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# Canadian Persian Gulf Cohort Study: Summary Report



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- P preliminary
- r revised
- x suppressed to meet the confidentiality requirements of the *Statistics Act*
- E use with caution
- F too unreliable to be published



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## **Canadian Persian Gulf Cohort Study: Summary Report**

### **Background**

IRAQ INVADED KUWAIT on August 2, 1990, marking the beginning of the Gulf and Kuwait War of 1990-1991. More than 5,100 Canadian military personnel were deployed to the Persian Gulf region between August 1990 and October 1991.

Canada's contribution consisted principally of a headquarters, a naval task force, an air task group, a field hospital, two infantry companies and a security platoon. About 2,200 Canadian Force members were present during the time of actual conflict (January and February, 1991).

After the end of the hostilities, a number of Gulf and Kuwait War veterans began reporting a broad range of symptoms and illnesses. In this study, the term "veterans" refers to retired and currently serving members of the Canadian military. In 1997, the Department of National Defence commissioned a survey (Goss Gilroy Inc., 1998) to examine the self-reported health status of all Canadian Gulf and Kuwait War veterans.

The health of these veterans (known as the "deployed cohort") was compared to a group of veterans who were eligible for deployment, but did not happen to go to the Persian Gulf. These are known as the "non-deployed cohort". Both military groups were comparable in terms of age, sex and regular as opposed to reserve force status.

According to this survey, deployed veterans had a higher prevalence of self-reported illnesses (including diseases of bones and joints, digestive system, skin, and respiratory system) as well as higher rates of depression, Post-traumatic Stress Disorder (PTSD) and generalized anxiety disorder in comparison to non-deployed veterans.

The deployed group were also more likely to report a broad range of physical and psychological symptoms. All of these findings were consistent with the results of surveys conducted in other countries.

The causes of what are now known as Gulf War illnesses remain controversial. Attention initially focused on a broad range of vaccines, medications, and chemical agents that the veterans were exposed to. However, to date, there has been no consistent association between illness and exposure to these substances. The exposure patterns of Canadian veterans varied. However, on average, their exposure to the agents of greatest concern was low relative to veterans from the United States (US) and United Kingdom (UK).

The clear excess of symptoms and common illnesses in Gulf and Kuwait War veterans, documented by the Gilroy study and other studies, prompted further investigations, including record linkage studies that examined of the post-war mortality and cancer experience of these veterans.

Studies in the United States and United Kingdom involving 750,000 Gulf War veterans showed no overall increased risk of death relative to veterans of the same era who were not deployed to the Persian Gulf. Consistent with earlier studies conducted on US Vietnam veterans, both the US and UK noted an increase in the risk of fatal motor vehicle crashes for only the first few years after the Gulf and Kuwait War. There was no evidence of increased risk of cancer or death due to suicide or diseases.

### **Present study**

The availability of the original Canadian cohorts established for the Goss Gilroy survey and national mortality and cancer registries provided an opportunity to replicate these studies in Canada. The "Canadian Persian Gulf War Cohort Study" was initiated in 2001 to determine if Canadian Gulf and Kuwait War veterans had a higher risk of death or cancer compared to other Canadian veterans of the same era, and to members of the general population.

The final study population consisted of 5,117 Gulf and Kuwait War veterans deployed to the Persian Gulf area from August 24<sup>th</sup>, 1990 through October 31st, 1991(referred to as the “deployed cohort”) and another 6,093 veterans who were eligible, but who were not subsequently deployed to the Persian Gulf (known as the “non-deployed cohort”).

In Canada, death and cancer registries are maintained by the provinces and territories, and at the national level by Statistics Canada. There is generally a two- to three-year time lag until the national data are available.

Therefore, at the time of the record linkage procedure in 2003, national mortality and cancer incidence data were available up to December 31 1999, permitting a nine-year follow-up period. Because the age and sex distribution of the two military cohorts and the general population differed, standardization methods were used to compare cancer and death rates.

## **Key findings**

### **Mortality: Deployed versus non-deployed comparisons (Table 1)**

- There was no significant difference in the overall risk of death between the deployed and non-deployed cohorts; the total number of deaths amounted to 96, 42 in the deployed cohort and 54 in the non-deployed cohort.
- Over the full follow-up period, there was no significant difference in the rate of suicide between the two groups (nine events in each group). While the suicide rate in the first half (1991-1995) of the follow-up period was higher among the deployed group, this was compensated by a lower rate in the latter half (1996-1999) of the follow-up period. Due to the small number of events, this finding was not statistically significant and could be due to chance.
- There was a statistically significant increased risk of death from airspace crashes in the deployed group. This result may be explained by the fact that there were three times as many members in flying occupations, such as pilots, navigators, flight engineers, in the deployed cohort as there were in the non-deployed cohort. (Table 2)
- In contrast to the US and UK studies, during the early and full follow-up periods, there was no increased risk of death due to motor vehicle crashes in the deployed cohort compared to the non-deployed cohort.

### **Mortality: Canadian Forces compared with the general population (Table 3)**

- For both the deployed and the non-deployed cohorts, there was a statistically significant lower risk of death from all causes of about 50% compared to the general population.
- For each study group, the risk of dying from coronary heart disease was not different from the risk for the general population.
- The overall risk of suicide in each cohort was not different from the risk for the general population.
- The death rate from airspace crashes was higher in the deployed cohort. These differences are likely due to a higher number of individuals in flying-related

occupations relative to the general population, as well as the higher risk associated with military aviation activities.

#### **Cancer comparisons (Table 4)**

- There was no significant difference in the risk of being diagnosed with cancer in the two military cohorts. In total, there were 71 cancer cases, 29 in the deployed cohort and 42 in the non-deployed cohort.
- The rate of cancer in both the deployed and non-deployed cohorts was not significantly different from the rate in the general population.

The lack of observed differences between the two cohorts, in some cases, may be related to the small number of events.

#### **Summary**

These results are consistent with those of other larger studies on the health of Gulf War veterans of other countries. Canadian Gulf War veterans did report symptoms and common illnesses at significantly higher rates than other veterans of the same era. However, they did not appear to be at increased risk of dying or developing cancer.

This study also documented that military populations have lower rates of all-cause and disease-related mortality than the general population. A “healthy worker” effect caused by the exclusion from military service of persons with serious chronic illnesses likely accounts for this finding.

The study was large enough to detect differences in the overall risk of death and cancer. However, the small number of events in specific disease categories or types of cancer reduced the ability to detect differences between the deployed and non-deployed cohorts.

Since the number of Canadian Gulf War Veterans was fixed, it was not possible to increase the sample size of this investigation. Given that the delay between the exposure to a health hazard and the development of cancer or disease may be several decades, this kind of linkage study could be repeated to increase years of follow-up.

However, a longer follow-up period will not address the major limitation of this study, which is the overall size of the Gulf and Kuwait War veteran cohort.

To enquire about the concepts, methods and data quality of the report, please contact Client and Technical Services at 613-951-1746, Health Statistics Division. For comment on the report or to obtain a copy of the full report, please contact the Department of National Defence, Canadian Forces, Media Liaison office at 613-996-2353 or 613-996-2354.

## APPENDIX A

**Table 1: Deployed versus non-deployed mortality ratios by main cause of death and follow-up period**

Cause	Mortality Rate Ratio (95% CI) 1991-1999	Mortality Rate Ratio (95% CI) 1991-1995	Mortality Rate Ratio (95% CI) 1996-1999
<b>All Causes</b>	0.97 (0.65-1.45)	0.95 (0.46-1.95)	0.72 (0.39-1.34)
<b>Disease-related</b>	0.71 (0.41-1.25)	0.44 (0.16-1.23)	0.96 (0.46-2.03)
All cancers	0.91 (0.41-2.00)	0.93 (0.26-3.33)	1.32 (0.44-4.00)
Circulatory system	0.49 (0.17-1.40)	0.13 <sup>1</sup> (0.02-0.77)	0.59 (0.15-2.38)
<b>All external causes</b>	1.47 (0.79-2.74)	3.72 <sup>1</sup> (1.31-10.6)	0.49 (0.17-1.45)
Motor vehicle crash	0.78 (0.19-3.26)	0.58 (0.09-3.76)	1.28 (0.12- 14.16)
Airspace crash	4.77 <sup>1</sup> (1.01-22.5)	...	...
Suicide	1.17 (0.46-2.95)	2.82 (0.58-13.7)	0.32 (0.06-1.55)

**Data Sources:** Department of National Defence and the Mortality and Cancer Incidence Databases.

<sup>1</sup>p is less than or equal to 0.05

... Not applicable (table cell is not logically possible)

**Table 2: Military occupational classification (MOC) codes: Final reference date by cohort**

MOC codes	Deployed cohort		Non-deployed cohort	
	Number	%	Number	%
Total	5,139	100	6,077	100
All flying related MOC	472	9.1	227	3.7
Pilots	282	5.5	127	2.1
Flight engineers	89	1.7	21	0.3
Navigators	101	2.0	79	1.3

**Data Sources:** Department of National Defence and the Mortality and Cancer Incidence Databases.

**Table 3: Standardized mortality ratios (SMR) by cohorts**

Deployed cohort	Observed versus Expected Number	SMR (95% CI)
<b>All causes</b>	42 versus 75.2	0.56 <sup>1</sup> (0.40-0.75)
<b>Disease-related</b>	20 versus 45.6	0.44 <sup>1</sup> (0.27-0.68)
Coronary heart disease deaths	3 versus 7.39	0.41 (0.08-1.19)
<b>All external causes</b>	22 versus 29.6	0.74 (0.47-1.12)
Airspace crash	8 versus 0.29	27.2 <sup>1</sup> (11.8-53.6)
Suicide	9 versus 11.9	0.76 (0.35-1.43)
<b>Non-deployed cohort</b>		
<b>All causes</b>	54 versus 94.4	0.57 <sup>1</sup> (0.43-0.75)
<b>Disease-related</b>	36 versus 59.2	0.61 <sup>1</sup> (0.42-0.84)
Coronary heart disease deaths	10 versus 10.1	0.98 (0.47-1.81)
<b>All external causes</b>	18 versus 35.2	0.51 <sup>1</sup> (0.30-0.81)
Airspace crash	x	5.68 (0.69-20.5)
Suicide	9 versus 14.2	0.64 (0.29-1.21)

**Data Sources:** Department of National Defence and the Mortality and Cancer Incidence Databases.

<sup>1</sup>p is less than or equal to 0.05

x suppressed to meet the confidentiality requirements of the Statistics Act

**Table 4: Unadjusted and age- and sex-adjusted cancer incidence density ratios (IDR) based on cases from the post-cancer reference date<sup>1</sup>**

Cancer types	Deployed cohort		Non-deployed cohort		Crude IDR (95% CI)	Adjusted IDR (95% CI)
	N	%	N	%		
<b>All cancers</b>	29	8.5	42	10.3	0.83 (0.52-1.33)	0.88 (0.55-1.42)
Digestive	8	2.3	5	1.2	1.92 (0.63-5.86)	2.01 (0.66-6.18)
Respiratory	3	0.9	x	x	1.80 (0.30-10.8)	2.48 (0.41-15.0)
Prostate	0	0	5	1.2	...	...
Testicular	3	0.9	5	1.2	0.72 (0.17-3.01)	0.64 (0.15-2.71)
Genitourinary	3	0.9	x	x	1.80 (0.30-10.8)	1.93 (0.32-11.6)
Brain/Central nervous system	0	0	4	0.8	...	...
Leukemia	3	0.9	0	0	...	...
Lymph nodes	3	0.9	6	1.5	0.60 (0.15-2.40)	0.68 (0.17-2.75)
Miscellaneous	6	1.8	7	1.7	1.03 (0.35-3.06)	1.09 (0.36-3.28)

**Data Sources:** Department of National Defence and the Mortality and Cancer Incidence Databases.

<sup>1</sup>The post-cancer reference date, which is an arbitrary date, occurs two years after the final reference date.

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... Not applicable (table cell is not logically possible)

Detail may not add to totals because of suppressed cells with less than 3 events.