



**Finnish Institute of
Occupational Health**

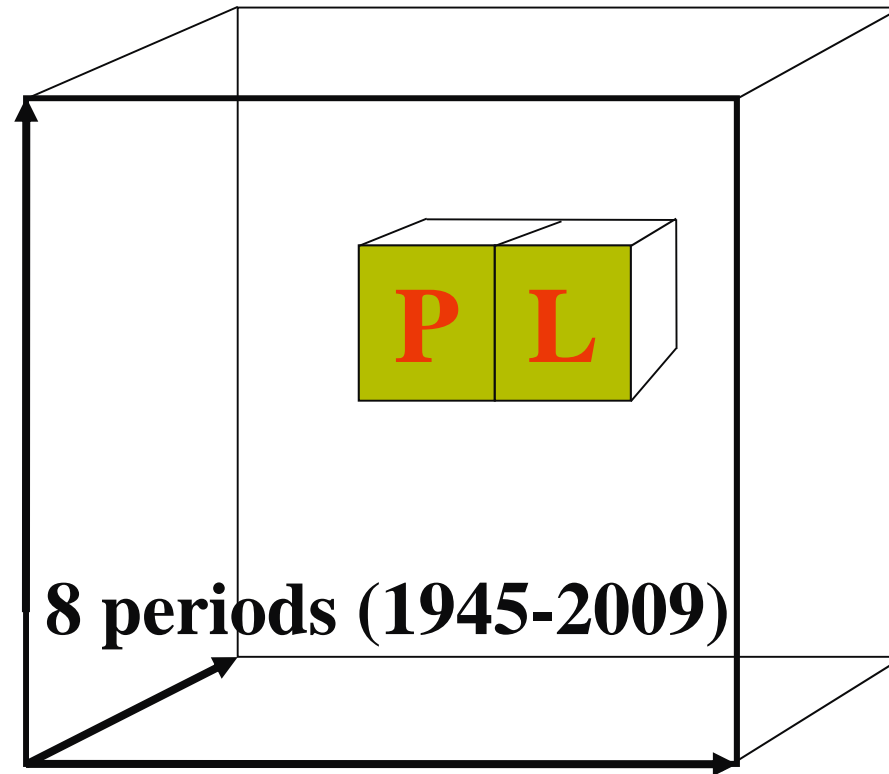
The Finnish Job-Exposure matrix FINJEM: strengths and uses in research and surveillance

Timo Kauppinen

FINJEM



84 exposures:
(chem,
phys,
ergo,
psycho,
lifestyle)

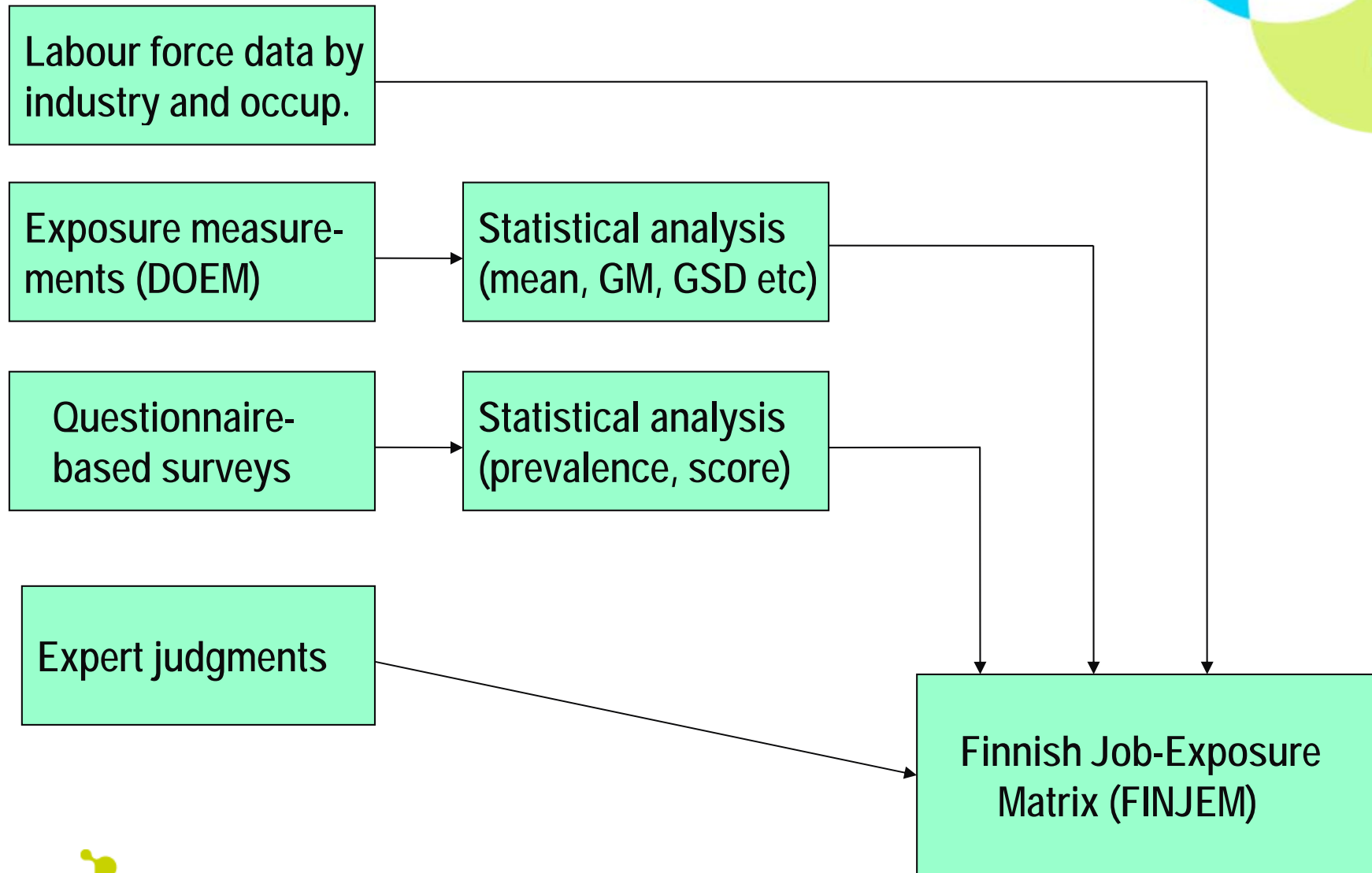
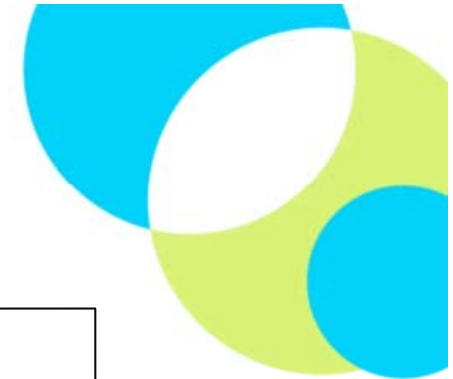


P, preva-
lence of
exposure
(%)

L, level of
exposure
(ppm, etc.)

311 occupations (Finnish classification)

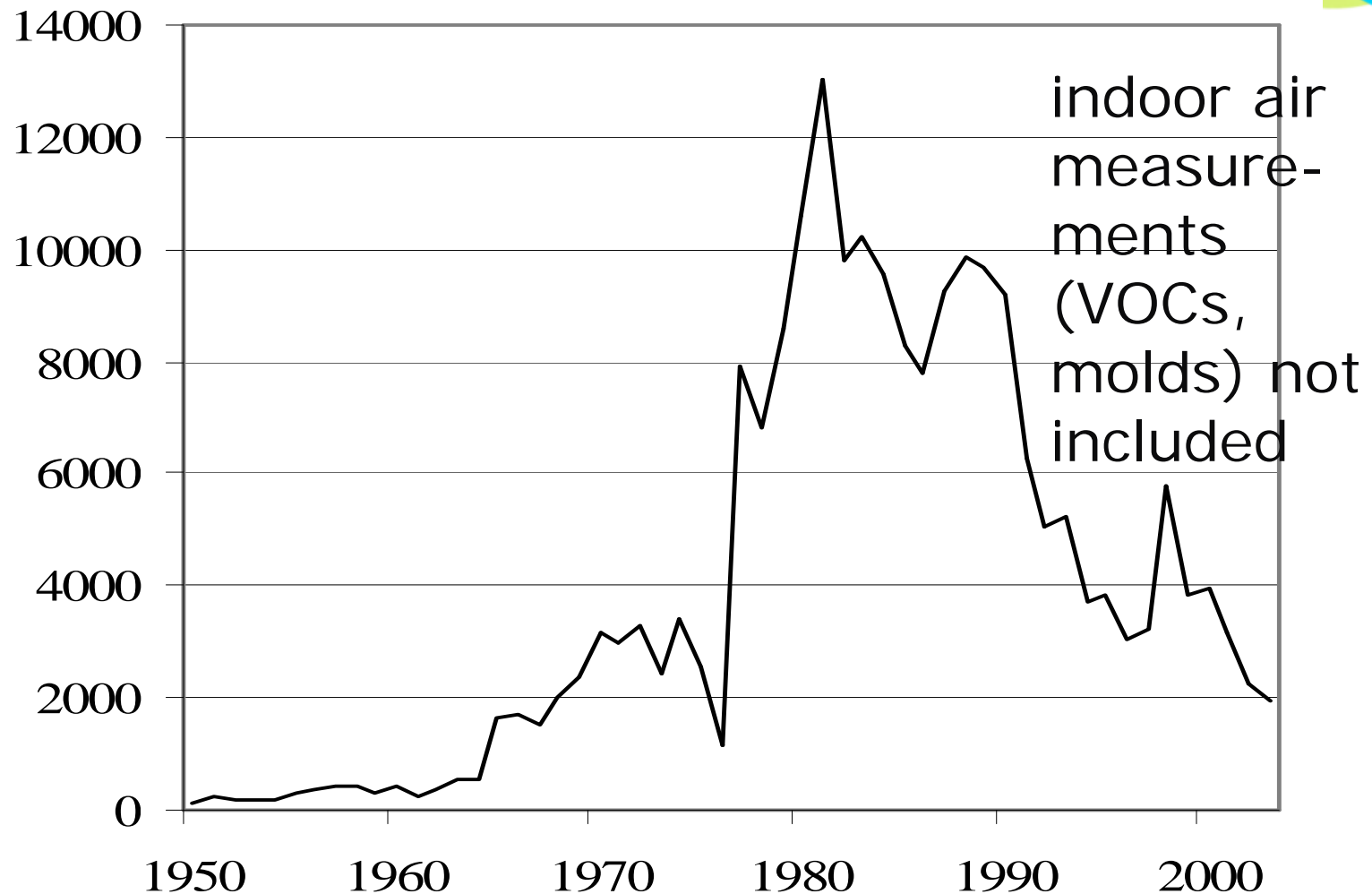
FINJEM: Sources of information





**FINNISH
DATABASE OF
OCCUPATIONAL
EXPOSURE
MEASUREMENTS
(FDOEM)**

The number of 'traditional' chemical air contaminant measurements by FIOH in 1950-2003



Application areas of FINJEM (1)



- **Occupational epidemiology**
- Surveillance of hazards
- Prevention of hazards
- Assessment of risks and burdens of diseases
- Data source for other JEMs
- Prediction of future exposures
- General databank for miscellaneous other uses

Advantages of using FINJEM in occupational epidemiology



- possibility to study **causal factors** (exposures) instead of surrogates (occupation) for risk assessment and prevention
- rather **easy to use**
- in large studies much **cheaper** than other methods of exposure assessment (eg, expert judgment)
- **independent** of case-control status (no selective exposure assessment bias)
- often the **only feasible method** in very large studies

FINJEM as epidemiological exposure assessment tool



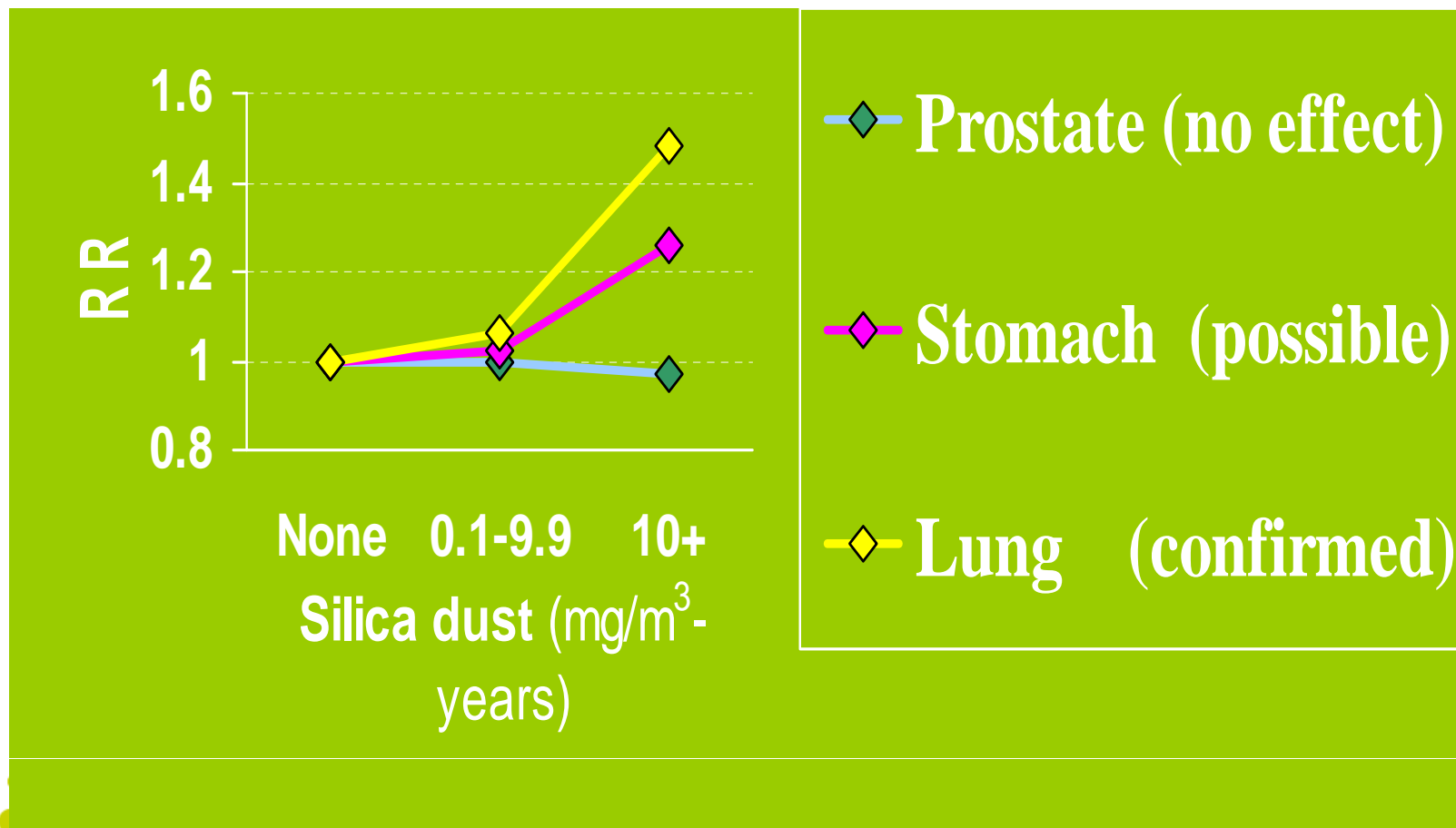
- about 50 peer-reviewed epidemiological articles on studies where FINJEM was used
- Finland, Sweden, Spain, Germany, France, Australia, the Netherlands, multinational...
- Census-based cohort studies and large case-control studies mainly
- Outcomes: cancer, mortality, work disability, heart diseases, COPD, dementia, sleep apnea...
- FINJEM suits best to large studies where only occupation of subjects is known
- individual assessment of exposure is better if study is small, FINJEM can be used for preliminary/additional survey of risks

Disadvantages of using a JEM in occupational epidemiology



- exposure estimates are **subjective** (validity difficult to test)
- **laborious** to construct (expert judgment time)
- requires coding of occupations according to a certain classification, or inaccurate **conversions**
- inherent **misclassification** of exposure and 'dilution' of exposure may produce unreliable results (within-occupation variability)
- therefore **quantitative estimates (P*L) preferable** (valid at group level, if P and L correct)

Example results of the Census-FINJEM study on cancer (Pukkala et al 2005)



Application areas FINJEM (2)



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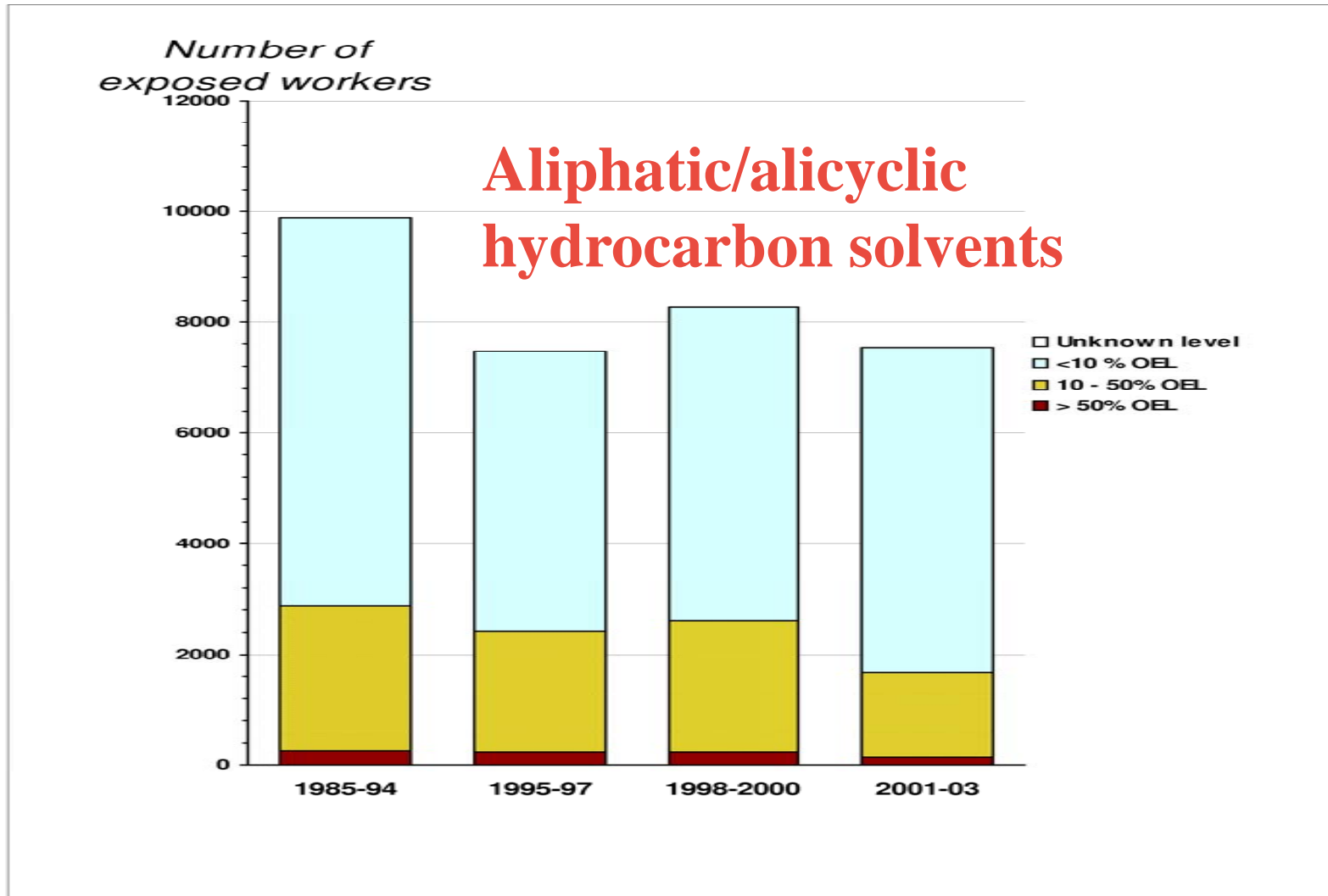
EXPOSURE TRENDS FOR AGENTS

Exposure by period

5.3.2004

Finland

ALIPHATIC AND ALICYCLIC HYDROCARBON SOLVENTS

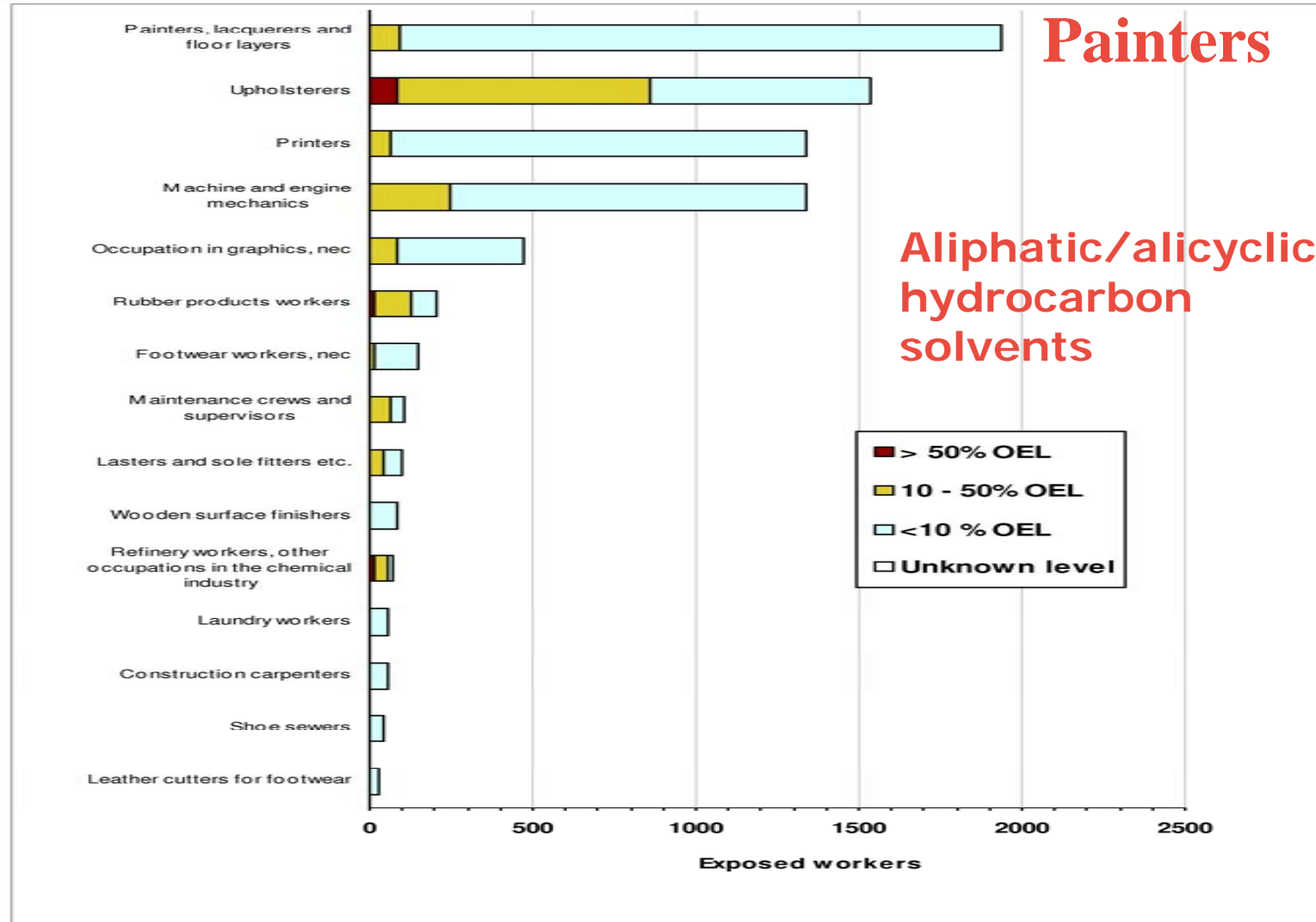


EXPOSURE PROFILES FOR AGENTS

Chemical Exposure by Occupation in 2001-03

8.3.2004

ALHC ALIPHATIC AND ALICYCLIC HYDROCARBON SOL

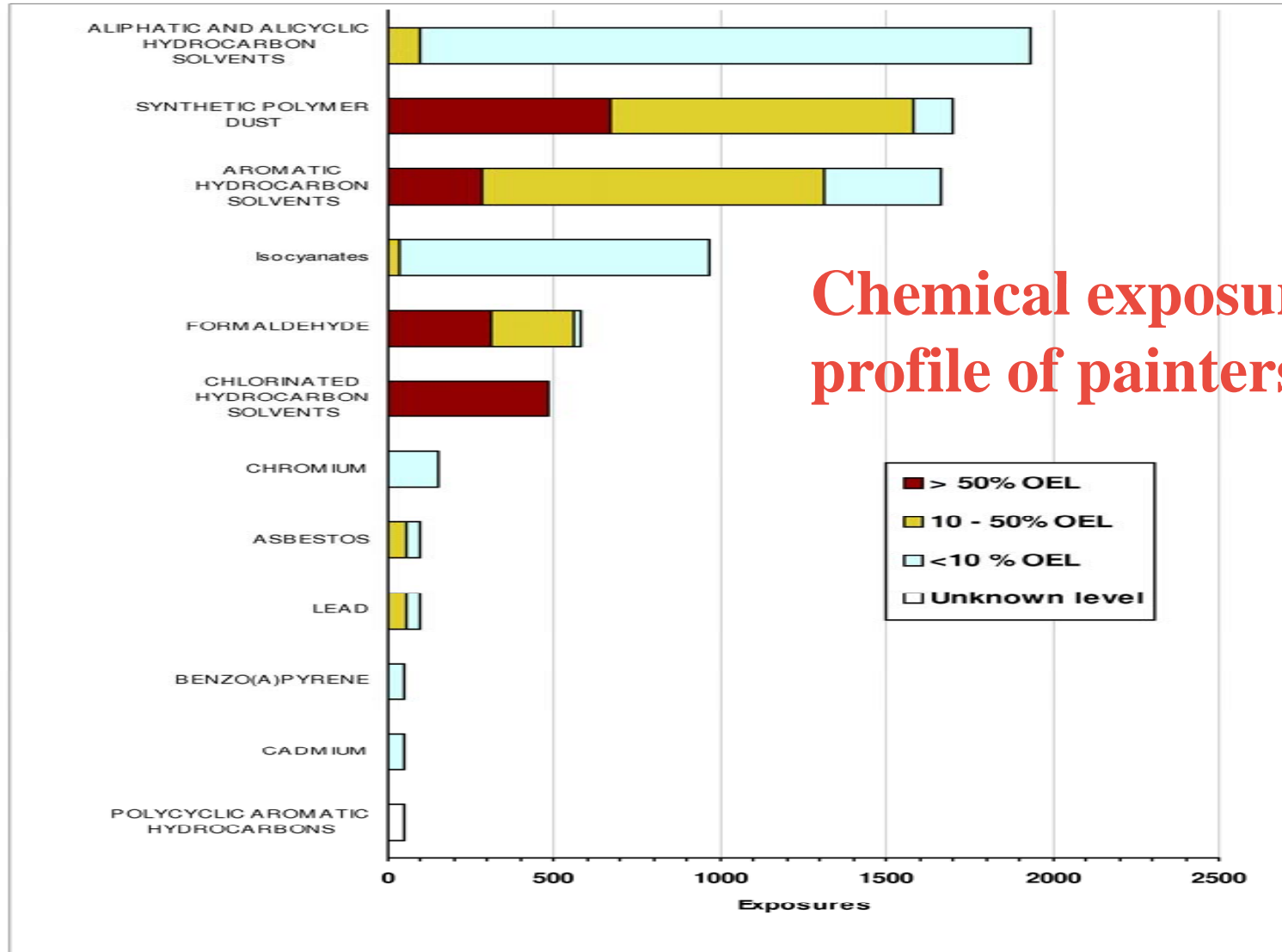


EXPOSURE PROFILES FOR OCCUPATIONS

The most common chemical exposures in 2001-03

8.3.2004

680 Painters, lacquerers and floor layers



Application areas FINJEM (3)



- Occupational epidemiology
- Surveillance of hazards
- **Prevention of hazards**
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Prevention of health hazards



- JEMs may guide **priority setting of prevention** at national or regional level
- Use of JEMs limited at work-place level due to between-workplace **variability of exposure**.
- **OTHER METHODS FOR WORK-PLACE LEVEL PREVENTION:**
- identification of **potential hazards**
 - Labeling of dangerous chemicals, material safety datasheets, international chemical safety cards (ISCS) and occupation/task-based hazard sheets (Internet, ILO Worksafe).
- assessment of **level of exposure**
 - industrial hygiene measurements, biomonitoring, exposure modeling (eg control banding, risk management toolbox)
- prevention, **good practices**, safe use
 - eg COSHH Essentials, partly in Spanish

Application areas FINJEM (4)

- Occupational epidemiology
- Surveillance of hazards
- Prevention of hazards
- **Assessment of risks and burdens of diseases**
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FINJEM in risk assessment



- **EXPOSURE DISTRIBUTION + EXPOSURE-RESPONSE RELATION = ATTRIBUTABLE CASES, DALYs, economic consequences...**
- 2001 Occupational mortality in Finland in 1996 and exposure (FINJEM, etc.): estimation of the effect of past exposures (**Nurminen and Karjalainen**: Scand J Work Environ Health 2001;27:161-213)
- Effects of current exposures (In Finnish: Priha et al. Ympäristö ja terveystieteet 2010;41:36-41)
- A new possibility: Probabilistic risk assessment of carcinogens (Monte Carlo simulation)

Example of use: Burden of work-related diseases and accidents

- Garcia A, Gadea Merino R, Lopez Martinez V: **Estimate of the mortality rate attributable to occupational diseases in Spain, 2004. (In Spanish)**
- Rev Esp Salud Publica. 2007 May-Jun;81(3):261-70.
- FINJEM-based attributable risk estimates by Nurminen and Karjalainen (Finland, 2001) were applied to the total number of deaths by the relevant diseases and age groups in Spain and in Autonomous Communities in 2004.
- Nearly **16,000 deaths/y** would have occurred in Spain due to occupational exposure-related diseases, the majority in males (87%). These deaths could have caused nearly 152,000 potential years of life lost and over 47,000 potential years of working life lost, which would entail a cost in productivity losses of **580-1000 million euros**.

Application areas of FINJEM (5)



- Occupational epidemiology
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Construction of job-exposure matrices for the Nordic Occupational Cancer Study (NOCCA)

Acta Oncologica 2009;48:791-800

Downloadable freely from **NOCCA web-site**
(<http://astra.cancer.fi/NOCCA>)

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Some examples of exposure differences between countries



- **ASBESTOS**: Mining of asbestos only in Finland, levels probably rather similar in other occupations in all 5 countries (based on asbestos use and mesothelioma statistics), asbestos prohibition year recorded and may be used as cutpoint between periods
- **SILICA**: Silica in Iceland only in Kieselguhr production and ferrosilicon plants, Norwegian levels maybe higher than elsewhere
- **Major exposure differences** tabulated in the article in Acta Oncologica

Workload in different JEM-approaches



TASK	Direct use	Modification	New JEM
Planning of JEM construction	no	low	moderate
Collection of exposure data	no	no-high	high
Exposure assessment	no	low-high	high
Database construction	no	low	moderate
Occupation conversions	moderate	moderate	no
TOTAL Finnish Institute of Occupational Health	LOW	MODERATE (LOW-HIGH)	HIGH

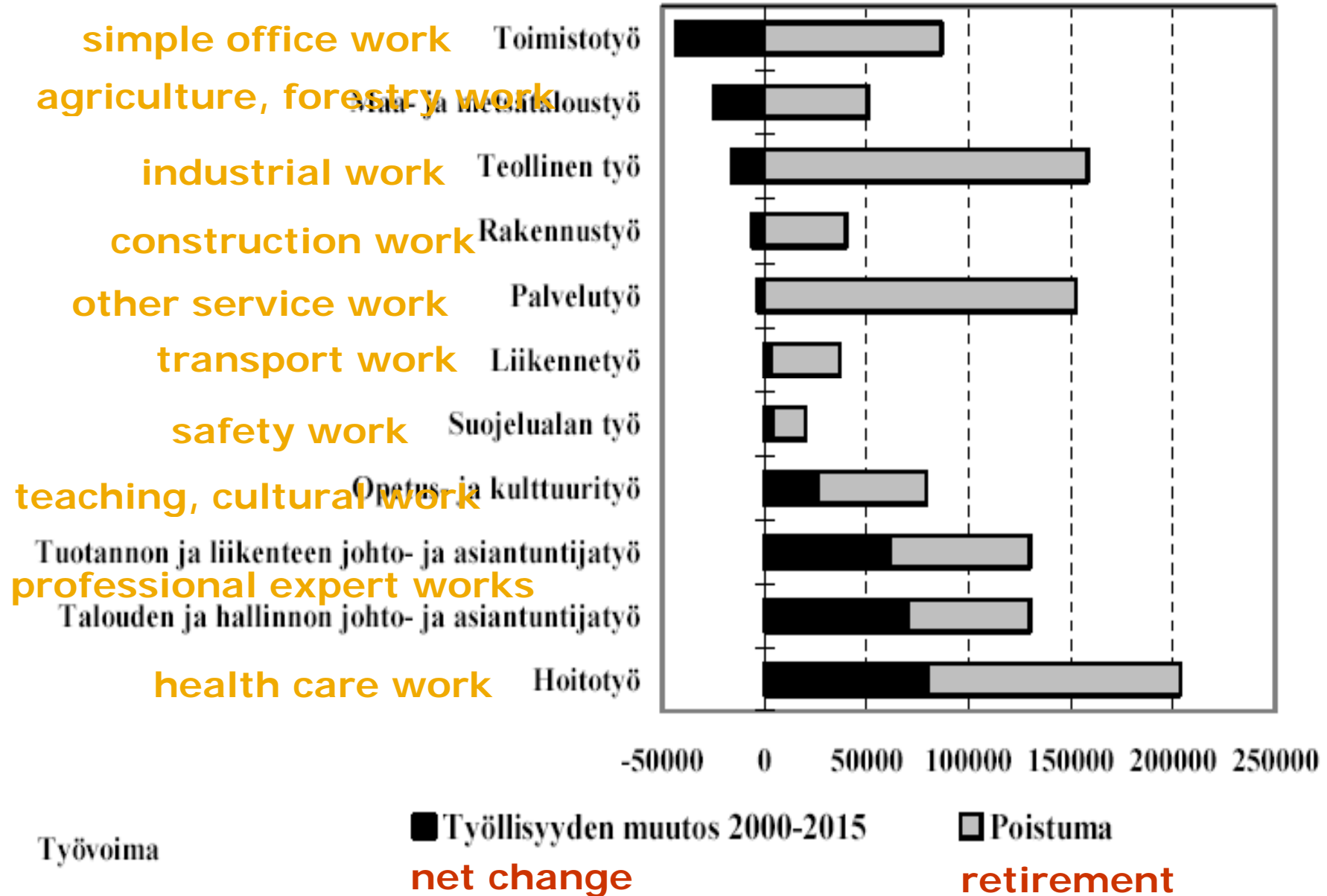
Application areas of FINJEM (6)



- Occupational epidemiology
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Kuvio 7.14. Työpaikka-avausket 2000 - 2015, perusura

Changes of occupational structure in 2000-2015



Changes of chemical exposures in Finland in 2000-2015 (FINJEM)



- The prevalence of workers exposed to chemicals in FINJEM is expected to **decrease by 5%**
- The decrease is partly due to changes in occupational structure (eg, health care and professional works increase)
- The prevalence of workers **heavily exposed** (over 50% of OEL) to chemicals in FINJEM is expected to **decrease by more than 5%** (due to technological change, preventive measures, etc)
- **Some substantial decreases:** environmental tobacco smoke (over 90%), agricultural exposures (20-30%)
- Source: Kauppinen et al 2006 (In Finnish)

Summary



- Occupational epidemiology: **MAJOR USE**
- Surveillance of hazards: **MAJOR USE**
- Prevention of hazards: **USEFUL**
- Assessment of risks and burdens of diseases: **USEFUL**
- Data source for other JEMs: **USEFUL**
- Prediction of future exposures: **USEFUL**
- General databank for miscellaneous other uses: **USEFUL**

Gracias!

