CANCER
Registry of Norway
INSTITUTE OF POPULATION-BASED CANCER RESEARCH

Cancer among Nordic firefighters - study results and future plans

Kristina Kjærheim, MD, PhD,
Assistant Head of Department of Research
Cancer Registry of Norway

Brussels
March 3rd 2015

CANCER
Registry of Norway
INSTITUTE OF POPULATION-BASED CANCER RESEARCH

10/04/2015

- Results of studies of firefighter's cancer risk
- Remaining questions to be answered
- Further research needs

Foto: Hagen, Øyvind

Norsk Oljemuseum

CANCER Registry of Norway
INSTITUTE OF POPULATION-BASED CANCER RESEARCH

10/04/2015

Exposures

- Smoke, aerosols, particles, droplets, ashes

- Via lungs
- Via skin
- May penetrate personal protective equipment

- A number of these chemicals are known human carcinogens according to IARC

Individual exposure to carcinogens

- **Varies** by what is combusted
- - by specific task(s) at fires and at fire department
- - by type and frequency of fires
- - by fire extinction method(s)
- - by use of personal protection equipment
- - by hygienic facilities and practices

- Can be quite high, generally for short periods of time (peaks)
- **Common:** benzene, formaldehyde, polycyclic aromatic hydrocarbons, and fine particulates

- More sporadic: asbestos exposure when older structures burn, diesel exhaust from firefighting vehicles may occur

Study characteristics

- LeMasters 2006: Meta-analysis of 28 cohort and case-control studies
- IARC 2010: Meta-analysis of the four consistent results from LeMasters including two additional large studies
- NOCCA 2014: Cohort study of 16,000 professional Nordic firefighters followed 1960-2005, 2536 incident cancers
- Daniels 2014: Cohort study 30,000 professional firefighters in three large U.S. cities followed 1985-2009, 4461 incident cancers
- Glass 2015: Cohort study of 17,000 career full time Australian firefighters, followed 1990-2011, 1208 incident cancers

Summary of results

	LeMasters	IARC	NOCCA	Daniels	Glass
	2006	2010	2014	2014	2015
	Meta	Meta	SIR	SIR	SIR
All sites	1.05*	-	1.06*	1.09*	1.08*
Testicular cancer	2.02*	1.47*	0.51	0.75	1.44
Multiple myeloma	1.53*	-	1.13	0.72	1.14
≥ 70 yrs.	-	-	1.69*	-	-
Non-Hodgkin lymphoma	1.51*	1.21*	1.04	0.99	0.98
Prostate cancer	1.28*	1.30*	1.13*	1.03	1.23*
Malignant melanoma	1.32*	-	1.25*		1.45*
Other skin cancer	1.39*	-	1.33*	-	-

Results, cont.

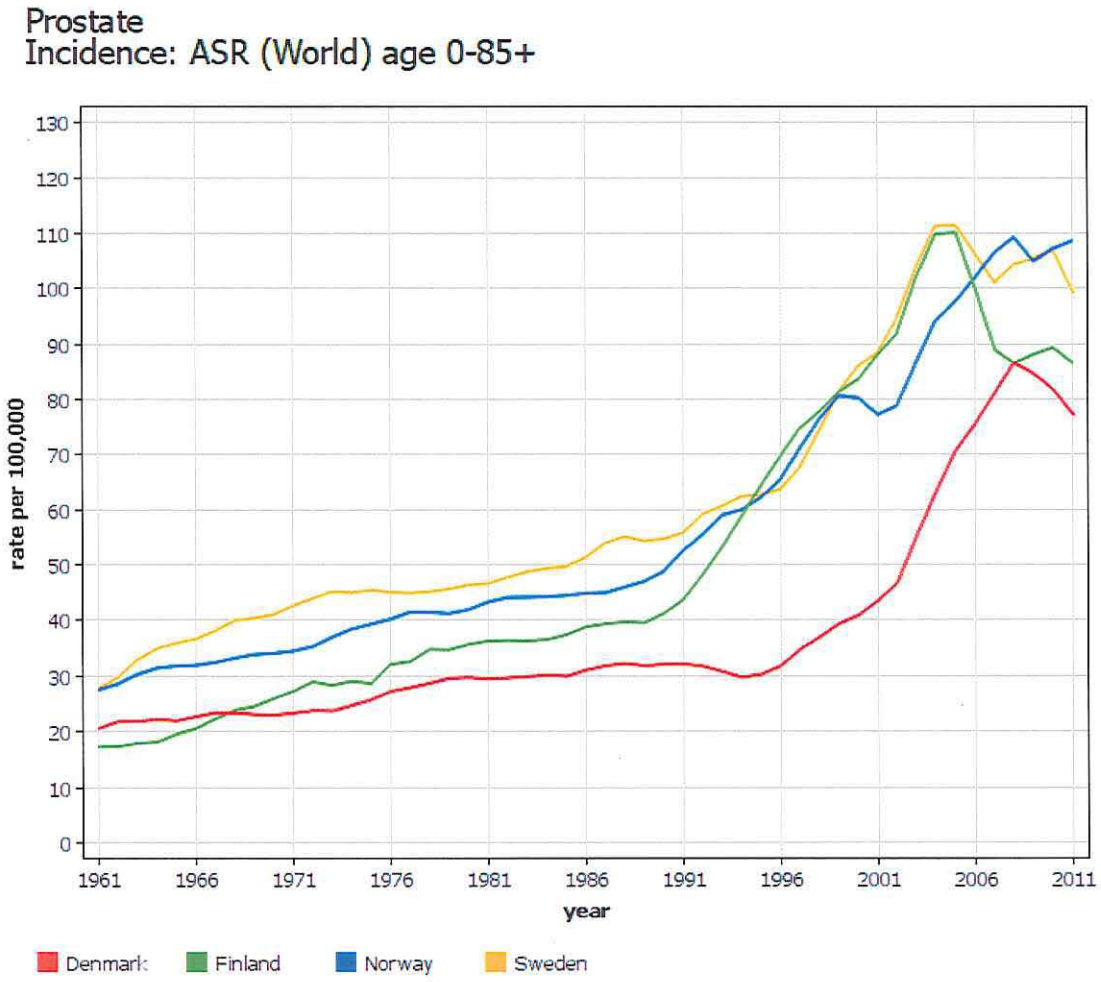
	LeMasters	NOCCA	Daniels	Glass
Brain	1.32*	0.86	1.02	0.76
Rectum	1.29*	0.99	1.11	1.18
Stomach	1.22*	1.09	1.15	0.98
Colon	1.21*	1.14	1.21*	1.13
- Lung adenocarcinoma	-	1.29*	-	-
Mesothelioma		1.55	2.29*	1.33
≥ 70 yrs.	-	-	2.59*	-
Kidney	1.07	0.94	1.27*	0.97
by duration of employment	-	-	Increasing risk	-

Prostate cancer in Nordic firefighters by country, age and period

	Obs.	SIR	95 % CI
Country			
Denmark	27	1.03	0.68-1.50
Finland	**143**	**1.21**	**1.02-1.43**
Iceland	6	0.90	0.33-1.95
Norway	137	1.16	0.97-1.37
Sweden	**347**	**1.11**	**1.00-1.24**
Age at diagnosis			
30-49	**12**	**2.59**	**1.34-4.52**
50-69	**306**	**1.16**	**1.04-1.30**
70+	339	1.09	0.98-1.21
Period of diagnosis			
1961-1975	20	0.97	0.59-1.49
1976-1990	145	1.10	0.93-1.29
1991-2003	**495**	**1.15**	**1.05-1.26**

CANCER Registry of Norway
INSTITUTE OF POPULATION-BASED CANCER RESEARCH

Incidence trends of prostate cancer in the Nordic countries



CANCER Registry of Norway
INSTITUTE OF POPULATION-BASED CANCER RESEARCH

Malignant melanoma and other skin cancer in Nordic firefighters by country, age and period

Malignant melanoma

- Elevated risk most prominent in Norway, among the youngest (30-49), and in the earliest time period (1961-75).

Other skin cancer

- Elevated in Norway and Sweden, among the older (≤70), and in the later period (1991-2005).

Interpretation

- Cancer epidemiology = Observational studies
- Assosiation ≠ Causality
- Causality must be discussed/inferred, based on strength, consistency, biological plausibility, dose-response, etc.

Relation to occupational exposures?

- Prostate cancer
- Malignant melanoma
- Other skin cancer - consistent in previous studies

- Lung adenocarcinoma
- Mesothelioma - new observations

- NHL
- Multiple myeloma
- Kidney - inconsistent

Plans for follow-up study

Aims

- To evaluate the work-relatedness of cancer risks among firefighters
- To evaluate specific exposures and cancer risk

Objectives

- establish a cohort of male professional firefighters
- Construct a job exposure matrix for firefighters using exposure indicators and measurements
- Perform cohort and case-cohort analyses of relevant outcomes
- Perform a meta-analysis of Nordic cohorts

Challenges

To identify and describe period and work site specific

- fire extinction method(s)
- types and use of personal protective equipment
- number of incidents by type of incident (house, car, industry, forest, etc.)

To identify cancer relevant chemically plausible agents

- measurements during training (+ during extinguishing real fires)
- airborne exposures and skin exposure
- biological markers in urine/blood including

- unaltered agents
- metabolites
- genetic/epi-genetic changes

Collaborators

Cancer Registry of Norway

- Kristina Kjaerheim, Tom Kr. Grimsrud

National Occupational Health Institute, Norway

- Wijnand Eduard, Raymond Olsen

Cancer Society, Denmark

- Johnnie Hansen

National Occupational Health Institute,

- Finland Sirpa Lusa

Karolinska Institute, Sweden

- Carolina Bigert, Göran Tornling, Per Gustavsson

Thank you for your attention

CANCER Registry of Norway
INSTITUTE OF POPULATION-BASED CANCER RESEARCH

CANCER
Registry of Norway
INSTITUTE OF POPULATION-BASED CANCER RESEARCH

10/04/2015

IARC Group 1 evaluations of chemicals present in fires

Chemical	Human evidence	Animal evidence	Cancer site/type
Arsenic	Sufficient	Limited	Skin, lung, liver
Asbestos	Sufficient	Sufficient	Lung, mesothelioma, larynx, gastrointestinal tract
Benzene	Sufficient	Limited	Leukemia
Benzo[a]pyrene	No data	Sufficient	Lung, bladder, skin
1,3-Butadiene	Sufficient	Sufficient	Lymphohaematopoietic
Cadmium	Sufficient	Sufficient	Lung
Formaldehyde	Sufficient	Sufficient	Nasopharynx (possibly nasal sinuses, leukemia)
Polychlorinated bifenyls (PCB)	Sufficient	Sufficient	Skin (possibly NHL, breast)
Radioactivity (ϒ activity)	Sufficient	Sufficient	All sites combined
Radionuclides (α- and β -particle-emitting)	Sufficient	Sufficient	All sites combined
Silica (crystalline)	Sufficient	Sufficient	Lung
2,3,7,8-tetrachlorodibenzo-*para*-dioxin	Limited	Sufficient	All sites combined, lung, NHL