

# Factors Associated with the High Burden of Injuries in the Canadian Forces

Elsbeth Payne, Epidemiologist

Directorate of Force Health Protection,  
Canadian Forces Health Services Group Headquarters,  
Department of National Defence

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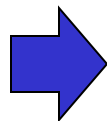
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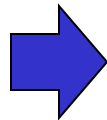
# Background on the Canadian Forces (CF)



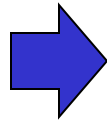
Air Force



Navy



Army



## CANADIAN FORCES





- 65 000 Regular Force
- 25 000 Reserve Force
- Bases and Wings located across Canada
- Men (83%) and women (17%)



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# Canadian Forces – Description of Population and Health

	 <b>CANADIAN FORCES</b>	 <b>CANADIAN CIVILIANS</b>
Age Distribution	18 – 60 years	0 – 80+ years
Health care	Federal Government	Provincial Government
Health Status	Screened, healthy worker	Range of health conditions
Work Environment	Employed, occupational exposures, military training and operational deployments	Unemployment, Occupational exposures
Health Survey	Health and Lifestyle Information Survey (HLIS)	Canadian Community Health Survey (CCHS)



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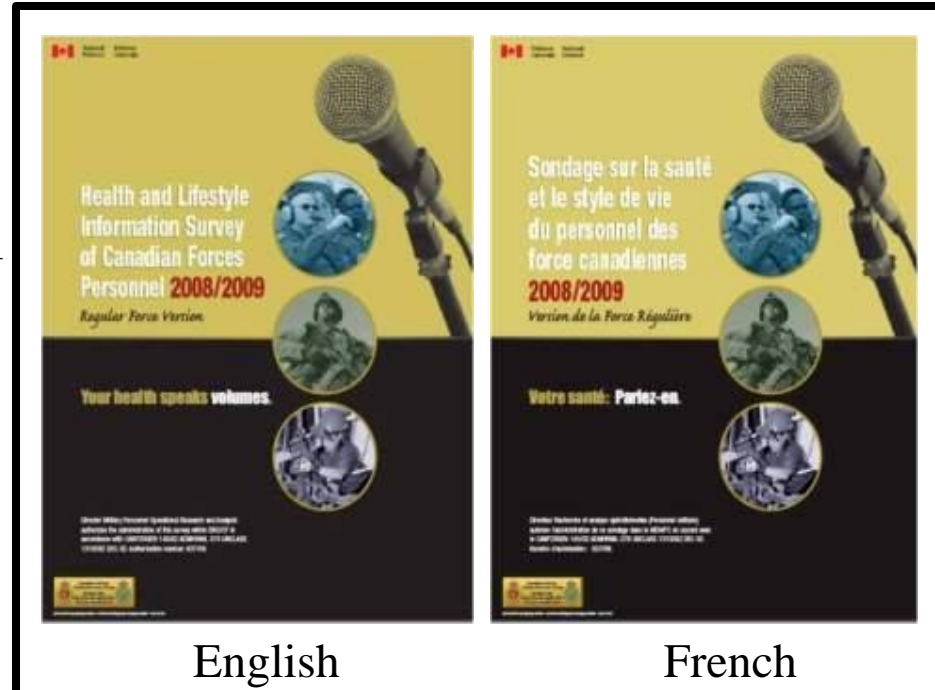
# Injury Among Canadian Forces Personnel

- Physical fitness is encouraged (physical training and/or sports and military exercises)
- Physical activities and military training place military personnel at risk of non-battle related injuries (Knapik, et al., 2005)
- Prevalence of injury among military personnel reduces operational readiness (Ruscio, et al., 2010)



# Health and Lifestyle Information Survey (HLIS)

- HLIS consists of both specific military and non military health questions
- Used to guide research, inform policy and for program development
- Most recent HLIS was conducted in 2008/2009
- **Key source of injury data**



# Health and Lifestyle Information Survey (HLIS)

## Survey Methods

- Anonymous, cross-sectional, self report
- Mailed hard copy with 2 mailed reminders, completed surveys mailed to headquarters
- Surveys scanned using Teleform software into Access database
- 3-cycle design for seasonal effects (Nov 2008, Feb 2009, June 2009)

## Sampling Methods

- Stratified random sample of Regular & Reserve Forces from Human Resources data (June 2008)
- Strata:
  - Sex (Male/Female)
  - Rank (Non commissioned/Officer)
  - Overseas deployment in previous 2 years (Yes/No)
- 2,240 respondents (53% response rate)



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# Research Objectives

1. Determine the frequency and types of injuries that are occurring among Regular Force personnel
2. Investigate which health and lifestyle factors have a significant association with injury outcomes
  - Three outcomes of interest:
    - **Acute injuries** (attributed to physical or military training)
    - **Repetitive strain injuries (RSI)** (attributed to physical or military training)
    - **Musculoskeletal injuries (acute and RSI)** that prohibit deployment



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# Exploratory Analyses

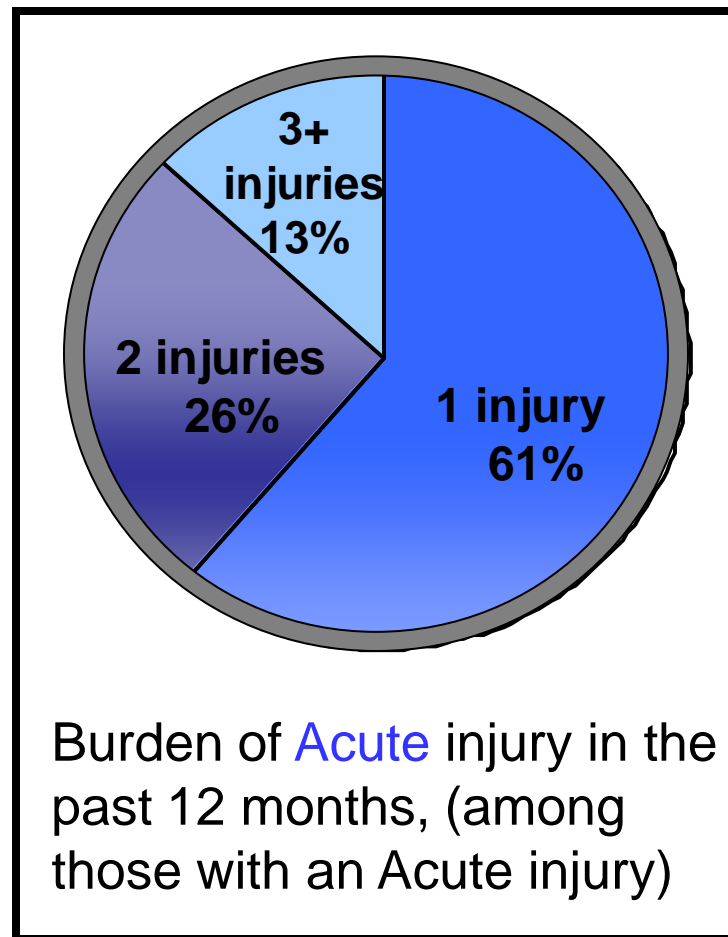
- **Descriptive analysis:** Quantify incidence and type of injuries and of physical and training activities
- **Bivariate analysis:** Identify which military and physical training variables were associated with acute, RSI, and deployment prohibitive injuries
- **Multivariate analysis:** Logistic regression used to investigate which military and physical training variables remained significantly associated with injury outcomes, when adjusted for demographic and context factors





# Descriptive Results: Burden of injury

- **Overall 36%** of respondents reported an injury serious enough to limit their normal activities in the past 12 months
  - **23%** reported a **RSI**
  - **21%** reported an **Acute** injury
- **Of those CF personnel unable to deploy in the previous 2 years:**
  - **32%** reported **musculoskeletal injury** as the reason



# Descriptive Results: **Acute** Injury Prevention

- **61%** reported that their most serious acute injury could not have been prevented
- Others reported that their most serious acute injury could have been prevented if...
  - There had been less pressure to perform = 12%
  - They had been less tired = 6%
  - They had not exceeded their personal physical limitations = 5%
  - They had worn proper protective equipment = 5%



# Descriptive Results: Top five **Acute** and **RSI** events

## Acute

Back injury 21%

Sprain/strain- hip/knee/ankle/foot 21%

Broken or fractured bones 9%

Sprain/strain- shoulder/wrist/hand 7%

Joint damage (excluding knee) 7%

Indicate injury type for the most serious acute injury

## RSI

Lower back 36%

Thigh and knee 32%

Shoulder and upper back 26%

Lower leg and ankle 22%

Foot 18%

Indicate the body part affected



# Descriptive Results: Activities related to **Acute** injury and **RSI**

	<b>Acute</b>	<b>RSI</b>
Sport/PT/Adventure training	44%	53%
Military training	11%	44%
Other paid military duties	7%	25%
Battle related	7%	8%
Leisure activities	11%	6%
	Select the one activity related to your most serious acute injury	Select all activities that are related to your RSI





# Descriptive Results: Physical and Military Training activities hypothesized to be related to injury

	Mean	Measurement
Strenuous exercise sessions	3.4	Number of 15 min sessions/ per wk
Moderate exercise sessions	2.9	
Mild exercise sessions	2.9	
Sports- energy expenditure (EE)	4.03	Daily MET
Military training- energy expenditure (EE)	0.13	

# Descriptive Results: Physical and Military Training activities hypothesized to be related to injury

Exercised without a proper warm up  
Exercised without adequate food or fluid  
Rucksack marched with  $> 1/3$  body weight  
Trained so hard that felt sick afterwards  
Ran in combat boots  
Ran while wearing a rucksack

Frequency (%)

45%

31%

29%

23%

21%

20%

Measurement

Occurred in  
the past 12  
months



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# Exploratory Analysis Approach: **Bivariate** and **Multivariate**

## Training

- Strenuous exercise
- Moderate exercise
- Mild exercise
- Military training - EE
- Sports - EE
- Exercise without warm up
- Inadequate food or fluid
- Train so hard felt sick
- Run in combat boots
- March with heavy load
- Run wearing rucksack

## Context

- Command
- Hazardous alcohol use
- Daily smoking
- Health risk taking
- Recreational risk taking
- BMI
- Activity level at work

## Demographic

- Age
- Sex
- Rank

## Injury outcomes

- Acute (yes/no)
- RSI (yes/no)
- **Deployment prohibitive MSK (yes/no)**



# Acute Injury Model

Physical and Military Training Factors	Unadjusted logistic regression OR (95%CI)	Adjusted <sup>†</sup> logistic regression OR (95%CI)
Strenuous exercise sessions	1.13 (1.03-1.24)*	0.99 (0.82-1.20)
March with load >1/3 body weight	0.43 (0.26-0.73)*	0.36 (0.19-0.67)*
Exercise without warm up	1.45 (0.85-2.47)	1.47 (0.80-2.69)
Exercise with inadequate food or fluids	1.56 (0.90-2.73)	1.63 (0.91-2.94)
Train so hard felt sick	1.62 (0.97-2.70)	1.49 (0.83-2.66)

OR = odds ratio, CI = confidence interval, \* p<0.05

<sup>†</sup> Adjusted for Demographic (Age continuous, sex, rank), and Context (Exceed AUDIT, Daily smoking, Recreational risk taking continuous, BMI continuous)



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# Repetitive Strain Injury Model

Physical and Military Training Factors	Unadjusted logistic regression OR (95%CI)	Adjusted † logistic regression OR (95%CI)
Strenuous exercise sessions	1.04 (0.99-1.10)	<b>1.08 (1.01-1.14)*</b>
Rucksack run	1.05 (0.62-1.80)	1.33 (0.74-2.36)
Exercise with no warm up	1.60 (1.05-2.43)*	<b>1.60 ( 1.04-2.44)*</b>
Exercise with inadequate food or fluids	1.32 (0.82-2.12)	1.42 (0.89-2.27)
Train so hard felt sick	1.20 (0.75-1.93)	1.39 (0.84-2.29)
Military training energy expenditure	1.22 (0.82-1.80)	1.01 (0.68-1.50)

OR = odds ratio, CI = confidence interval, ^ p<0.05

† Adjusted for Demographic (Age continuous, sex, rank), and Context (Health risk taking continuous, BMI continuous)



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# Deployment prohibitive Musculoskeletal Injury Model

Physical and Military Training Factors	Unadjusted logistic regression OR (95%CI)	Adjusted † logistic regression OR (95%CI)
Strenuous exercise sessions	0.84 (0.73-0.99)*	<b>0.88 (0.76-1.01)</b>
Moderate exercise sessions	0.95 (0.83-1.08)	0.91 (0.79-1.05)
March with load > 1/3 body weight	0.38 (0.14- 0.99)*	<b>0.50 (0.18-1.37)</b>
Run in combat boots	0.59 (0.28-1.23)	0.80 (0.36-1.75)
Rucksack run	1.27 (0.59-2.73)	1.20 (0.49-2.95)

OR = odds ratio, CI = confidence interval, \* p<0.05

† Adjusted for Demographic (Age groups, sex, rank), and Context (Recreational risk taking continuous, BMI groups)

# Deployment prohibitive Musculoskeletal Injury Model

Demographic and Context Factors	Unadjusted logistic regression OR (95%CI)	Adjusted † logistic regression OR (95%CI)
Male vs Female	0.38 (0.22-0.65) *	0.32 (0.18-0.58)*
Age 30-39 vs 18-29	2.91 (0.97-8.74)	2.77 (0.94-8.17)
Age 40-49 vs 18-29	6.28 (2.24-17.61)*	4.92 (1.80-13.49)*
Age 50-60 vs 18-29	5.79 (1.64-20.45) *	4.79 (1.23-18.65) *
BMI overweight vs normal/underweight	1.08 (0.43-2.72)	1.37 (0.53-3.53)
BMI obese vs normal/underweight	5.40 (2.13-13.69) *	6.92 (2.57- 18.58) *
Low work place activity vs none	2.44 (1.34-4.46) *	2.86 (1.55-5.27) *
Moderate workplace activity vs none	1.07 (0.32-3.59)	1.41 (0.40-5.01)
Recreational risk taking	1.00 (0.97-1.03)	1.00 (0.97-1.04)
Rank Officer vs NCM	0.89 (0.51-1.56)	0.90 (0.51-1.59)

OR = odds ratio, CI = confidence interval, \* p<0.05

† Adjusted for Training (Marching with a rucksack load, Running in combat boots, Strenuous exercise continuous, moderate exercise continuous)

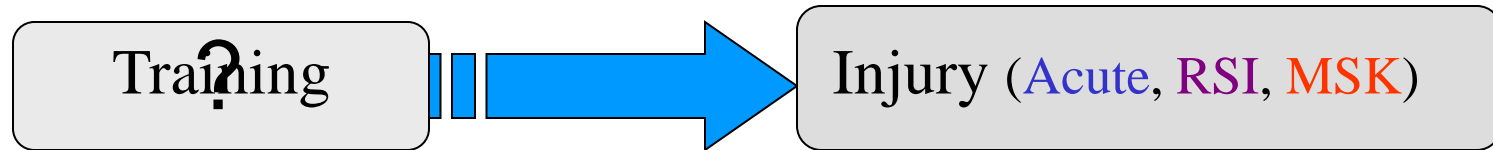
# Limitations

- Self report data
- Cross sectional data
- Response rate
- Mobile population
- Recall bias
- Respondent concern about anonymity



# Conclusions

- No consistent strong relationships between training variables and injury



- This may indicate that the physical and military training questions asked in the HLIS are not good predictors of injury
- Addition of demographic and context variables modified some of the relationships between training variables and injury outcomes
- **Deployment prohibitive injury model:** Demographic and context variables showed stronger relationships with the outcome than physical and military training variables
- Require more detailed injury data before drawing conclusions for injury prevention planning and programs

# Next Steps to improve Injury Prevention

- Next HLIS rolling out Jan 2011
  - Electronic version to reach a larger sample
  - Injury questions will be refined for the 2011 survey
- Currently pilot testing an Injury Surveillance system to collect injury specific data at the point of medical contact
  - Poster on the development of the surveillance system will be on display Sept 23<sup>rd</sup>



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# Thank you

Contact for more information:

[Elsbeth.Payne@forces.gc.ca](mailto:Elsbeth.Payne@forces.gc.ca)



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# Demographics of Regular Force Sample

	%	Weighted N	Sample n
Male	86.6	51,150	1,183
Female	13.4	7,906	974
Age 18 to 29	28.0	16,546	437
Age 30 to 39	28.1	16,621	704
Age 40 to 49	37.6	22,204	837
Age 50 to 60	6.2	3,686	179
NCM	77.6	45,828	1,009
Officer	22.4	13,230	1,148
Deployed Prev. 2y	24.1	14,249	994
French HLIS	30.8	17,912	709



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# Background

- **Acute Injury** Definition
  - A sudden transfer of energy or an acute exposure to a substance that exceeds the threshold of human tolerance
  - Described in the HLIS as an injury serious enough to limit normal activities in the past 12 months (e.g. Broken bone, a bad cut or burn, sprain)
- **Repetitive Strain Injury (RSI)** Definition
  - Any injury caused by overuse or by repeating the same movement frequently, affecting tendons and nerves over an extended period of time
  - Described in the HLIS as an injury serious enough to limit normal activities in the past 12 months (e.g. Carpal tunnel syndrome, tennis elbow, tendinitis)



# Survey questions

## Acute

- In the past 12 months, have you been injured seriously enough to limit your normal activities (e.g. broken bone, a bad cut or burn, sprain)? (Y/N)
- Please select all the types of serious acute injuries you experienced in the past 12 months and also select your most serious injury in the last column.
- What type of activity were you doing when you sustained your most serious acute injury? (choose 1)
  - Military training/involved in a military exercise, or Sports /PT/Adventure training
- Where did you most serious acute injury happen? (choose 1)
- My most serious acute injury could have been prevented if...(select all that apply)

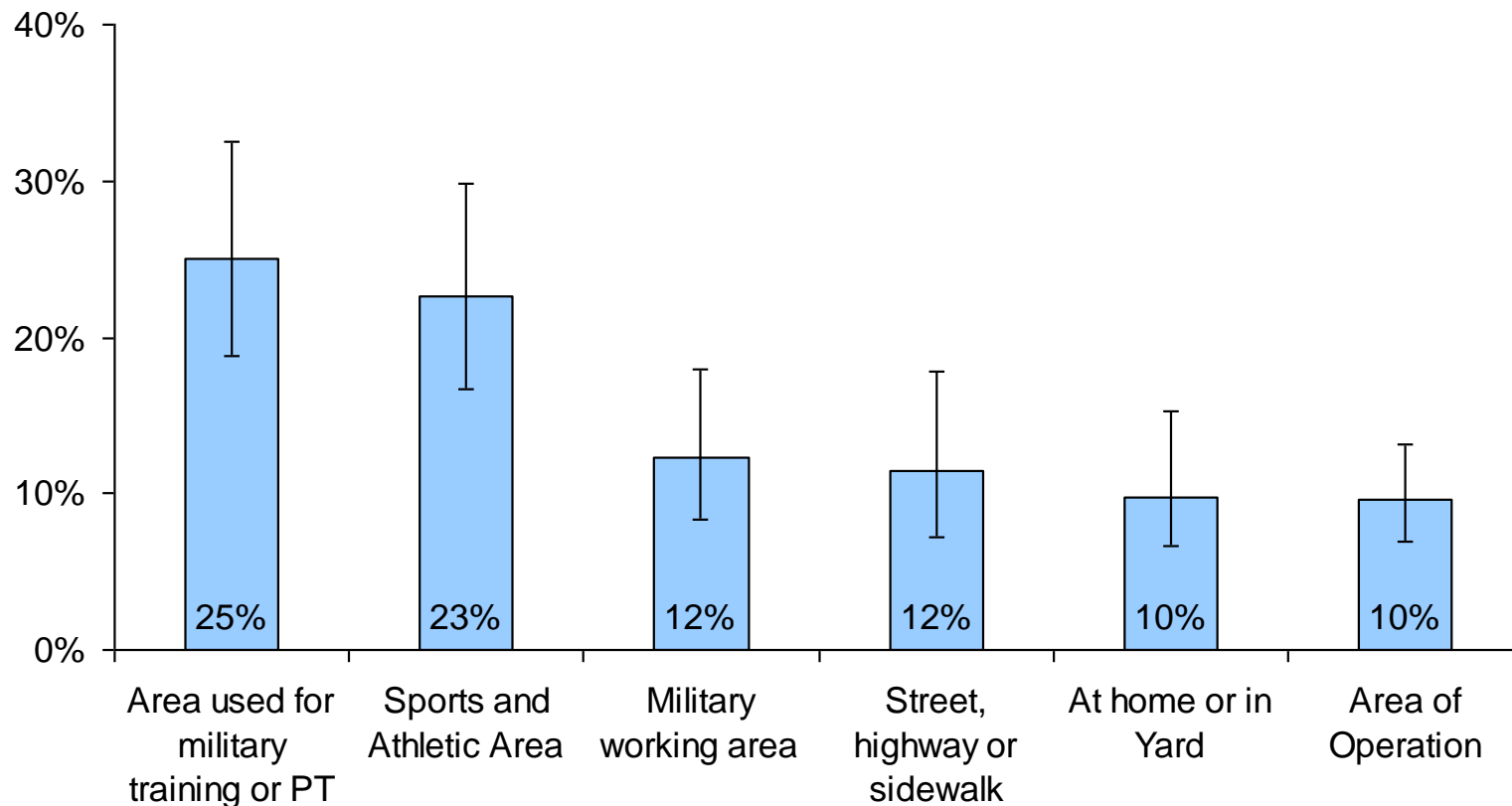
## RSI

- In the past 12 months, did you have any injuries due to repetitive strain which were serious enough to limit your normal activities? (Y/N)
- What type of activity were you doing when you got this repetitive strain injury? (select all that apply)
  - Military training/involved in a military exercise or Sports /PT/Adventure training
- Please indicate which areas of the body were affected by the repetitive strain injury (select all that apply)

## MSK

- During the past 2 years, was there any reason you would have been unable to deploy?
- For what reason would you have been unable to deploy (select all that apply)
  - Musculoskeletal injuries (back strain, broken bone)

# Place of Injury Associated with Most Serious **Acute** Injuries in Previous 12 months, HLIS 2008/9



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