Chapter 23
The economic burden of occupational cancers in the European Union

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According to the most recent statistics from the International Agency for Research on Cancer (IARC), there were 2.63 million new cancer cases and 1.28 million cancer deaths in the 28 European Union countries (EU28) in 2012. As regards prevalence, in the same year 7.16 million people in the EU28 were living with a cancer diagnosed in the previous five years (Ferlay *et al.* 2013).

These diseases lead to substantial costs for victims, their families and society as a whole. In a recent study, the social cost of all cancers combined for the EU27 was estimated at EUR 126 billion for 2009 (Luengo-Fernandez *et al.* 2013). Four types of cancer contribute to 44% of these costs: lung cancer (EUR 18.8 billion, 15% of overall cancer costs), breast cancer (EUR 15.0 billion, 12%); colorectal cancer (EUR 13.1 billion, 10%) and prostate cancer (EUR 8.43 billion, 7%).

A certain proportion of all cancers is linked to working conditions. These cancers are particularly shocking as they generally affect people who are involuntarily exposed to carcinogens in the course of their work. Moreover, certain categories of workers are affected much more than others. The risks of exposure to carcinogens for a labourer or nurse are, for example, much higher than for a senior executive, a factor increasing social inequalities in health (Mengeot *et al.* 2014).

Occupational cancers could be avoided if effective prevention actions were implemented to eliminate or reduce such exposure. Likewise, the costs associated with these diseases and deaths could be reduced to the benefit of society as a whole. In order to develop coherent occupational cancer prevention policies, it is particularly important to identify the nature of these costs and understand who bears them, and also to estimate the total amounts involved.

A comprehensive assessment of the cost of occupational cancers in a given country or region necessarily involves two stages. The first is to estimate the number of cancers attributable to occupational exposure. The second is to estimate the various costs associated with each of these cancers. By combining this data, the overall cost of occupational cancers to society can be monetised.

1. Number of occupational cancers

Cancers are multifactorial diseases, with clearly identified risk factors including heredity, lifestyle and environmental and occupational factors. The method generally used to determine the number of cases linked to a particular risk factor is the attributable fraction (AF) method. The attributable fraction can be defined as the percentage of cases of a disease that could have been avoided if there had been no exposure to the suspected risk factor. It reflects the risk of contracting the disease when exposed or not to the risk factor (relative risk) vis-à-vis the proportion of the total population exposed to the risk factor (prevalence of exposure).

The proportion of cancer cases attributable to working conditions varies according to gender and type of cancer. For example, mesotheliomas are almost exclusively occupational in origin (~95%) due to exposure to asbestos, whereas only a very small proportion of kidney cancers (~1%) are seemingly linked to work. However, it is possible to calculate the fraction of all cancers attributable to work.

Table 1 **Estimates of cancer cases and cancer deaths attributable to occupational exposure**

Author, year	Zone	% of cancer deaths attributable to occupational exposure		% of cancer cases attributable to occupational exposure	
		Men	Women	Men	Women
Vencovsky *et al.* (2017)	EU-28			6.0-15.0	3.0-7.0
Labrèche *et al.* (2014)	Quebec (Canada)	11.0-17.3	2.1-3.6	8.3-13.2	1.6-3.3
Rushton *et al.* (2012)	UK	7.2-9.9	1.7-3.2	4.0-8.4	1.4-3.2
Rushton *et al.* (2008)	UK	6.0-8.0	1.0-1.5	5.4-6.7	1.0-1.2
Hamalainen *et al.* (2007)	World	13.8	2.2		
Fritschi & Driscol (2006)	Australia			10.8	1.8
Deschamps *et al.* (2006)	France			3.18	
Steenland *et al.* (2003)	USA	3.3-7.3	0.8-1.0		
Nurminen & Karjalainen (2001)	Finland	13.8	2.2		
Dreyer *et al.* (1997)	Nordic countries			3	<0.1
Leigh *et al.* (1997)	USA	6-10			
Doll & Peto (1981)	USA	7.0	1.2		

Source: adapted from Orenstein *et al.* (2010)

Studies conducted in a number of countries estimate that 4% to 12% of all cancer deaths and a high proportion of cancer cases are attributable to occupational exposure (see Table 1). In the early 1980s, British epidemiologists put at 4% (with an uncertainty ranging between 2% and 8%) the fraction of cancer deaths attributable to an occupational cause in the United States (Doll and Peto 1981). This estimate is considered by many to be an underestimate due to the increasing number of carcinogens being identified and recognised by the IARC. More recently, the Rushton team put this attributable fraction at 5.3% for Great Britain in 2005 (8.2% for men and 2.3% for women), while recognising

that this was also an underestimation of the true situation (Rushton *et al.* 2012). The best estimate that is currently generally accepted is based on Finnish studies and puts the fraction of cancer deaths attributable to work at 8.3% (Takala 2015). On this basis, the number of male and female workers who die each year from an occupational cancer in the EU28 can be estimated at over 102 000 (see Table 2 for a breakdown by country). The overall attributable fraction of 8% or above is corroborated by a very recent study on occupational cancers and the associated costs in the EU-28 which indicates that 8% (between 6% and 12%) of all new cancer cases (6% to 15% among men and 3% to 7% among women) could be work-related (Vencovsky *et al.* 2017).

Table 2 **Estimate of the annual number of deaths due to occupational cancer in the EU 28**

Country	Number of occupational cancer deaths
Austria	1 820
Belgium	2 079
Bulgaria	1 445
Czech Republic	2 238
Croatia	742
Cyprus	179
Denmark	1 242
Estonia	292
Finland	1 135
France	12 035
Germany	17 706
Greece	2 131
Hungary	1 808
Ireland	928
Italy	10 609
Latvia	491
Lithuania	694
Luxembourg	98
Malta	75
Netherlands	3 721
Poland	7 501
Portugal	2 371
Romania	4 233
Slovakia	1 150
Slovenia	442
Spain	9 807
Sweden	2 103
United Kingdom	13 330
Total	102 405

Source: based on 2011 figures and adapted from Takala (2015)

2. Costs associated with a cancer case

There are three main types of cost associated with a cancer case: direct costs, indirect costs and intangible costs (see Table 3). The first category includes all medical and non-medical costs linked to the disease. Direct medical costs include medical visits for diagnosis and monitoring of the disease, hospitalisation costs (surgery, inpatient costs), outpatient care (chemotherapy, radiotherapy, physiotherapy, medical tests), accidents and emergency visits associated with the cancer (for example, bleeding, severe vomiting due to a therapy) and drugs used to treat the cancer. Direct non-medical costs include costs of transport to the hospital or attending doctor, costs of home help, and any costs of moving home or adapting housing.

Table 3 **Different types of cost associated with an occupational cancer case**

Type of cost		Category	Cost bearer			
			Worker	Family and friends	Employer	State
Direct costs	Medical costs	Medical visits				
		Inpatient care				
		Outpatient care				
		Emergency care				
		Drugs				
	Non-medical costs	Transport				
		Home help				
		Accommodation				
Indirect costs		Productivity loss (morbidity)				
		Productivity loss (mortality)				
		Productivity loss (family and friends)				
Intangible costs		Pain				
		Suffering				
		Grief				
		Loss of self-esteem				

The second category (indirect costs) covers productivity losses due to the morbidity (temporary absence due to sick leave or permanent absence due to work incapacity) as well as productivity losses linked to early mortality (years of work lost at the time of death). The patient's family and friends are often relied upon, spending part of their working (or leisure) time caring for the person suffering from a cancer. This 'informal care' similarly results in productivity losses, particularly for the patient's family and friends and employers who must also be taken into account.

The third category (intangible or human costs) involves the deterioration in the patient's quality of life. Cancers cause pain, suffering, grief and often a loss of self-esteem. Due to their very nature, these costs are difficult to monetise, but 'willingness to pay' methods have been developed for this purpose. These are based on the sums that a population is

willing to pay to avoid a disease or death, and they therefore allow these intangible costs to be considered (EPA 2010).

The cost bearers differ according to the category of costs (see Table 3). The costs borne by workers include some of the direct medical costs, the direct non-medical costs, the net wage losses (difference between lost wages and compensation received) and the costs associated with the deterioration in their quality of life. The patient's family and friends mainly bear wage losses for the time spent on informal care. Employers generally bear the costs of the short- or long-term absenteeism of sick workers (staff turnover, training of replacements, insurance premiums) and the State bears some of the healthcare and social insurance costs and the loss of human capital due to early deaths. The total cost to society as a whole is the net sum of these various costs, i.e. taking into account any transfers between cost bearers.

The costs associated with a cancer case vary according to the location of the cancer. In fact, the cost of treatment differs from one type of cancer to another, as do the survival statistics following first diagnosis. For example, among women, breast cancer has a better 10-year survival prognosis (76%) than lung cancer (12%) (Grosclaude *et al.* 2013). For the same type of cancer, the costs can also vary by country. Accordingly, a case of lung cancer costs EUR 15 per inhabitant and per year in Germany, compared to EUR 2 in Bulgaria (Luengo-Fernandez *et al.* 2013).

3. Estimate of the social cost of occupational cancers in the EU

To our knowledge, two studies are currently available on the cost of occupational cancers for all EU28 countries. They both estimate the current economic burden resulting from past occupational exposure to selected carcinogenic agents. The first study estimates the costs of healthcare and productivity losses to range between €4-7 billion annually for the EU-28. When quality-of-life losses associated with premature deaths and cancer diagnoses are added, the total annual societal impact is estimated to be in the order of €334 (242 - 440) billion (RIVM 2016). The second study commissioned by ETUI puts the direct and indirect annual cost of reported cases of occupational cancer between €4 and €10 billion for the EU-28. When all intangible costs are included in the analysis, the total cost shoots up to between €270 and €610 billion (Vencovsky *et al.* 2017).

Despite the differences in the methodology and the inevitable limitations linked to economic valuations, these results are consistent with each other and give estimates in the same order of magnitude for the sum of direct and indirect costs and for the intangible costs.

These figures are also in line with those produced by Luengo-Fernandez et al on the annual costs of cancer in the EU-27, estimated at €129 billion for 2009. It is important to note that this figure covers occupational and non-occupational cancers. In addition, these costs are for direct and indirect costs only and do not include any allowance for intangible costs. Assuming that around 8% of the costs in Luengo-Fernandez study are attributable to occupational cancer suggests that the direct and indirect costs of

occupational cancer were around €10 billion in 2009. This is in line with the annual costs (excluding intangible costs) for the EU-28 calculated by RIVM for 2012 and Vencovsky for 2015.

Whether intangible costs should be quantified or not is debatable. There is an ethical issue in putting a price on workers' loss of quality of life or even on the value of life. This is part of a broader discussion that involves questioning the market rhetoric and the neo-liberal paradigm where all that we value can be monetised.

However, it is important to point out that intangible costs are substantial, and their use is well entrenched in policymaking. Human costs are indeed taken into account in Europe and the United States by the regulatory agencies responsible for developing legislation to reduce risks to humans and the environment from the use of hazardous chemicals (Albertini and Scasny 2014; Woodruff 2015).

4. Conclusions

Occupational cancers are the main cause of work-related mortality in the industrialised countries. Each year they are responsible for the deaths of over 102 000 male and female workers, and for a sizable proportion of the new cancer cases diagnosed in the EU28. The social cost of occupational cancers is significant. It can be roughly estimated at €10 billion per year in the EU28 for direct and indirect costs only and in the order of €300 billion per year when human cost is added. This cost is mostly borne by workers and their families but also by employers and the social security systems in the various Member States. However, occupational cancers and their negative socioeconomic impacts can be avoided if exposure to carcinogens is eliminated or reduced in the workplace. It is high time that policymakers in Europe and around the world finally realised the extent of the problem and the massive impact of inaction in this area of occupational health, and urgently adopt effective policies to prevent occupational cancers.

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