Burden of lung cancer due to occupational carcinogen exposure in South Africa, 2000

Pam Groenewald

Objectives

To estimate the fraction of lung cancer attributable to current or past exposure to occupational carcinogens in South Africa in 2000.

Methods

The estimation of the burden of lung cancer attributable to current or past exposure to occupational carcinogens for South Africa, 2000, followed the methods used by WHO for assessing the global burden of disease from occupational exposure to carcinogens [1]. We followed the steps outlined in one of the Environmental Burden of Disease series published by the WHO, which provides a more detailed step-by- step explanation of the methods for assessing the environmental burden of disease at national level [2].

The following steps are required:
1. Identify known occupational lung carcinogens
2. Identify the proportion of the country population with exposure to the carcinogens and divide this into high exposure and low exposure groups, which requires the following information:
    a. The proportion of the workforce employed in each sector
    b. The proportion of workers exposed to individual carcinogens
    c. The likely turnover of workers
    d. The estimated level of exposure
    e. The proportion of the population who are in the workforce
3. Determine the relative risk for cancer in persons exposed to the carcinogen from the literature
4. Estimate the impact of the carcinogen in terms of the fraction of deaths and disability caused by the carcinogen, using the relative risks and the fraction of the population exposed to the carcinogen.

The lung carcinogens and their relative risks are set out in Driscoll et al., 2004.

The proportion of the workforce by race and sex employed in each industry sector was obtained from the South African labour force survey 2000:1 [3]. Since no exposure data was available at national level we estimated the proportion of male workers exposed to individual lung carcinogens,in each industry sector from the CAREX survey [4]. The proportion of male and female workers exposed to individual lung carcinogens in each industry sector was obtained by multiplying the proportion of the workforce in the sector by the proportion in the sector exposed to the carcinogen. The proportions for each carcinogen were summed across all eight sectors to provide an estimate of the proportion of the total workforce exposed to that carcinogen. The workforce proportions for each

carcinogen were summed to provide an estimate of the proportions of the total male and female workforce currently exposed to lung carcinogens.

Since we have no data on workforce turnover we estimated the factor to be 4 (as suggested by Driscoll et al.) in order to estimate the proportion of the male and female workforce ever exposed to lung carcinogens.

We assumed that the level of exposure for Coloureds and Africans would be higher than for Whites and Asians and applied the WHO partitioning factors for developed countries to Whites and Asians (0.9 – low level exposure and 0.1 – high level exposure) and those for developing countries to Africans and Coloureds (0.5 and 0.5).

We estimated the proportion of the population in the workforce by race and sex from the labour force survey (15 yrs and older) and estimated the proportion of the total male and female population ever exposed to carcinogens by multiplying the proportion of ever exposed males and females in the workforce by the proportion of males and females in the workforce, by race. We then calculated the proportion of the male and female population ever exposed at a low level and at a high level by race. We used the mean relative risk for workers exposed to eight lung carcinogens, as estimated by Driscoll et al. [2] to estimate the attributable fraction for lung cancer arising from exposure to lung carcinogens.

The attributable fraction was estimated using the standard formula using the proportion of the total population 15 years or older, by race and sex group, ever exposed and the relevant relative risks.

Results
The proportion of the total male and female populations greater than 15 years exposed to occupational lung carcinogens as well as the relative risks for lung cancer due to low and high exposure are set out in Table 1 below.

Table 1. Relative risks and proportion of males and females > 15 years exposed to occupational lung carcinogens in South Africa, 2000.

	Males > 15 years				Females > 15 years				RR
	African	Coloured	Asian	White	African	Coloured	Asian	White	*(95%CI)*
Unexposed	0.82	0.82	0.84	0.75	0.97	0.94	0.95	0.93	1
Low exposure	0.09	0.09	0.08	0.22	0.02	0.03	0.03	0.03	1.3 *(1.2;1.4)*
High exposure	0.09	0.09	0.08	0.02	0.02	0.03	0.03	0.03	1.9 *(1.7; 2.1)*

The attributable fractions for lung cancer due to exposure to occupational carcinogens by race and sex group, for South Africa 2000, are set out in Table 2 below.

Table 2: Attributable fractions for lung cancer due to exposure to occupational carcinogens by gender and population group, South Africa 2000.

Population group	Attributable Fractions	
	Male	Female
African	0.099	0.02
Asian	0.088	0.03
Coloured	0.097	0.03
White	0.081	0.04

References
1. World Health Organization, 2003. World Health Report 2002. Chapter 4: Quantifying selected major risks to health. Geneva: World Health Organization.
2. Driscoll T, Steenland K, Pruss Ustin A, Imel Nelson D, Leigh D 2004. Occupational Carcinogens Assessing the environmental burden of disease at national and local levels. Environmental burden of disease series No 6. WHO, Geneva: 2004.
3. Statistics South Africa. Labour Force Survey, (South Africa) February 2000; Pretoria, South Africa: Statistics South Africa (producer); Pretoria: South African Data Archive (distributor), 2001.
4. FIOH 1998. CAREX database. Helsinki, Finnish Institute of Occupational Health (http://www.ttl.fi/NR/rdonlyres/4444380F-B1FB-4D01-A974-0B6A9E663CFA/0/1_description_and_summary_of_results.pdf)