

An analysis of cancer risk experienced by fire fighters who were trained at Fiskville



Background

Cancer Council Victoria was commissioned by CFA to perform an analysis of cancer risk for Country Fire Authority (CFA) fire fighters that may have arisen from past practices undertaken at the CFA's training facility at Fiskville.

Materials

Cancer Council Victoria was supplied with a data file containing a list of the names and dates of birth for groups of people who worked and trained at Fiskville during the period 1971-1999. Individuals on the list were described as having 'High', 'Medium' and 'Low' risk of exposure as described in Table 7.1 on page 96 of the Independent Fiskville Investigation report by Professor Rob Joy.

The data file provided contained records for 616 individuals. The file included only 5 females, given this small number these were excluded for analysis. A further 12 individuals were excluded for analysis due to incomplete data. These exclusions resulted in a cohort of 599 males for analysis.

Methods

The cohort of 599 men was linked with the Victorian Cancer Registry to identify those who were diagnosed with invasive primary malignancies in the years 1982-2012.

The method used to assess cancer risk was the computation of standardised incidence ratios (SIRs). This method essentially compares the number of cases observed in the cohort with the number of cases that would be expected to have occurred on the basis of the age-, sex- and calendar-year- specific incidence rates for a reference population.

Two reference populations were used for analysis; 1) the population of Victoria and 2) the population of Victoria that was born in Australia. The latter was used as the composition of the CFA workforce is predominantly Australian-born and is under represented by immigrant groups.

SIRs and their 95% confidence intervals were calculated for all cancers and also for specific types of cancer.

The principal analysis was based on person years calculated between 1982 and 2012. Further analyses were repeated for person years that were calculated; 1) from when members were first recorded with some affiliation with the CFA, if after 1st January 1982; and 2) from when members were first recorded to have worked at Fiskville, if after 1st January 1982. As the results were not materially different, only those from the principal analysis are presented.

Results

Altogether, 61 men were identified as having been diagnosed with a first primary invasive cancer of whom four had a second invasive cancer. The most common cancers were prostate (14 cases) and melanoma (13 cases) while all other cancers that occurred were represented by 1 to 5 cases. Results are presented in four tables.

Table 1 describes the main characteristics of the cohort and the cancers that were obtained from the record linkage to the cancer registry.

Table 2 describes the number of cancer cases according to the assigned exposure category.

Table 3 contains the essential findings from the principal analysis that used the Victorian population as its reference and considered risk from the year 1982. It describes the SIRs and 95% confidence intervals for all cancers taken together and for each specific cancer including both first and second primaries.

Table 4 gives results from an analysis based on the Australian-born Victorian population for all cancers taken together, by exposure category, and for melanoma.

The risk estimate for all cancers combined was not statistically different to unity, SIR = 0.92 (95% CI, 0.72, 1.17). The analysis by assigned exposure category identified that men with high exposure were at a 62% increased risk and this was statistically significant, SIR = 1.62 (95% CI, 1.08, 2.41). Risk estimates for specific types of cancer ranged from low (SIR = 0.57) to high (SIR = 14.38) but most of these were based on very small numbers and were not statistically significant. Melanoma was identified as having a significantly elevated SIR = 1.74 (95% CI, 1.01, 3.00).

The analysis using only Australian-born Victorians as the reference population delivered different results to the principal analysis. The estimated SIR for all cancers was reduced to 0.81 but remained statistically non-significant (95% CI, 0.63, 1.03). The SIR for the high exposure category was reduced to 1.41 and was no longer statistically significant (95% CI, 0.95, 2.11). The SIR for melanoma was also reduced in strength and was no longer statistically significant (SIR = 1.22, 95% CI 0.71, 2.09).

Conclusions

Overall, this cohort of fire fighters did not have an increased incidence of cancer. The excess risks obtained using the principal analysis based on using the entire population of Victoria as the reference population were attenuated and became statistically non-significant when the reference population used was restricted to the Australian-born component of the Victorian population. This underlines the importance of using reference populations appropriate to the demographic composition of industrial cohorts.

Limitations

Complete data from the cancer registry was available for the years 1982 to 2012 (inclusive) and so risk of cancer was considered during this period only. This follow-up time may be too short to have detected all cancers that might occur in this cohort above and beyond that which is normally expected as a result of ageing.

Information about grade (low, medium or high) and duration of exposure to hazardous material was limited and so was not considered in the analysis.

SIR estimates, particularly those for specific cancers for which a small number of cases was observed, should be interpreted with caution as they are highly imprecise. The 95% confidence interval for each SIR estimate can be interpreted as the range of possible values of the "true" SIR.

Table 1: Description of men in the cohort during the years 1982-2012

Characteristics	
Number of male employees	599
Employees diagnosed with a first invasive	61
Employees diagnosed with a second invasive cancer	4
Employees deceased by 31Dec2012	22
	mean(SD), (range)
Age of employees on 1Jan1982	26 (10), (6-71)
Age of employees alive on 31Dec2012	56 (9), (37-102)
Age at death of employees deceased by 31Dec2012	63 (10), (34-87)
Age at diagnosis of first invasive/metastatic cancer	58 (9), (31-79)
Age at diagnosis of second invasive cancer	71 (9), (65-85)
Exposure category, N (%)	
Low	251 (42)
Medium	253 (42)
High	95 (16)
Exposure category of men diagnosed with cancer, N (%)	
Low	5 (8)
Medium	33 (54)
High	23 (38)
First cancer types, N	
Bone	1
Bowel	5
Brain	3
Breast	1
Connective tissue	1
Diffuse non-Hodgkin lymphoma	1
Hodgkin lymphoma	2
Hypopharynx	1
Kidney	2
Lung	3
Melanoma	13
Multiple myeloma	2
Myeloid leukaemia	1
Myeloproliferative	1
Oesophagus	1
Other and ill-defined digestive organs	1
Other mouth	1
Other skin	1
Pancreas	2
Prostate	14
Stomach	2
Testis	1
Thyroid	1
Second cancer types, N	
Brain	1
Diffuse non-Hodgkin lymphoma	1
Liver	1
Lung	1

Table 2: Number of cancer diagnoses of men in the cohort during the years 1982-2012 by exposure category

	Exposure category		
	Low	Medium	High
First cancer types			
Bone		1	
Bowel		3	2
Brain		2	1
Breast			1
Connective tissue		1	
Diffuse non-Hodgkin lymphoma		1	
Hodgkin lymphoma		1	1
Hypopharynx		1	
Kidney		1	1
Lung		2	1
Melanoma	2	5	6
Multiple myeloma		1	1
Myeloid leukaemia			1
Myeloproliferative		1	
Oesophagus		1	
Other and ill-defined digestive organs	1		
Other mouth			1
Other skin		1	
Pancreas		2	
Prostate	2	7	5
Stomach		1	1
Testis			1
Thyroid		1	
Second cancer types			
Brain		1	
Diffuse non-Hodgkin lymphoma			1
Liver		1	
Lung		1	

Table 3: Standardized incidence ratio (SIR) of the men in the cohort for the years 1982-2012 for first and second invasive cancers using Victorians as the standard population

	Observed	Expected	SIR	(95% CI)*
All cancers	65	70.66	0.92	(0.72, 1.17)
Low exposure	5	17.07	0.29	(0.12, 0.70)
Medium exposure	36	38.74	0.93	(0.67, 1.29)
High exposure	24	14.85	1.62	(1.08, 2.41)
Bone	1	0.19	5.21	(0.13, 29.03)
Bowel	5	8.78	0.57	(0.24, 1.37)
Brain	4	1.52	2.63	(0.72, 6.73)
Breast	1	0.13	7.64	(0.19, 42.54)
Connective tissue	1	0.55	1.81	(0.05, 10.10)
Diffuse non-Hodgkin lymphoma	2	1.78	1.13	(0.14, 4.07)
Hodgkin lymphoma	2	0.55	3.66	(0.44, 13.23)
Hypopharynx	1	0.18	5.43	(0.14, 30.24)
Kidney	2	2.28	0.88	(0.11, 3.16)
Lung	4	6.15	0.65	(0.18, 1.66)
Melanoma	13	7.45	1.74	(1.01, 3.00)
Multiple myeloma	2	0.91	2.21	(0.27, 7.97)
Myeloid leukaemia	1	0.88	1.14	(0.03, 6.33)
Myeloproliferative	1	0.92	1.09	(0.03, 6.07)
Oesophagus	1	1.00	1.00	(0.03, 5.57)
Other and ill-defined digestive organs	1	0.07	14.38	(0.36, 80.11)
Other mouth	1	0.22	4.61	(0.12, 25.69)
Other skin	1	0.21	4.71	(0.12, 26.22)
Pancreas	2	1.39	1.44	(0.17, 5.21)
Prostate	14	18.54	0.75	(0.45, 1.27)
Stomach	2	1.73	1.16	(0.14, 4.18)
Testis	1	1.44	0.69	(0.02, 3.87)
Thyroid	1	0.61	1.65	(0.04, 9.17)

* For specific cancer types with less than 5 cases observed in the cohort, exact confidence intervals are provided.

Table 4: Standardized incidence ratio (SIR) of the men in the cohort for the years 1982-2012 for first and second invasive cancers using Victorians born in Australia as the standard population

	Observed	Expected	SIR	(95% CI)
All cancers	65	80.74	0.81	(0.63, 1.03)
Low exposure	5	19.55	0.26	(0.11, 0.61)
Medium exposure	36	44.18	0.81	(0.59, 1.13)
High exposure	24	17.01	1.41	(0.95, 2.11)
Melanoma	13	10.69	1.22	(0.71, 2.09)