1.2.2 Age-adjustment method

The age structures of different populations can lead to misleading comparisons of summary rates such as crude hospitalisation rates or crude death rates. For these reasons, rates are often adjusted for age differences. There are two different methods of standardisation commonly used to adjust for age: the direct and indirect standardisation techniques. The direct method was used in this report to ensure consistency with the methods used by other reports on smoking attributable morbidity and mortality. The total 1991 Australian population was used as the standard population to adjust both the hospitalisation rates and death rates.

The usual convention of using age-specific rates for five-year age groups has been followed. These age-specific rates for five-year age groups have been used for adjustment according to the following formula:

$$\text{AR} = \frac{\sum \{R_i \times P_i\}}{\sum P_i}$$

where

AR = the age-adjusted rate

$R_i$  = the age-specific rate for age group  $i$

$P_i$  = the standard population in age group  $i$

## 2. Overview of population, mortality, morbidity and smoking in the Northern Territory

### 2.1 Overview of population

In 1986, there were approximately 148,000 people in the Northern Territory. Of these, 25% were Aboriginal. The majority of people resided in the Top End (79% of all non-Aboriginal people and 65% of all Aboriginal people). By 1995, the total Northern Territory population had grown to approximately 173,000 with approximately 28% of people identifying as Aboriginal. The split between Top End and The Centre for both Aboriginal and non-Aboriginal remained fairly constant. The numbers of people by sex, Indigenous status and region of residence for the years 1986 and 1995 are presented in the Appendix (Table A4).

### 2.2 Overview of mortality

Data on deaths and their causes can highlight the worst health problems in a population and are commonly used to describe the health status of a community.

Age-adjusted death rates in the Northern Territory are substantially higher than the rates for other states in Australia (ABS 1997). In 1994, the age-adjusted death rate for male Territorians of 12.1 deaths per thousand population was 41% percent higher than the rate of 8.6 deaths per thousand population for all Australian males (AIHW 1996). The relative difference between the two populations was even larger for females. In 1994, the Territorian female age-adjusted death rate of 9.2 was 77% higher than the all Australian female rate of 5.2 deaths per thousand population (AIHW 1996).

The disparity between death rates for Territorians and all Australians does not appear to be improving for either males or females. For males, the ratio of the Territory to the Australian death rate in 1995 was 1.4 compared with 1.3 in 1986. For females, the rate ratio was 1.6 in 1995 compared with 1.5 in 1980.

**Table 2.1: Age-adjusted death rates: Number of deaths per thousand population by sex and Indigenous status, NT, 1986–95**

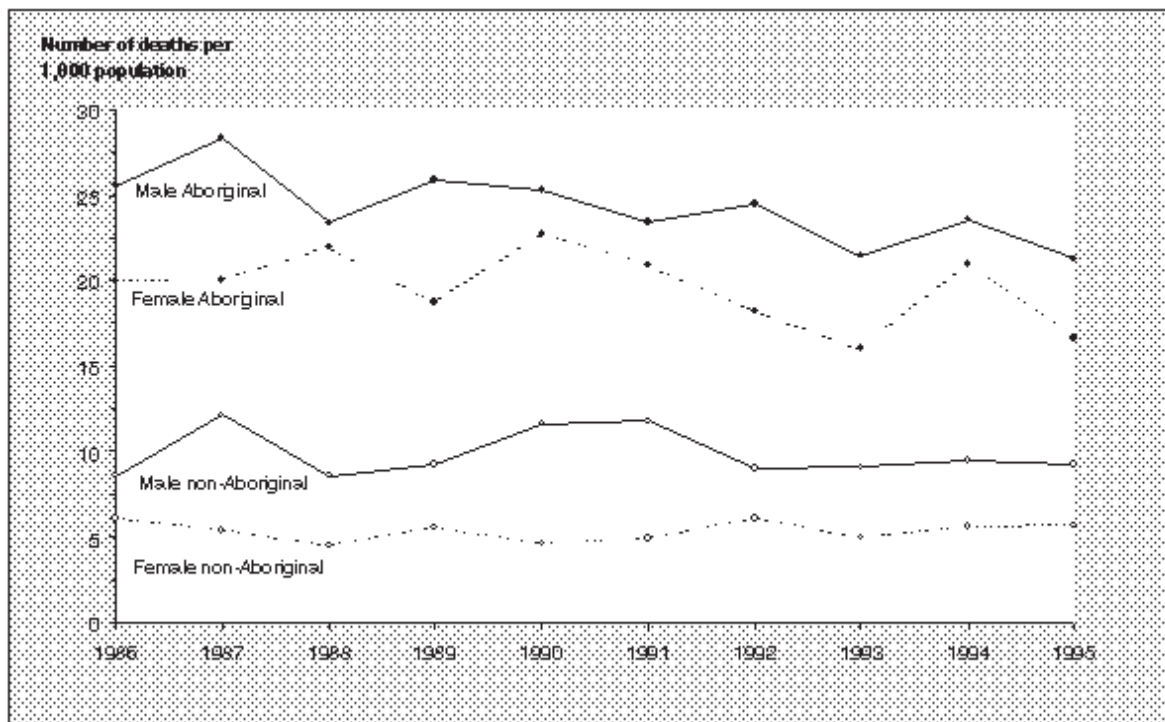
Year	Male			Female		
	Aboriginal	Non-Aboriginal	Rate ratio	Aboriginal	Non-Aboriginal	Rate ratio
1986	25.6	8.6	3.0	20.0	6.1	3.3
1987	28.4	12.1	2.3	20.1	5.4	3.7
1988	23.4	8.6	2.7	22.0	4.5	4.9
1989	25.9	9.2	2.8	18.7	5.5	3.4
1990	25.3	11.6	2.2	22.8	4.6	5.0
1991	23.5	11.8	2.0	20.9	4.9	4.3
1992	24.5	9.0	2.7	18.2	6.1	3.0
1993	21.5	9.1	2.4	16.0	5.0	3.2
1994	23.6	9.4	2.5	21.0	5.6	3.7
1995	21.3	9.2	2.3	16.7	5.7	2.9

Note: The death rates were adjusted for age by the direct method of age standardisation (using the 1991 total Australian population as the standard).

These higher death rates are reflected in lower life expectancies at birth for Northern Territory residents compared with those for all Australians. In 1994, males born in the Northern Territory had a life expectancy of 69.1 years compared with 75.0 years for the whole of Australia. The corresponding female life expectancy was 73.6 years for Territorians and 80.9 years for all Australians (ABS 1997).

The considerable differences in the health status of Aboriginal people compared with that of other Territorians have been amply demonstrated in other reports (Plant *et al* 1995; ABS 1997). It is often argued that the high mortality rates in the Territory are due to the relatively high proportion of Aboriginal people making up the Territory's total population. Aboriginal people account for about 28% of the total population of the Northern Territory whereas, they make-up about one to two percent of the populations of the other states of Australia.

Much, but not all, of the difference between death rates for Territorians and other Australians can be attributed to the high death rates for Aboriginal people living in the Northern Territory. In 1994 Australian males as a whole experienced an age-adjusted death rate of 8.6 deaths per thousand population (AIHW 1996) compared with 9.4 for non-Aboriginal male Territorians. The corresponding levels for females were 5.3 for all Australian females compared with 5.6 for non-Aboriginal female Territorians (AIHW 1996).



**Figure 2.1: Age-adjusted death rates: Number of deaths per thousand population, NT, 1986–94**

The ratios of the Aboriginal to non-Aboriginal death rates clearly demonstrate the greater burden of ill-health among the Aboriginal population (Table 2.1). In 1986, the age-adjusted death rate for Aboriginal males and females were 3.0 and 3.3 times higher than those for non-Aboriginal males and females respectively. In 1995, the relative differences between the two groups were 2.3 for males and 2.9 for females.

### *Age-specific death rates*

The differences in the age-adjusted death rates are reflected in the age-specific death rates which indicate higher levels of mortality at each age for the Aboriginal population compared with the non-Aboriginal population.

For the years 1986–1995 combined, the rates for Aboriginal females were greater than those for non-Aboriginal females at every age, with rate ratios ranging from 2.2 to 12.1. For the same period, the ratios of male Aboriginal rates to male non-Aboriginal rates ranged from 1.6 to 7.1. The relative differences were greater among 30–49 year old women and the 35–49 year old men.

**Table 2.2: Age-specific death rates: Number of deaths per thousand population by sex and Indigenous status, NT, 1986–95.**

Age group (Years)	Male			Female		
	Aboriginal	Non- Aboriginal	Rate ratio	Aboriginal	Non- Aboriginal	Rate ratio
0–4	6.9	2.2	3.1	6.2	2.0	3.1
5–9	0.7	0.3	2.3	0.6	0.1	6.0
10–14	0.8	0.4	2.0	0.5	0.1	5.0
15–19	2.6	1.4	1.9	1.1	0.4	2.8
20–24	4.3	2.3	1.9	2.3	0.6	3.8
25–29	7.0	2.1	3.3	3.3	0.5	6.6
30–34	7.8	1.7	4.6	3.7	0.4	9.3
35–39	11.5	1.8	6.4	6.5	0.7	9.3
40–44	15.0	2.8	5.4	10.9	0.9	12.1
45–49	23.4	3.3	7.1	14.0	1.5	9.3
50–54	34.3	6.7	5.1	17.7	2.6	6.8
55–59	39.0	12.1	3.2	32.7	4.5	7.3
60–64	59.0	19.5	3.0	43.7	9.2	4.8
65–69	75.3	32.1	2.3	67.0	14.2	4.7
70–74	94.3	40.0	2.4	106.5	24.9	4.3
75 and over	153.6	97.2	1.6	135.9	62.4	2.2
Age adjusted rate	24.1	9.8	2.5	19.4	5.3	3.7

### *Causes of death*

During the period 1986–1995, diseases of the circulatory system, neoplasms (cancers) and respiratory diseases were responsible for the majority of deaths among both Aboriginal and non-Aboriginal Australians living in the Northern Territory. Cigarette smoking is a well established cause of these diseases (US DHSS 1989). The other major group of causes of death in the Northern Territory is described under the International Classification of Diseases category, ‘Injury and poisonings’.

**Table 2.3: Number and proportion of deaths and age standardised death rates (per 100,000 population) by cause and Indigenous status, males, NT, 1986–1995**

Cause of death	Aboriginal			Non-Aboriginal		
	Number	Percent	Rate	Number	Percent	Rate
Diseases of the circulatory system	538	25.1	751.0	716	26.7	357.7
Diseases of the respiratory system	352	16.4	514.1	231	8.6	124.6
Neoplasms	222	10.3	337.8	532	19.8	221.9
Injury and poisonings	421	19.6	245.3	701	26.1	117.0
Infectious diseases	96	4.5	105.7	39	1.4	12.9
Other causes	518	24.1	459.6	466	17.4	145.2
<b>All causes</b>	<b>2147</b>	<b>100.0</b>	<b>2413.5</b>	<b>2685</b>	<b>100.0</b>	<b>979.3</b>

*Note:* 1. The cause-specific age-adjusted death rates were adjusted for age using the direct method of age standardisation (using the 1991 total Australian population as the standard).

2. Percentages shown are the proportion of the total in each column.

Together, diseases of the circulatory system and respiratory system and cancers accounted for 52% of deaths among Aboriginal males and 55% among non-Aboriginal males. The Aboriginal age-adjusted death rates were substantially larger than those for other Territorians for each specific cause of death.

**Table 2.4: Number and proportion of deaths and age standardised death rates (per 100,000 population) by cause and Indigenous status, females, NT, 1986–1995**

Cause of death	Aboriginal			Non-Aboriginal		
	Number	Percent	Rate	Number	Percent	Rate
Diseases of the circulatory system	392	23.7	552.6	297	26.6	195.7
Diseases of the respiratory system	299	18.1	416.3	97	8.7	57.0
Neoplasms	196	11.8	244.1	309	27.6	143.5
Injury and poisonings	152	9.2	98.2	178	15.9	40.6
Infectious diseases	77	4.6	91.2	7	0.6	4.2
Other causes	540	32.6	541.2	230	20.6	88.7
<b>All causes</b>	<b>1656</b>	<b>100.0</b>	<b>1943.6</b>	<b>1118</b>	<b>100.0</b>	<b>529.7</b>

*Notes:* 1. The cause-specific age-adjusted death rates were adjusted for age using the direct method of age standardisation (using the 1991 total Australian population as the standard).

2. Percentages shown are the proportion of the total in each column.

Diseases of the circulatory and respiratory systems and cancers accounted for 54% of Aboriginal and 63% of non-Aboriginal female deaths. As for the male population, the cause-specific age-adjusted death rates for each cause were substantially larger for Aboriginal females compared with those for all other female Territorians.

## 2.2 Overview of morbidity

The level of ill-health and disease (morbidity) in a community is particularly difficult to measure. One commonly used indicator is the number of, and reason for, admissions to hospital. This indicator measures the more severe cases of illness in a community. The condition(s) that causes a person to be admitted to hospital is more accurately recorded at time of discharge (that is, at the time of separation from) rather than at the time of admission to hospital. The major cause of hospitalisation used in this report therefore refers to the cause recorded at discharge from hospital. For this report, data referring to the number of episodes of hospital admission were analysed for the calendar years 1986–1988 and 1993–1995.

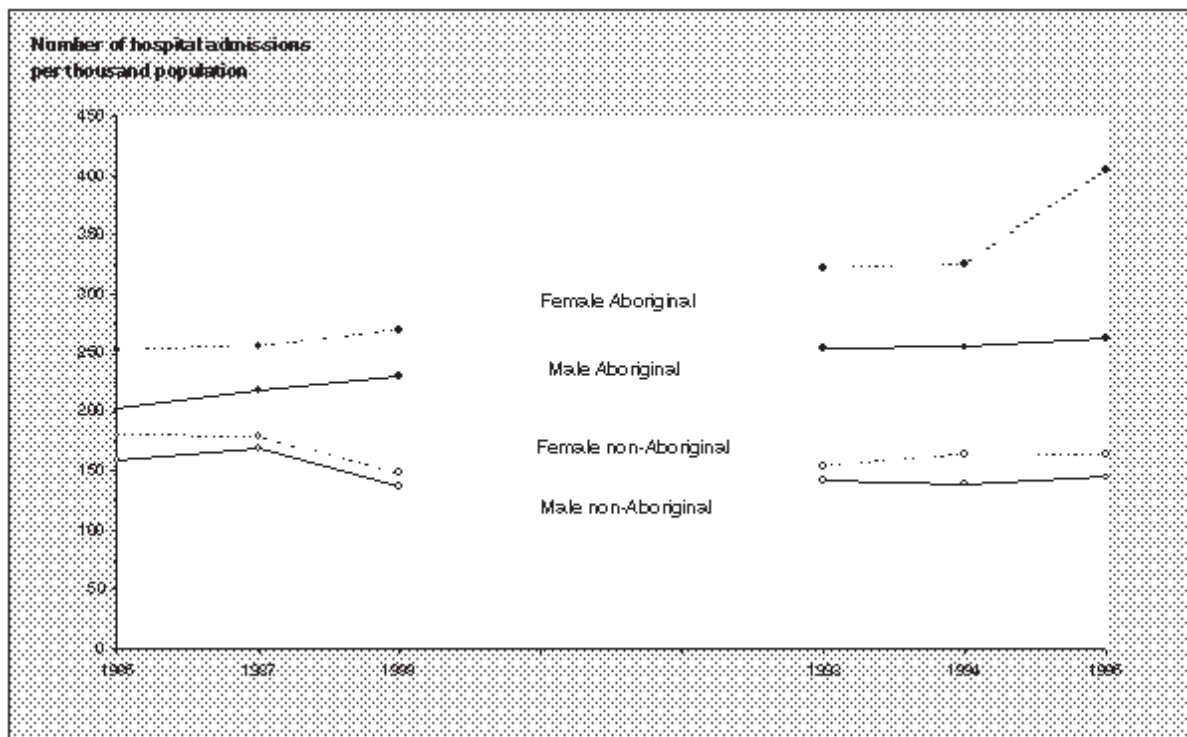
**Table 2.5: Age-adjusted hospitalisation rates: Number of hospital admissions per thousand population, public hospitals only, Northern Territory, 1986–1988 and 1993–1995**

	Male			Female		
	Aboriginal	Non-Aboriginal	Rate Ratio	Aboriginal	Non-Aboriginal	Rate Ratio
1986	202.0	159.7	1.3	252.7	180.1	1.4
1987	217.9	169.4	1.3	256.2	179.7	1.4
1988	229.3	137.1	1.7	269.7	148.5	1.8
1993	254.0	142.1	1.8	322.2	154.1	2.1
1994	254.7	139.8	1.8	324.9	164.2	2.0
1995	262.2	145.0	1.8	405.0	163.9	2.5

*Note:* The hospitalisation rates were directly adjusted using the 1991 total Australian population as the standard.

Within the Territory, the age-adjusted hospital admission rates were greater for Aboriginal people compared with those for non-Aboriginal people. The trends over time in the rates for these two groups were different with a decline in the non-Aboriginal group and an increase in the Aboriginal group. The non-Aboriginal age-adjusted hospitalisation rates declined, between 1986 and 1995, from 159.7 to 145.0 admissions per thousand population for males and from 180.1 to 163.9 for females. In contrast the Aboriginal rates increased from 202.0 to 262.2 for males and from 252.7 to 405.0 for females. This difference in the direction of the trends for the two population groups means that the relative disparity between them is also increasing. In the ten years from 1986 to 1995, the ratio of the age-adjusted hospital admission rates for Aboriginal males relative to non-Aboriginal males increased from 1.3 to 1.8. The corresponding increase among females was from 1.4 to 2.5.

The hospital admission rates for non-Aboriginal males declined by approximately 15% in the ten years from 1986 to 1995. The rates for non-Aboriginal females also declined from 1986 to 1995. The drop in the rates for non-Aboriginal people from 1986 onwards may be partially explained by the establishment of a private hospital in Darwin in September 1987. This hospital has a majority of non-Aboriginal people as its clientele. The private hospital separation data are not available and were not included in this report.



**Figure 2.2: Age-adjusted hospitalisation rates: Number of hospital admissions per thousand population, public hospitals only, Northern Territory, 1986–1988 and 1993–1995.**

### *Causes of hospital admissions*

Although admission to hospital sometimes reflects severity of diseases or conditions, there are occasions when people admitted to hospital may not be ill. Examples include admissions for normal childbirth and procedures associated with activities such as organ donation or admission for accompanying a sick person. These conditions do not provide useful information about the level of morbidity in a population and were excluded in the analysis for this report.

The proportion of hospital admissions due to diseases of the respiratory system, circulatory diseases and neoplasms (cancers) increased from 13.1% in 1986–1998 to 14.1% in 1993–1995 for non-Aboriginal females. The corresponding change among Aboriginal females was similar (16.7% to 18.0%).

In their analysis of hospital admission data for the period 1979 to 1991, Plant *et al.* (1995) concluded that the increase in the rates for Aboriginal people had almost certainly resulted from an improvement in access to health services. Plant *et al.* (1995) also noted that the difference between the death rates for Aboriginal and non-Aboriginal people was much greater than that for hospitalisation rates, indicating a relatively high level of unmet need for health services in Aboriginal communities.

## 2.3 Overview of cigarette smoking

Information on the prevalence of smoking in the Northern Territory is mostly available from surveys carried out by the Australian Bureau of Statistics (ABS) and Territory Health Services.

The ABS surveys, conducted in 1986, 1990 and 1994 provide information about the smoking patterns of urban-based residents of the Northern Territory. The published results from these surveys do not distinguish between Aboriginal and non-Aboriginal people but the figures most likely reflect the smoking pattern of non-Aboriginal people as they make up the majority of people living in the urban areas of the Northern Territory. An analysis of the ABS urban-based surveys focusing on Darwin indicated that 37% of Darwin residents aged 18 years and over reported that they smoked in 1990 (Richards and McComb, 1996). This level was substantially higher than that reported for people living in other parts of Australia with 28% of adult Australians reporting that they were smokers in the 1989–90 ABS National Health Survey (ABS 1992).

In addition to the difference in reported levels, a comparison of trends in smoking rates indicated that there may be substantial differences between the NT trend and that reported at national level. Richards and McComb (1996) found that the smoking prevalence for Darwin men decreased from 46% at the 1986 survey to 40% in 1990. That proportion did not change between 1990 and 1994. The situation for women was slightly different. The proportion of women who smoked increased from 26% in 1986 to 34% in 1990. Although the proportion of women smoking had declined to 31% in 1994, that proportion was still higher than that observed in 1986. In contrast, an analysis of trends using national data from the National Heart Foundation 1980, 1983 and 1989 Risk Factor Prevalence Surveys and the ABS surveys indicated that the proportion of Australian men and women who smoked declined steadily between 1980 and 1995 (Abraham *et al.* 1995). The smoking rate for Australian men aged 25–64 years declined from 34% in 1989–90 to 29% in 1994–95 and for women of the same age group from 26% to 23%.

The major sources of information on smoking in Aboriginal populations are a comprehensive survey of drug use patterns conducted in 1986 among Northern Territory Aboriginal Communities (Watson, Fleming and Alexander 1988) and the 1994 National Aboriginal and Torres Strait Islander Survey (NATSIS) (ABS 1996).

The Watson survey collected information on drug use from 1,764 Aboriginal people aged 15 years and over living in major communities, town camps, cattle stations and outstations. The survey data were collected in the Top End between April and May 1986 and in The Centre between May and October 1987. The 1994 ABS NATSIS was the first national survey seeking information on the social, demographic, health and economic status of Indigenous people. The major difference between the 1986–87 Watson survey and the 1989–90 ABS National Health Survey is the difference in the age of the respondents – 15 years and over for the Watson survey and 13 years and over for the ABS survey. In addition, the surveys were conducted in different time periods. Any comparison of the results from these two surveys must, therefore, be done with care.

An analysis of the Watson survey for Darwin-based people found that 56% of Aboriginal people smoked compared with 36% of non-Aboriginal Darwin residents (Richards and McComb 1996). Another major finding of the Watson survey was that smoking patterns varied significantly between Aboriginal people who resided in the Top End and those living in The Centre. Over twice the proportion of Top End residents smoked (70%) compared with those from The Centre (33%). This pattern was confirmed in the 1994 NATSIS which found substantial differences between regions with 29% in the Alice Springs ATSIIC (part of The Centre) region compared with 61% in the Jabiru ATSIIC (part of the Top End) region (AHIW 1996).

These differing patterns between Aboriginal and non-Aboriginal people and between Aboriginal people living in the Top End and Centre regions of the Territory suggest that analyses of data in this report should be reported separately for these population groups. For the purposes of this report the Top End consists of the Darwin, East Arnhem and Katherine districts and The Centre consists of the Alice Springs and Barkly districts (see map, page 1).



### 3. Mortality attributable to smoking, 1986–1995

#### 3.1 Adult mortality in the Northern Territory

An analysis of death for the period 1986–95 indicated that there was a total of 6,409 deaths (15 years of age and over) of adults usually resident in the Northern Territory.

**Table 3.1: Number of registered deaths of adults aged 15 years and over, by sex, region and Indigenous status, Northern Territory, 1986–1995.**

Age group (years)	Men		Women		Total	
	Top End	The Centre	Top End	The Centre	Top End	The Centre
<b>Aboriginal</b>						
15-24	87	65	56	22	143	87
25-34	154	99	75	44	229	143
35-44	158	104	118	71	276	175
45-54	235	110	140	59	375	169
55-64	240	100	234	78	474	178
65-74	174	80	214	85	388	165
75 and over	95	116	99	116	194	232
<b>Total 15 years and over</b>	<b>1143</b>	<b>674</b>	<b>936</b>	<b>475</b>	<b>2079</b>	<b>1149</b>
<b>Non-Aboriginal</b>						
15-24	130	37	37	9	167	46
25-34	179	35	40	10	219	45
35-44	206	45	63	14	268	59
45-54	271	61	80	19	351	80
55-64	386	98	104	39	490	137
65-74	330	97	150	41	480	138
75 and over	306	83	241	71	547	154
<b>Total 15 years and over</b>	<b>1807</b>	<b>456</b>	<b>715</b>	<b>203</b>	<b>2522</b>	<b>659</b>

3,228 Aboriginal adults (aged 15 years and over) died in the Northern Territory between 1986 and 1995. Of these, the majority 2,079 (64%) were from the Top End compared with 1149 (36%) from The Centre.

Of the 3,181 non-Aboriginal adult deaths in the Northern Territory, 79% (2522) were from the Top End and 21% (659) from The Centre.

### 3.2 Number of deaths attributable to smoking

Tobacco smoking was estimated to be responsible for the death of 1,255 or 20% of the 6,409 adults who died in the Northern Territory between 1986 and 1995 - that is, one in every five adults from the Northern Territory died as a result of smoking cigarettes.

**Table 3.2: Number of registered deaths of adults aged 15 years and over, by sex, region and Indigenous status, Northern Territory, 1986–1995.**

Region	Men			Women		
	Total number of deaths	No. of smoking related deaths	Percent	Total number of deaths	No. of smoking related deaths	Percent
<b>Aboriginal</b>						
Top End	1143	331	29	996	240	26
The Centre	674	84	13	475	5	1
<b>Total</b>	<b>1817</b>	<b>415</b>	<b>23</b>	<b>1411</b>	<b>245</b>	<b>17</b>
<b>Non-Aboriginal</b>						
Top End	1807	390	22	715	80	11
The Centre	456	101	22	203	24	12
<b>Total</b>	<b>2263</b>	<b>491</b>	<b>22</b>	<b>918</b>	<b>104</b>	<b>11</b>

*Note: Percent refers to the proportion of total deaths which can be attributed to smoking.*

**Difference by Indigenous status:** There was little difference in the proportions of deaths attributable to smoking for Aboriginal and non-Aboriginal people. Of the 3,228 Aboriginal adults who died, 660 or 20% were due to smoking. In comparison, smoking was responsible for 595 or 19% of the 3,181 deaths of non-Aboriginal people.

**Difference by sex:** Smoking attributable deaths were more likely to occur among men than women for both Aboriginal and non-Aboriginal people. The difference was greatest among non-Aboriginal people with 22% of men dying from smoking compared with 11% of women. The proportion of deaths attributable to smoking among Aboriginal men was 23% compared with 17% for Aboriginal women.

**Difference by region:** There was a higher proportion of smoking attributable deaths among Aboriginal people who resided in the Top End compared with those from The Centre. Among Aboriginal women, smoking accounted for 26% of deaths in the Top End compared with only 1% in The Centre. Among Aboriginal men, smoking was responsible for 29% and 13% of deaths in the Top End and The Centre respectively – a twofold relative difference.

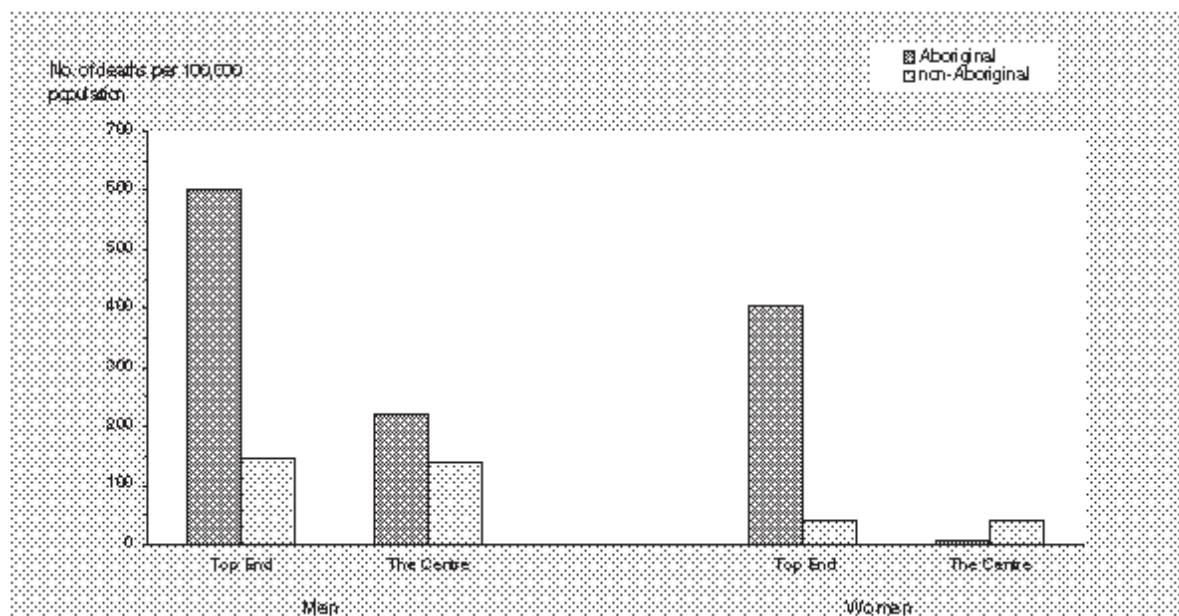
Smoking accounted for a similar proportion of deaths among non-Aboriginal people regardless of whether they resided in the Top End or The Centre. Approximately 22% of all deaths of non-Aboriginal men and 11% of non-Aboriginal women in the Top End and The Centre were attributable to smoking.

### 3.3 Smoking attributable death rates

#### Age-adjusted death rates

Differences in the age structure of the Aboriginal and non-Aboriginal populations of the Northern Territory required that the rates be adjusted for these age differences before a comparison could be made. Age-specific rates are also presented (Table 3.4).

**Figure 3.1: Age-adjusted death rates: Number of deaths attributable to smoking per 100,000 persons aged 15 years and over by sex, Indigenous status and region, 1986–1995.**



**Table 3.3: Age-adjusted death rates: Number of deaths attributable to smoking per 100,000 adults aged 15 years and over by sex, Indigenous status and region, 1986–1995.**

Region	Aboriginal		Non-Aboriginal	
	Men	Women	Men	Women
Top End	606	407	147	38
The Centre	221	9	140	38
<b>Total</b>	<b>457</b>	<b>251</b>	<b>145</b>	<b>38</b>

**Difference by Indigenous status:** Aboriginal people had substantially higher rates of smoking attributable deaths compared with non-Aboriginal people except for women in The Centre where the non-Aboriginal death rate for women was four times the Aboriginal rate. At Territory level, Aboriginal women had an age-adjusted smoking attributable death rate of 251 per 100,000 population, seven times that of non-Aboriginal women who had a rate of 38 deaths per 100,000 population. In contrast, the death rate for Aboriginal men (457 per 100,000) was three times that of non-Aboriginal men (145 per 100,000 population).

**Difference by sex:** Men were more likely than women to die from a smoking related cause. The relative difference between the rates for men and women was greater in the non-Aboriginal population than in the Aboriginal population. The age-adjusted death rate for non-Aboriginal men (145 per 100,000) was four times that for non-Aboriginal women (38 per 100,000). Among the Aboriginal population, the age-adjusted death rate for men (457 per 100,000) was 1.8 times that for women (251 per 100,000).

**Difference by region:** Aboriginal people living in the Top End were more likely to die from a smoking related cause than those living in The Centre. Aboriginal women in the Top End had an age-adjusted death rate 45 times that of Aboriginal women in The Centre. Aboriginal men in Top End had an age-adjusted death rate three times that of Aboriginal men in The Centre. In contrast, non-Aboriginal men and women in the Top End had similar death rates to those in The Centre.

### Age-specific death rates

Although the summary adjusted death rates presented above provide a good overview of mortality, perusal of age-specific death rates is vital to understand differences at finer age levels. These rates are based on small numbers of deaths and any difference between them should be interpreted with caution.

**Table 3.4: Age-specific death rates: Number of deaths due to smoking per 100,000 adults aged 15 years and over, by sex and Indigenous status and region, 1986–1995**

Age group (years)	Men		Women	
	Top End	The Centre	Top End	The Centre
<b>Aboriginal</b>				
15-24	10	8	5	4
25-34	88	28	36	8
35-44	220	207	183	25
45-54	1136	382	483	15
55-64	1866	791	1459	19
65-74	3698	708	2566	15
75 and over	4609	2345	3668	0
<b>Age-adjusted rate</b>	<b>605</b>	<b>221</b>	<b>407</b>	<b>9</b>
<b>Non-Aboriginal</b>				
15-24	1	0	0	0
25-34	4	1	0	0
35-44	22	18	2	3
45-54	99	111	21	19
55-64	466	437	102	134
65-74	818	1009	229	268
75 and over	2611	1922	760	534
<b>Age-adjusted rate</b>	<b>147</b>	<b>140</b>	<b>38</b>	<b>38</b>

**Difference by Indigenous status:** In general, Aboriginal people experienced higher age-specific smoking attributable death rates than non-Aboriginal people.

In the Top End, the age-specific death rates for each age group were higher for Aboriginal compared with non-Aboriginal people. The pattern in The Centre was a little different with non-Aboriginal men aged 65–74 years having a higher death rate than Aboriginal men of the same age. Non-Aboriginal women in The Centre aged 35 years and over were more likely to die from a smoking related cause than Aboriginal women of the same age. Only five Aboriginal women living in The Centre died from smoking related causes, making them the group least likely to die from smoking.

**Difference by sex:** Between 1986 and 1995, the risk of dying from smoking related causes was greater for men than for women, regardless of Indigenous status. Men experienced higher age-specific death rates than women for every age group.

**Difference by age:** In the period 1986 to 1995, the death rates for Aboriginal people started to increase at an earlier age than did those for non-Aboriginal people. The risk of dying from a smoking related disease for Aboriginal people increased substantially from about 35 years of age, compared with about 45 years for non-Aboriginal people.

### 3.4 Most common causes of death

The aetiological fraction method was applied to all adult diseases and conditions known to be caused by smoking (see Appendix, Table A1, page 29 for a complete list). Of these, chronic obstructive pulmonary disease, ischaemic heart disease, lung cancer, stroke, pneumonia, and oropharyngeal cancer were the six most common causes of death.

**Table 3.5: Age-adjusted death rates: Number of deaths per 100,000 population for the six most common causes of death due to smoking among adults aged 15 years and over, by Indigenous status, sex and region, 1986–1995**

Cause of death	Men		Women	
	Top End	The Centre	Top End	The Centre
<b>Aboriginal</b>				
Chronic obstructive pulmonary disease	219	44	185	0
Ischaemic heart disease	156	84	84	1
Lung cancer	109	25	45	1
Stroke	48	30	35	1
Pneumonia	26	20	23	2
Oropharyngeal cancer	12	3	3	0
All other causes	35	15	32	4
<b>All smoking related causes</b>	<b>605</b>	<b>221</b>	<b>407</b>	<b>9</b>
<b>Non-Aboriginal</b>				
Lung cancer	42	39	14	10
Ischaemic heart disease	36	39	7	8
Chronic obstructive pulmonary disease	34	41	8	14
Stroke	6	6	3	3
Laryngeal cancer	6	2	1	0
Atherosclerosis	6	1	2	0
All other causes	17	12	3	3
<b>All smoking related causes</b>	<b>147</b>	<b>140</b>	<b>38</b>	<b>38</b>

**Difference by Indigenous status:** Chronic obstructive pulmonary disease (COPD) was the most common specific cause of death due to smoking among Aboriginal people in the Top End with a rate substantially higher than that for ischaemic heart disease, the second most common cause of death. Lung cancer was the third largest cause of smoking related deaths. The pattern in the Centre was similar except that ischaemic heart disease was the most common specific cause of death among Aboriginal men.

In contrast, lung cancer were the most common specific cause of death due to smoking among non-Aboriginal people in the Top End, followed by ischaemic heart disease and COPD. In the Centre, COPD was the most common cause of death, closely followed by lung cancer and ischaemic heart disease.

**Difference by region:** Among the Aboriginal population, residents of the Top End had higher age-adjusted death rates for all six of the most common specific causes of death than did residents of The Centre. Aboriginal women in The Centre had substantially lower smoking attributable death rates for all of the top six specific causes. There was little difference between the cause specific death rates for non-Aboriginal people in the Top End and in The Centre.

## 4. Hospital morbidity attributable to smoking, 1986–1988 and 1993–1995

### 4.1 Hospital admissions in the Northern Territory

Information on public hospital admissions is presented for two periods, 1986–1988 and 1993–1995. Information on admissions to the Darwin Private Hospital were not available at the time of analysis and therefore have not been included. This will result in a conservative estimate of rates of smoking attributable admissions to hospital in the Northern Territory, particularly for non-Aboriginal people. The information presented is based on the principal diagnosis at time of discharge from hospital. Admissions for uncomplicated childbirth and for factors influencing health status and contact with health services (coded as V Codes under the ICD–9 Classification) were excluded from this analysis.

**Table 4.1: Total number of hospital admissions among adults aged 15 years and over, Northern Territory, 1986–1988 and 1993–1995**

Region	Aboriginal			Non-Aboriginal		
	Men	Women	Total	Men	Women	Total
<b>1986–1988</b>						
Top End	3207	5873	9080	12614	16066	28680
The Centre	2742	4251	6993	4095	4864	8959
<b>Total</b>	<b>5949</b>	<b>10124</b>	<b>16073</b>	<b>16709</b>	<b>20930</b>	<b>37639</b>
<b>1993–1995</b>						
Top End	4551	8861	13412	12810	16197	29007
The Centre	4116	6906	11022	4237	6082	10319
<b>Total</b>	<b>8667</b>	<b>15767</b>	<b>24434</b>	<b>17047</b>	<b>22279</b>	<b>39326</b>

There were 53,712 hospital admissions among Northern Territory residents aged 15 years and over between 1986 and 1988 (excluding admissions for normal child birth and those admissions coded under the V Codes of the ICD–9). Of these, 16,073 (30%) were Aboriginal and 37,639 (70%) were non-Aboriginal adults. Between 1993 and 1995, there were 63,760 adult hospital admissions in the Northern Territory. Of these, 24,434 (38%) were Aboriginal and 39,326 (62%) were non-Aboriginal.

## 4.2 Number of hospital admissions attributable to smoking

Smoking was responsible for 1,527 hospital admissions between 1986 and 1988, accounting for 3% of the 53,712 admissions of Northern Territory adults.

**Table 4.2: Number and proportion of hospital admissions attributable to smoking among adults aged 15 years and over, Northern Territory, 1986–1988**

Region	Men			Women		
	Total number of admissions	Number of smoking related admissions	Percent	Total number of admissions	Number of smoking related admissions	Percent
<b>Aboriginal</b>						
Top End	3207	217	6.8	5873	208	3.5
The Centre	2742	149	5.4	4251	34	0.8
<b>Total</b>	<b>5949</b>	<b>366</b>	<b>6.2</b>	<b>10124</b>	<b>242</b>	<b>2.4</b>
<b>Non-Aboriginal</b>						
Top End	12614	504	4.0	16066	162	1.0
The Centre	4095	193	4.7	4864	60	1.2
<b>Total</b>	<b>16709</b>	<b>697</b>	<b>4.2</b>	<b>20930</b>	<b>222</b>	<b>1.1</b>

Note: Percent refers to the proportion of total hospital admissions which can be attributed to smoking

Between 1986 and 1988, there were 608 Aboriginal adults were admitted to hospital as a result of smoking. This represented four per cent of the 16,073 admissions. In contrast, smoking accounted for 919 (2%) of 37,639 admissions of non-Aboriginal adults.

The proportion of total admissions due to smoking increased slightly to 4% in 1993–1995 when there were 2,299 (out of 63,760 total) admissions. Of the 24,434 admissions of Aboriginal adults, 1,059 (4%) were attributable to smoking compared with 1,240 (3%) of the 39,326 admissions of non-Aboriginal adults.

**Table 4.3: Number and proportion of hospital admissions attributable to smoking among adults aged 15 years and over, Northern Territory, 1993–1995**

Region	Men			Women		
	Total number of admissions	Number of smoking related admissions	Percent	Total number of admissions	Number of smoking related admissions	Percent
<b>Aboriginal</b>						
Top End	4551	366	8	8851	376	4
The Centre	4116	256	6	6906	61	1
<b>Total</b>	<b>8667</b>	<b>622</b>	<b>7</b>	<b>15757</b>	<b>437</b>	<b>3</b>
<b>Non-Aboriginal</b>						
Top End	12810	732	6	16197	211	1
The Centre	4237	225	5	6082	72	1
<b>Total</b>	<b>17047</b>	<b>957</b>	<b>6</b>	<b>22279</b>	<b>283</b>	<b>1</b>

Note: Percent refers to the proportion of total hospital admissions which can be attributed to smoking

**Difference by Indigenous status:** In the periods 1986–1988 and 1993–1995, Aboriginal adults (except for women living in The Centre) had a higher proportion of hospital admissions attributable to smoking compared with non-Aboriginal adults.

In 1986–1988, the proportion of Aboriginal women whose admission to hospital was due to smoking (2%) was twice the proportion for non-Aboriginal women (1%). The corresponding proportions for 1993–1995 were similar to those for 1986–1988 with 3% for Aboriginal and 1% for non-Aboriginal women.

Smoking was responsible for 6% and 4% of hospitalisations of Aboriginal and non-Aboriginal men in 1986–1988. In 1993–1995, these proportions increased slightly to 7% for Aboriginal men and 6% for non-Aboriginal men.

**Difference by region:** The proportion of hospital admissions attributable to smoking among Aboriginal people in the Top End was higher than the proportion for those living in The Centre. This difference was greater for women than for men. In 1986–1988 and in 1993–1995, smoking accounted for 4% of hospitalisations among Aboriginal women in the Top End, four times the proportion for The Centre at 1%.

Smoking accounted for a similar proportion of hospital admissions of non-Aboriginal people regardless of whether they resided in the Top End or The Centre, for both periods. In 1986–1988, smoking was responsible for 4% of admissions of non-Aboriginal men in the Top End and 5% of those in The Centre. Smoking accounted for approximately 1% of hospitalisations of non-Aboriginal women in the Top End and The Centre.

By 1993–1995, the proportions of hospital admissions of non-Aboriginal men had increased marginally in the Top End to 6% and remained constant in The Centre at 5% of admissions. This increase, however, should be viewed with caution because of the instability associated with the small numbers used to calculate these proportions. There was no change in the corresponding proportions for non-Aboriginal women from 1986–1988 to 1993–1995.

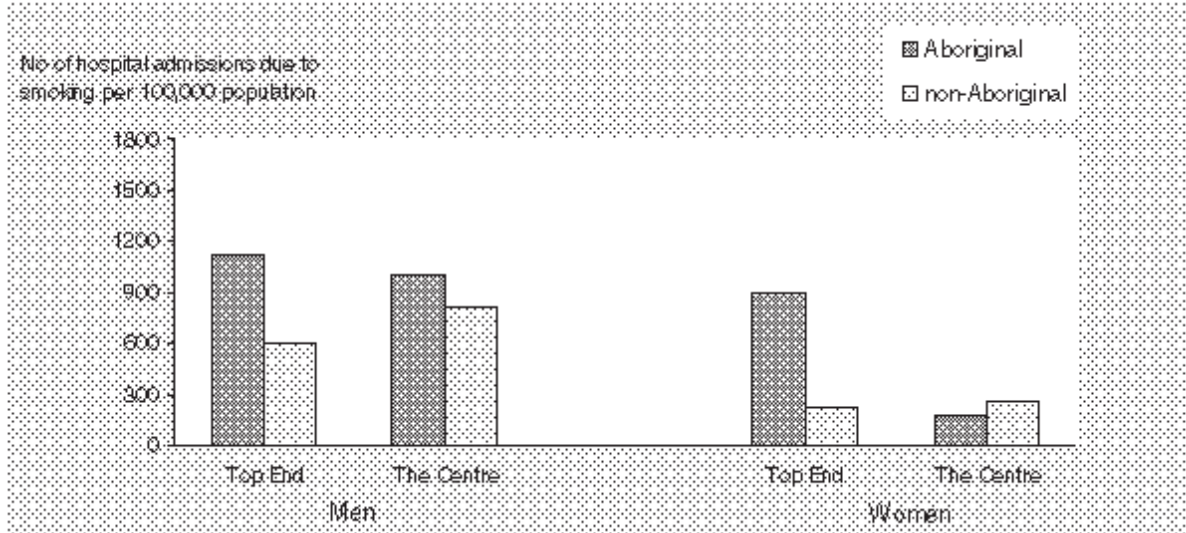
**Difference by sex:** The proportion of hospital admissions attributable to smoking among men was greater than for women, for both Aboriginal and non-Aboriginal people.



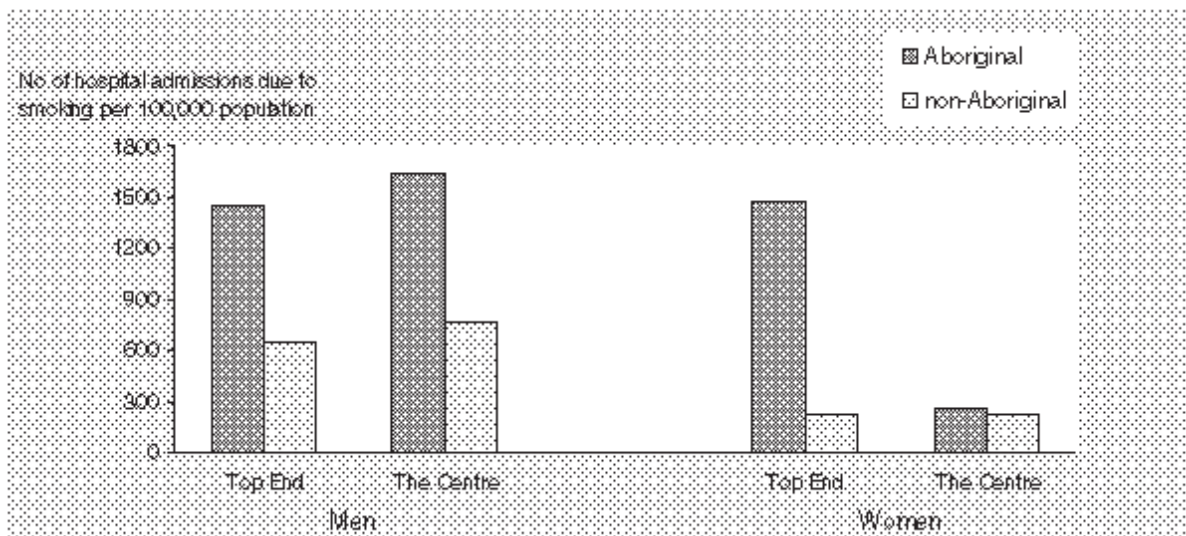
### 4.3 Smoking attributable hospitalisation rates

Differences in the age structure of the Aboriginal and non-Aboriginal populations of the Northern Territory required that the rates be adjusted for these age differences before a comparison could be made. Age-specific rates are presented in the Appendix (Tables A7 and A8, p32).

**Figure 4.1: Age-adjusted smoking attributable hospital admission rates: Number of admissions attributable to smoking per 100,000 population by sex, Indigenous status and region, 1986–1988**



**Figure 4.2: Age-adjusted smoking attributable hospital admission rates: Number of admissions attributable to smoking per 100,000 population by sex, Indigenous status and region, 1993–1995**



**Table 4.4: Age-adjusted hospitalisation rates per 100,000 population for hospitalisations attributable to smoking by sex, Indigenous status and region**

Region	Aboriginal		Non-Aboriginal	
	Men	Women	Men	Women
<b>1986-1988</b>				
Top End	1123	901	606	227
The Centre	1007	174	817	261
<b>Total</b>	<b>1022</b>	<b>689</b>	<b>654</b>	<b>234</b>
<b>1993-1995</b>				
Top End	1469	1472	649	230
The Centre	1636	270	772	222
<b>Total</b>	<b>1520</b>	<b>1013</b>	<b>672</b>	<b>228</b>

**Difference by Indigenous status:** Aboriginal people had higher age-adjusted rates of hospital admissions due to smoking compared with non-Aboriginal people. For the period 1986–1988, Aboriginal women had a smoking attributable hospitalisation rate almost three times that of non-Aboriginal women. For the same period, Aboriginal men one and a half times more likely to be admitted to hospital for smoking related conditions than were non-Aboriginal men.

The difference between the rates for Aboriginal people and non-Aboriginal people was greater in 1993–1995 than in 1986–1988. In 1993–1995, Aboriginal women had a smoking attributable hospitalisation rate over four times that of non-Aboriginal women. For the same period, Aboriginal men were over two times more likely than non-Aboriginal men to be admitted to hospital for a smoking related condition.

**Difference by region:** In 1986–1988 and 1993–1995, Aboriginal women in the Top End had a smoking attributable hospitalisation rate over five times that of Aboriginal women in The Centre. There was little difference in the smoking attributable hospitalisation rates by region for the other groups. For both periods non-Aboriginal men in the Centre had a slightly higher risk of being admitted to hospital for a smoking related condition than did non-Aboriginal men in the Top End.

**Difference by sex:** Men were far more likely to be admitted to hospital for a smoking related cause than were women, except for Aboriginal women in the Top End in 1993–1995 who had a rate similar to their male counterparts. Non-Aboriginal men were over twice as likely to be admitted for a smoking related cause than were non-Aboriginal women. Aboriginal men were one and a half times more likely than Aboriginal women to be admitted to hospital for a smoking related condition.

**Trends:** The rates of admissions to hospital for conditions due to smoking among Aboriginal people increased by over 40% from 1986–1988 to 1993–1995. Rates for non-Aboriginal people remained fairly stable between 1986–88 to 1993–1995.

The age-adjusted hospital admission rate for smoking related causes among Aboriginal women increased by nearly 50% from 689 admissions per 100,000 population in 1986–1988 to 1013 per 100,000 in 1993–1995. The rates for Aboriginal men increased by over forty percent from 1,060 admissions per 100,000 population in 1986–1988 to 1,520 in 1993–1995. Overall, Aboriginal women in the Top End and Aboriginal men in The Centre experienced the greatest increase with their rates increasing by over sixty percent.

## 4.4 Most common causes of hospitalisation

The aetiological fraction method was applied to a variety of conditions and diseases for which people were admitted to hospital (see Appendix, Tables A9 and A10, page 34 for a complete list). Of these, chronic obstructive pulmonary disease, pneumonia, ischaemic heart disease, stroke and lung cancer were the five most common causes of hospital admission due to smoking.

**Table 4.5: Age-adjusted smoking attributable hospital admission rates: Number of Indigenous hospital admissions attributable to smoking for the five most common specific causes by sex, and region, 1986–1988 and 1993–1995**

Specific cause	Men		Women	
	Top End	The Centre	Top End	The Centre
<b>1986–1988</b>				
Chronic obstructive pulmonary disease	372	251	435	64
Pneumonia	201	282	129	18
Ischaemic heart disease	162	151	93	8
Stroke	158	91	94	6
Lung cancer	98	26	17	2
Other	132	206	133	76
<b>All smoking related causes</b>	<b>1123</b>	<b>1007</b>	<b>901</b>	<b>174</b>
<b>1993–1995</b>				
Chronic obstructive pulmonary disease	474	484	612	29
Pneumonia	277	399	273	40
Ischaemic heart disease	293	284	248	32
Stroke	144	163	99	11
Lung cancer	144	49	64	0
Other	127	256	176	158
<b>All smoking related causes</b>	<b>1459</b>	<b>1635</b>	<b>1472</b>	<b>270</b>

**Table 4.6: Age-adjusted smoking attributable hospital admission rates: Number of non-Indigenous hospital admissions attributable to smoking for the five most common specific causes by sex, and region, 1986–1988 and 1993–1995**

Specific cause	Men		Women	
	Top End	The Centre	Top End	The Centre
<b>1986–1988</b>				
Chronic obstructive pulmonary disease	200	276	68	96
Ischaemic heart disease	104	169	41	41
Lung cancer	79	102	30	18
Stroke	38	49	18	26
Atherosclerosis	46	8	10	4
Other	467	604	167	185
<b>All smoking related causes</b>	<b>605</b>	<b>817</b>	<b>227</b>	<b>261</b>
<b>1993–1995</b>				
Chronic obstructive pulmonary disease	179	311	75	52
Ischaemic heart disease	165	169	51	35
Lung cancer	72	41	15	33
Stroke	48	47	14	11
Cardiac dysrhythmias	34	61	13	12
Other	498	629	168	143
<b>All smoking related causes</b>	<b>649</b>	<b>772</b>	<b>230</b>	<b>222</b>

**Difference by Indigenous status:** Chronic obstructive pulmonary disease was the most common specific cause of smoking related hospitalisation for both Aboriginal and non-Aboriginal people. However, the rates at which Aboriginal people were admitted for this condition were generally higher than those for non-Aboriginal people, particularly in the Top End.

The second most common smoking related causes of hospitalisation among the Aboriginal population was pneumonia. This was followed by ischaemic heart disease, stroke and lung cancer. Among the non-Aboriginal population, ischaemic heart disease was the second most common cause followed by lung cancer, stroke and atherosclerosis.

**Difference by region:** Aboriginal residents of the Top End had higher age-adjusted hospitalisation rates for specific smoking related causes than those of The Centre. The corresponding rates for non-Aboriginal people were similar in the Top End and The Centre.

## 5. Discussion and conclusion

**Table 5.1: Age-adjusted rates: Number of deaths and hospital admissions attributable to smoking per 100,000 population by Indigenous status, sex and region**

	Aboriginal		Non-Aboriginal	
	Men	Women	Men	Women
<b>Smoking attributable death rates 1986–1995</b>				
Top End	606	407	147	38
The Centre	221	9	140	38
<b>Total</b>	<b>457</b>	<b>251</b>	<b>145</b>	<b>38</b>
<b>Smoking attributable hospital admission rates 1993–1995</b>				
Top End	1459	1472	649	290
The Centre	1635	270	772	222
<b>Total</b>	<b>1520</b>	<b>1013</b>	<b>672</b>	<b>228</b>

Smoking is responsible for a substantial number of hospital admissions and deaths among the Aboriginal and the non-Aboriginal residents of the Northern Territory. The Northern Territory has the highest rate of smoking of any state in Australia and this report demonstrates the significant impact of smoking on the health of its people. To date, similar work at a state level has only been carried out in Western Australia with the Health Department of Western Australia producing a report on the impact of smoking and alcohol on Aboriginal morbidity and mortality in Western Australia in 1994. It was reported that 16% of deaths in Western Australia during the period 1983–1991 were due to smoking, (Unwin *et al* 1994), four percent less than the proportion of deaths found to be attributable to smoking in the Northern Territory (20%).

Information presented in this report showed that men are more likely to suffer from a smoking related hospital admission or death compared with women. Aboriginal men in particular have very high rates of smoking related health problems and are three times more likely to die from a smoking related cause than non-Aboriginal men. Aboriginal women in The Centre were least likely to be admitted to hospital or to die from a smoking related condition.

Smoking was responsible for a greater proportion of deaths than for hospital admissions. This is because people are admitted to hospital for a large range of diseases and conditions many of which are not chronic and life threatening. In comparison, many of the deaths in the Northern Territory are caused by chronic diseases which are more likely to be linked to smoking, such as cancer and heart disease.

Chronic obstructive pulmonary disease, ischaemic heart disease, pneumonia, stroke and lung cancer were the most likely smoking related conditions resulting in hospital admissions or death. In general, smoking related deaths tend to occur among the older population because of the long delay between exposure to smoking and the development of disease symptoms. Among the Aboriginal population, however, these conditions affect people at a younger age resulting in premature mortality. The greatest difference between the rates for Aboriginal and non-Aboriginal people was for those aged between 25 and 54 years. It is likely that the amount of mortality and morbidity due to smoking in this report may be underestimated for a variety of reasons which are presented below.

- The determination of the cause of a hospital admission may be complex and the underlying cause of admission may not be reported accurately.
- Information on Northern Territory residents who were admitted to hospital or died interstate was not available. This may have resulted in an underestimation of morbidity and mortality due to smoking. It is, however, unlikely that the inclusion of these events would result in a substantial increase in the smoking attributable death and hospitalisation rates presented in this report.
- It is likely that the number of smoking attributable deaths is underestimated because of the interstate movement of Northern Territory residents after diagnosis with a terminal disease. The usual state of residence of these persons is then changed to a state other than the Northern Territory and is recorded as such on their death certificates (Plant *et al.* 1995). This may have resulted in an underestimation of the number of terminal conditions which developed in the Northern Territory.
- The recording of indigenous status in hospital admission data and on death certificates is not always accurate. This may mean that some Aboriginal deaths and hospitalisations have been misclassified as non-Aboriginal. The effect of any such misclassification would have resulted in an underestimate of the hospital admission and death rates for Aboriginal people and an overestimate of these rates for non-Aboriginal people.
- The relative risks used in this report were based on the results of a meta-analysis of many studies which examined the relationship between smoking and various conditions among populations with similar characteristics to the non-Aboriginal population of Australia (English *et al.* 1995). As some of the factors which may influence the strength of the relationship between smoking and a specific condition include ethnicity and environmental conditions, it is uncertain whether these relative risks are applicable to the Aboriginal population. The relative risks used may have resulted in an underestimate of the amount of smoking attributable events for some conditions and an overestimate for some other conditions. The use of relative risks developed specifically for the Aboriginal population might have been more appropriate for the analyses undertaken for this report. There are, however, insufficient published studies on the relationship between smoking and related diseases among Indigenous populations to derive Aboriginal specific relative risks.

This report demonstrates that smoking makes a significant contribution to the high levels of morbidity and mortality experienced in the Northern Territory. Aboriginal people in the Northern Territory have higher smoking rates than non-Aboriginal people and the high rate ratios for morbidity and mortality reflect the excess burden of ill-health in the Aboriginal community attributable to smoking relative to the non-Aboriginal population. The diseases which result from smoking represent a substantial proportion of all ill-health, particularly those leading to premature death among Aboriginal and non-Aboriginal populations.

# Appendix

**Table A1: Relative risks for smoking related conditions**

The estimates of the pooled relative risks for smoking related conditions are presented below (English *et al.* 1995). They were used to calculate the condition specific aetiologic fractions for the conditions presented in this report.

Condition	ICD-9 Code	Relative risk
Oropharyngeal cancer	141, 143-146, 148, 149	4.55
Oesophageal cancer	150	4.01
Stomach cancer	151	1.41
Anal cancer	154.3, 154.4	3.18
Pancreatic cancer	157	1.86
Laryngeal cancer	161	7.48
Lung cancer	162	Male: 13.0 Female: 11.4
Endometrial cancer- post menopausal	179, 182	0.53
Cervical cancer	180, 233.1	1.75
Vulval cancer	184.4	3.42
Penile cancer	187.1- 187.4	1.8
Bladder cancer	188	2.72
Renal parenchymal cancer	189	1.64
Renal pelvic cancer	189.1	3.96
Tobacco abuse	305.1	n.a.
Parkinson's disease	332	0.57
Ischaemic heart disease	410-414	Under 65 years of age: 3.06 65 years and over: 1.66
Pulmonary circulatory disease	415-417	n.a.
Cardiac dysrhythmias	427	n.a.
Stroke	428-429	Under 65 years of age: 3.12 65 years and over: 1.65
Heart failure	430-438	n.a.
Atherosclerosis	440-448	2.54
Pneumonia	480-487	1.47
Chronic obstructive pulmonary disease	490-492,496	9.8
Peptic ulcer	531-534	2.07
Chrohn's disease	555	Male: 1.92 Female: 3.27
Ulcerative colitis	556	0.63
Fire Injuries	E890-E899	n.a.

**Notes:**

1. All hospital admissions for tobacco abuse are attributable to smoking
2. No pooled estimates were calculated. The aetiologic fractions for chronic obstructive pulmonary disease were assigned to these codes.
3. No pooled estimates were calculated. The aetiologic fractions for ischaemic heart disease were assigned to these codes.
4. No pooled estimates were calculated. Deaths or hospitalisations assigned to these codes were apportioned to ischaemic heart disease and other specified heart disease codes in accordance with the proportional distribution of specified heart conditions.
5. English and Holman estimated that 23% of fire injuries are caused by cigarette smoking.

**Table A2: Proportion of Aboriginal adults aged 15 years and over who smoked tobacco by age, sex and region, Northern Territory, 1986-1987**

Age group (years)	Men		Women	
	Top End	The Centre	Top End	The Centre
15-19	0.68	0.62	0.54	0.18
20-24	0.83	0.68	0.62	0.10
25-29	0.83	0.68	0.62	0.10
30-34	0.77	0.62	0.66	0.14
35-39	0.77	0.62	0.66	0.14
40-44	0.91	0.65	0.61	0.03
45-49	0.91	0.65	0.61	0.03
50-54	0.75	0.34	0.72	0.03
55-59	0.75	0.34	0.72	0.03
60-64	0.73	0.29	0.64	0.00
65-69	0.73	0.29	0.64	0.00
70-74	0.73	0.29	0.64	0.00
75+	0.73	0.29	0.64	0.00

Source: Watson *et al.* 1988

**Table A3: Proportion of non-Aboriginal adults aged 15 years and over who smoked tobacco by age and sex, Northern Territory, 1986**

Age group (years)	Men	Women
15-19	0.53	0.42
20-24	0.53	0.42
25-29	0.44	0.29
30-34	0.44	0.29
35-39	0.41	0.16
40-44	0.41	0.16
45-49	0.45	0.18
50-54	0.45	0.18
55-59	0.45	0.18
60-64	0.45	0.18
65-69	0.45	0.18
70-74	0.45	0.18
75+	0.45	0.18

Source: ABS 1987



**Table A4: Estimated number of deaths caused by tobacco smoking, and all deaths by age and sex, Aboriginal population aged 15 years and over, Northern Territory, 1986–1995**

Age group (years)	Men			Women		
	No. of smoking attributable deaths	Total number of deaths	Proportion (%)	No. of smoking attributable deaths	Total number of deaths	Proportion (%)
15-19	1.2	59	2	0	26	0
20-24	3.5	93	4	2.3	52	4
25-29	11.2	135	8	3	63	5
30-34	13.2	118	11	6.6	56	12
35-39	18.8	132	14	9.8	83	12
40-44	26.6	130	21	19.6	106	19
45-49	52.1	158	33	18.8	99	19
50-54	59.4	187	32	22.1	100	22
55-59	43.2	159	27	38.2	155	25
60-64	65.5	181	36	40.9	157	26
65-69	45.6	152	30	36.3	162	22
70-74	27.4	102	27	20.9	137	15
75+	48.1	211	23	26.9	215	13
<b>Total</b>	<b>415.8</b>	<b>1817</b>	<b>23</b>	<b>245.4</b>	<b>1411</b>	<b>17</b>

**Table A5: Estimated number of deaths caused by tobacco smoking, and all deaths by age and sex, non-Aboriginal population aged 15 years and over, Northern Territory, 1986–1995**

Age group (years)	Men			Women		
	No. of smoking attributable deaths	Total number of deaths	Proportion (%)	No. of smoking attributable deaths	Total number of deaths	Proportion (%)
15-19	0.0	56	0	0.00	14	0
20-24	1.0	111	1	0.00	32	0
25-29	1.8	112	2	0.00	29	0
30-34	2.2	102	2	0.2	21	1
35-39	6.2	100	6	1.2	37	3
40-44	19.4	150	13	1.2	40	3
45-49	30.2	139	22	4.1	46	9
50-54	46.6	193	24	7.4	53	14
55-59	80.4	239	34	9.4	56	17
60-64	80.8	245	33	15.8	87	18
65-69	70.0	254	28	11.3	87	13
70-74	47.9	173	28	16.5	104	16
75+	104.8	389	27	37.2	312	12
<b>Total</b>	<b>491.3</b>	<b>2263</b>	<b>22</b>	<b>104.2</b>	<b>918</b>	<b>11</b>

**Table A6: Age-adjusted rates for specific causes of smoking attributable deaths by sex and Indigenous status, Northern Territory, 1986–1995: No. of deaths per 100,000 population**

Condition	Aboriginal		Non-Aboriginal	
	Men	Women	Men	Women
Oropharyngeal cancer	8	2	8	2
Oesophageal cancer	5	2	3	0
Stomach cancer	1	0	1	0
Anal cancer	1	1	0	0
Pancreatic cancer	4	2	1	1
Laryngeal cancer	3	0	11	2
Lung cancer	74	30	65	19
Endometrial cancer- post menopausal	n.a.	-1	n.a.	-1
Cervical cancer	n.a.	7	n.a.	16
Vulval cancer	n.a.	3	n.a.	0
Penile cancer	1	n.a.	0	n.a.
Bladder cancer	3	1	15	6
Renal parenchymal cancer	1	0	1	1
Renal pelvic cancer	0	0	0	0
Tobacco abuse	0	0	0	0
Parkinson's disease	-2	0	-3	0
Ischaemic heart disease	136	55	165	47
Pulmonary circulatory disease	1	2	2	0
Cardiac dysrhythmias	4	2	39	13
Stroke	45	24	48	14
Atherosclerosis	4	2	33	12
Pneumonia	26	14	31	11
Chronic obstructive pulmonary disease	142	105	205	70
Peptic ulcer	1	1	23	8
Chrohn's disease	0	0	0	3
Ulcerative colitis	0	0	0	-1
Fire Injuries	1	1	21	7
<b>All smoking attributable deaths</b>	<b>457</b>	<b>251</b>	<b>672</b>	<b>228</b>

**Table A7: Age-specific rates for hospital admissions attributable to smoking, by sex and Indigenous status, Northern Territory, 1986–1988: No. of admissions per 100,000 population**

Age group (years)	Aboriginal		Non-Aboriginal	
	Men	Women	Men	Women
15-19	176	127	117	57
20-24	290	249	91	84
25-29	517	427	102	97
30-34	787	517	116	90
35-39	935	1218	161	37
40-44	1907	1008	314	76
45-49	1700	1089	511	236
50-54	2374	2329	1135	400
55-59	2661	2175	1477	713
60-64	3734	2154	3071	835
65-69	3343	854	3075	1242
70-74	4138	867	4663	1550
75+	3200	3028	6884	1902
<b>Age-adjusted rate</b>	<b>1022</b>	<b>689</b>	<b>654</b>	<b>234</b>

**Table A8: Age-specific rates for hospital admissions attributable to smoking, by sex and Indigenous status, Northern Territory, 1993–1995: No. of admissions per 100,000 population**

Age group (years)	Aboriginal		Non-Aboriginal	
	Men	Women	Men	Women
15-19	301	156	61	43
20-24	325	272	97	92
25-29	707	392	111	94
30-34	996	686	111	103
35-39	1478	990	210	75
40-44	2703	1246	237	92
45-49	2636	1948	560	169
50-54	3641	2378	1168	249
55-59	6885	3678	2023	496
60-64	4522	3732	3141	855
65-69	3921	3750	3575	1089
70-74	2271	4532	4273	1796
75+	6994	1744	6240	2413
<b>Age-adjusted rate</b>	<b>1520</b>	<b>1013</b>	<b>672</b>	<b>228</b>

**Table A9: Age-adjusted rates for specific causes of hospital admissions due to smoking, by sex and Indigenous status, Northern Territory, 1986–1988: No. of admissions per 100,000 population**

Condition	Aboriginal		Non-Aboriginal	
	Men	Women	Men	Women
Oropharyngeal cancer	0	4	11	9
Oesophageal cancer	5	0	3	0
Stomach cancer	0	0	2	0
Anal cancer	8	1	1	1
Pancreatic cancer	1	6	0	1
Laryngeal cancer	23	0	15	0
Lung cancer	68	12	85	30
Endometrial cancer- post menopausal	n.a.	0	n.a.	-1
Cervical cancer	n.a.	27	n.a.	12
Vulval cancer	n.a.	4	n.a.	0
Penile cancer	4	n.a.	0	n.a.
Bladder cancer	0	0	10	0
Renal parenchymal cancer	0	0	2	1
Renal pelvic cancer	3	0	0	0
Tobacco abuse	0	0	0	0
Parkinson's disease	-11	0	-4	0
Ischaemic heart disease	154	67	119	41
Pulmonary circulatory disease	2	17	2	2
Cardiac dysrhythmias	30	14	30	11
Stroke	131	67	40	18
Atherosclerosis	16	2	37	10
Pneumonia	229	98	23	8
Chronic obstructive pulmonary disease	318	323	218	68
Peptic ulcer	16	6	34	4
Chrohn's disease	0	1	1	3
Ulcerative colitis	0	0	0	-1
Fire Injuries	24	38	25	11
<b>All smoking attributable deaths</b>	<b>1022</b>	<b>689</b>	<b>654</b>	<b>234</b>

**Table A10: Age-adjusted rates for specific causes of hospital admissions due to smoking, by sex and Indigenous status, Northern Territory, 1993–1995: No. of admissions per 100,000 population**

Condition	Aboriginal		Non-Aboriginal	
	Men	Women	Men	Women
Oropharyngeal cancer	7	2	8	2
Oesophageal cancer	4	3	3	0
Stomach cancer	0	0	1	0
Anal cancer	1	12	0	0
Pancreatic cancer	3	0	1	1
Laryngeal cancer	2	0	11	2
Lung cancer	108	39	65	19
Endometrial cancer- post menopausal	n.a.	-1	n.a.	-1
Cervical cancer	n.a.	33	n.a.	16
Vulval cancer	n.a.	12	n.a.	0
Penile cancer	1	n.a.	0	n.a.
Bladder cancer	7	0	15	6
Renal parenchymal cancer	0	0	1	1
Renal pelvic cancer	0	0	0	0
Tobacco abuse	0	0	0	0
Parkinson's disease	-1	-3	-3	0
Ischaemic heart disease	288	171	165	47
Pulmonary circulatory disease	18	8	2	0
Cardiac dysrhythmias	38	29	39	13
Stroke	152	62	48	14
Atherosclerosis	13	10	33	12
Pneumonia	319	184	31	11
Chronic obstructive pulmonary disease	486	390	205	70
Peptic ulcer	10	1	23	8
Chrohn's disease	0	0	0	3
Ulcerative colitis	0	0	0	-1
Fire Injuries	65	62	21	7
<b>All smoking attributable deaths</b>	<b>1520</b>	<b>1013</b>	<b>672</b>	<b>228</b>

## Bibliography

Abraham B, d'Espaignet ET and Stevenson C 1995. Australian health trends 1995. Australian Institute of Health and Welfare. Canberra. AGPS

Australian Bureau of Statistics 1987. Alcohol, tobacco and analgesic consumption, Northern Territory, October 1986. ABS Catalogue number 4301.7, Darwin.

Australian Bureau of Statistics 1996. Causes of Deaths Australia 1995. ABS Catalogue number 3303.0, Canberra.

Australian Bureau of Statistics 1997. Deaths Australia 1995. ABS Catalogue number 3302.0, Canberra.

Australian Bureau of Statistics 1996. National Aboriginal and Torres Strait Islander Survey 1994. ABS Catalogue numbers 4196.0.00.030,.032,.035-.036 Canberra.

Australian Bureau of Statistics 1992. National Health Survey: Health Risk Factors 1989–90. ABS Catalogue number 4380.0, Canberra.

Australian Bureau of Statistics 1997. National Health Survey: Summary Results, Australian States and Territories 1995. ABS Catalogue number 4368.0, Canberra.

Australian Bureau of Statistics & Australian Institute of Health and Welfare 1997. The health and welfare of Australia's Aboriginal and Torres Strait Islander peoples. ABS Catalogue number 4704.0, Canberra.

Australian Institute of Health and Welfare 1994. Australia's Health 1994: the fourth biennial report of the Australian Institute of Health and Welfare. AGPS, Canberra

Australian Institute of Health and Welfare 1996. Australia's Health 1996: the fifth biennial report of the Australian Institute of Health and Welfare. AGPS, Canberra

English DR, Holman CDJ, Milne E, Winter MG, Hulse GK, Codde JP, Bower CI, Corti B, de Klerk N, Knuiman MW, Kurinczuk JJ, Lewin GF, Ryan GA 1995. The quantification of drug caused morbidity and mortality in Australia, 1995 edition. Commonwealth Department of Human Services and Health, Canberra.

Markey P, McComb J, Woods M 1996. Northern Territory midwives' collection: Mothers and babies 1994. Darwin, NT Government Printer.

Richards R, Mc Comb J 1996. Tobacco consumption in Darwin, October 1994. Territory Health Services, Darwin.

Plant A, Condon J, Durling G 1995. Northern Territory health outcomes, morbidity and mortality 1979–1991. Northern Territory Department of Health and Community Services, Darwin.

Townsend J, Wilkes H, Haines A, Jarvis M. Adolescent smokers seen in general practice: health, lifestyle, physical measurements, and response to antismoking advice. Br Med J 1991; 303:947-50

Unwin E, Thomson N, Gracey M 1994. The impact of smoking and alcohol consumption on Aboriginal mortality and hospitalisation in Western Australia: 1983–1991. Perth, Health Department of Western Australia.

US Department of Health and Human Services 1989. Reducing the Health Consequences of Smoking: 25 Years of Progress. A report of the Surgeon General. Rockville, Maryland: US Department of Health and Human Services, Public Health Service, Centres for Disease Control, Centre for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 1989. DHHS Publication NO (CDC) 89-8411.

Winstanley M, Woodward S, Walker N 1995 Tobacco in Australia: Facts and Issues 1995. Victorian Smoking and Health Program, Melbourne.

Watson C, Fleming J, Alexander K. A survey of drug use patterns in Northern Territory Aboriginal communities: 1986-1987. Northern Territory Department of Health and Community Services, Drug and Alcohol Bureau, Darwin.

World Health Organisation. Manual of the international classification of diseases, injuries and causes of death. Ninth revision, volumes 1 and 2. WHO, Geneva. 1977.