

Health economic costs of diabetes and bone fractures caused by exposure to chemicals

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Why these two examples?

- Potential large costs.
- **Data!**
- No previous studies.

Calculations – combining existing information from different disciplines.

Health costs of Diabetes associated with exposure by some organic environmental toxic substances

- 365 000-400 000 Swedes have diabetes (4%) and it is increasing
- Estimate of economic costs of Diabetes: 8.55 Bln SEK
- Corresponding figure for Cardiovascular deceases: 61.5 Bln SEK
- Probability to get cardiovascular deceases if you have Diabetes is increased 3-4 times
- Life expectancy is reduced by 10 years for persons who have diabetes
- QALY 500 000 to 650 000 SEK/year

*Hälsokostnader för Diabetes Bilaga 5 in Kemikalieskatt SOU 2015:30
by Lars Drake, Monica Lind and Lars Lind.*

Relation between concentration in blood samples and diabetes

- PIVUS-study: 1000 men and women, around 70 years old.
- Significant relations between some environmental toxins and diabetes was shown after correction for impact of overweight and some other factors.

Population attributable risk (PAR)

<i>Substance</i>	<i>PAR-value >median</i>	<i>PAR-value >75 perc.</i>
PCB153	13.0	16.6
p.p-DDE	34.1	19.4
MMP	15.2	6.3
PFNA	5.2	9.0

Cost of lost years

$$400\ 000 * 10/80 * 500\ 000 * 0.5 * PAR = TC\ life$$

Costs of hospital and other treatment

- **PAR * TC diab = TC chem diab**
- **Work loss?**
- **Suffering?**
- **Includes hospital costs for cardiovascular deceases**

Costs of Cardiovascular deceases as a result of having Diabetes

$$\text{DIAB} * \text{PROB} / (\text{NonDIAB} * 1 + \text{DIAB} * \text{PROB}) = \text{SHARE}_{c,d}$$

$$\text{SHARE}_{c,d} * \text{PAR} * \text{TC}_{\text{card}} = \text{TC}_{\text{chemcard}}$$

Only informal treatment costs

Sum of costs Bln SEK per year

<i>Substance</i>	<i>Diab + Cardio</i>	<i>including lost lifes</i>
PCB153	1.16	2.78
P.p-DDE	3.24	7.51
MMP	1.36	3.26
PFNA	0.45	1.10
<i>Sum (PAR 0.5)</i>	<i>4.98</i>	<i>11.23</i>

Conclusion: Diabetes

- ✓ **Pathways of exposure?**
- ✓ **Biological/chemical mechanisms causing Diabetes?**
- ✓ **Relation established.**
- ✓ **Low precision - indicates level of magnitude**
- ✓ **Changes over time**

Bone fractures caused by Cadmium intake

Health effects of Cadmium

- Bone fractures
- Kidney damage
- Fertility (suspected)
- Genetic (suspected)

Economic cost of fractures caused by dietary cadmium exposure by Jenny von Bahr, Agneta Åkesson and Lars Drake, Swedish Chemicals Agency, Report 4/13.

Flows of Cd in the agriculture and food system

- Concentration of Cadmium in P-fertilizers
 - 1970 ~ 150 mg Cd/kg P (» increase in soil concentration)
 - 2010 ~ 5 mg Cd/kg P (» reduction in soil concentration)
- Wet and dry deposition
- Manure
- Mineral fertilizers P
- Soil stock, i.e. slow process!
- Food import!

Content of cadmium in some food products

High: spinach, cereals, rice, potatoes

Low: milk, cheese, fish, meat

Cost of bone fractures due to Cadmium intake

- **Two studies based on calculation of cadmium content in different food. One dissertation for women and one for men.**
- **PAR women 13 %**
- **PAR men, 7 %**
- **(PAR, 11 %)**

Cost calculation

Total costs for fractures in Sweden:

(hospital, other care, reduced life quality, death,
but not work loss)

39 Bln SEK/year

$$39 * 0.11 = 4.2$$

Cost caused by intake of cadmium in food:

4.2 Bln SEK/year

Conclusions

One chemical and one effect for one country:
400 million euros.

(EU has 50 times the population of Sweden)

- Solution in the short run avoid food with high content of Cd.
- Solution in the long run 1. decadmiate the phosfate and 2. use less coal and improve abatement technology used.

Concluding discussion

- **Diabetes and Bone fracture studies 0.2-0.5 % of GDP**
- **All health costs of chemical exposure $\sim\sim$ 1 - 3 % of GDP**
- **Health impacts are larger than costs of chemicals policy**