

The value of OSH: Estimating the societal costs of work-related injuries and diseases

In Finland, Germany, the Netherlands, Italy and Poland



Objective of the study

To estimate the costs of work-related injuries and diseases for five countries

- Including the valuation of life and health impacts
- Distinction between different cost bearers (employers, workers, society)
- Differentiation between causes of injuries and diseases
- Transparent and reproducible methodology

Country selection - criteria

Most important condition:

Sufficient data quality to enable the cost estimation

To represent the diversity in the European Union:

- Sufficient geographical coverage
- Variance in main type of industry (services, industry, agriculture)
- Variance in insurance system (health care, social security)

Selected countries

Countries	Geographical location	Insurance system ^[1]	% employed in services ^[2] (EU average = 73.1%)
Finland	North	Mixed	73.1%
Germany	West	Bismarckian	73.9%
The Netherlands	West	Bismarckian	82.9%
Italy	South	Beveridgean	72.4%
Poland	Central	Bismarckian	58.3%

Sources:

[1] EU-OSHA, 2017b

[2] Labour Force Survey 2015 (Eurostat)

Two approaches

Bottom-up model

- Building up from costs per case to total costs
- Direct costs (i.e. healthcare), indirect costs (i.e. productivity loss), intangible costs (monetized life and health impacts)

Top-down model

- Based on work-related fraction of total burden of disease expressed in DALYs
- Monetary value of a DALY
- Monetization approaches based on loss of productivity and life and health impacts

Bottom-up model

Bottom-up model

Estimation of cases

Definition of cost categories

Price weights

Total (sub) category costs
for a strata =

of cases in the strata
x
per case costs for the
strata

Bottom-up model – estimation of cases

- **Non-fatal work-related injuries¹**
- **Fatal work-related injuries¹**
- **Non-fatal work-related diseases^{2,3}**

Different data sources, different scenarios of the case count. Baseline scenario:

- Count of compensated (accepted, recognized) and non-compensated non-fatal cases for most types of diseases²; with the following exceptions:
- for cancers, circulatory diseases, respiratory diseases, and musculoskeletal diseases we estimated case counts and used attributable fractions to estimate the work-related cases³

- **Fatal work-related diseases³**

Sources:

[1] ESAW 2015 (non-fatal cases of Poland and Italy are adjusted based on the fatal to non-fatal ratio). To estimate the number of non-fatal cases with 1-3 workdays lost, the severity distribution in the LFS 2013 was applied

[2] National sources: Finland - Finnish Institute of Occupational Health (2012); Germany - DGUV Statistics (2013); The Netherlands - NCvB statistiek, Nationale Registratie Beroepsziekten (2015); Italy - Banche dati static, occupational injury and disease (2015); Poland: Choroby Zawodowe W Polsce W (2014)

[3] IHME 2015

Bottom-up model – estimation of cases

	work-related injuries		work-related diseases	
Countries	Non-fatal (> 1 workday lost)	Fatal	Non-fatal	Fatal
Finland	63,407	35	67,795	628
Germany	1,158,865	450	1,088,793	13,924
The Netherlands	99,880	35	220,368	3,262
Italy	1,257,987	543	638,448	10,524
Poland	697,337	301	454,090	4,663

Bottom-up model - definition of cost categories

Direct costs

- Healthcare costs (public sector/insurer)
- Overhead costs (public sector/insurer)
- Informal care giving (family/community)
- Out of pocket costs healthcare products (worker/family)

Indirect costs

- Market output losses
- Payroll/fringe benefits
- Employer adjustment costs
- Insurance administration costs
- Home production losses
- Presenteeism

Intangible costs

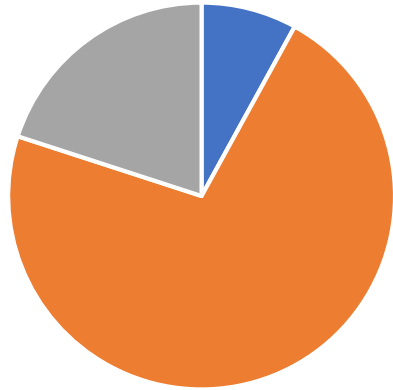
- Monetary value of Quality Adjusted Life Years (QALYs)

Bottom-up model – estimation of costs

Country		Finland	Germany	The Netherlands	Italy	Poland
Cases		131,867	2,262,031	323,544	1,907,504	1,156,394
Direct costs	In million €	€ 484	€ 10,914	€ 2,137	€ 8,491	€ 1,882
Direct cost % total		8%	10%	9%	8%	4%
Indirect costs	In million €	€ 4,362	€ 70,658	€ 16,468	€ 58,961	€ 19,588
Indirect cost % total		72%	66%	69%	56%	45%
Intangible costs	In million €	€ 1,196	€ 25,557	€ 5,147	€ 37,392	€ 22,311
Intangible cost % total		20%	24%	22%	36%	51%
Total economic burden	In million €	€ 6,042	€ 107,129	€ 23,751	€ 104,844	€ 43,781
Percentage of GDP with intangible cost		2.9%	3.5%	3.5%	6.3%	10.2%
Percentage of GDP, direct and indirect costs only		2.3%	2.7%	2.7%	4.0%	5.0%
Per case cost		€ 45,816	€ 47,360	€ 73,410	€ 54,964	€ 37,860
Per employed person		€ 2,479	€ 2,664	€ 2,855	€ 4,667	€ 2,722
GDP per employed		€ 86,016	€ 75,692	€ 82,159	€ 73,565	€ 26,738

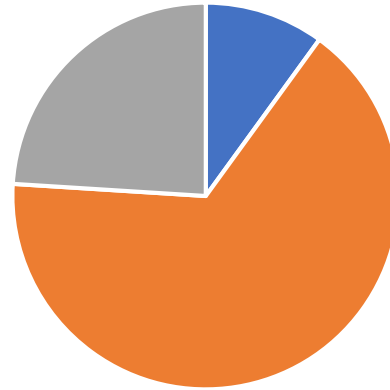
Bottom-up model – type of costs by country

Finland



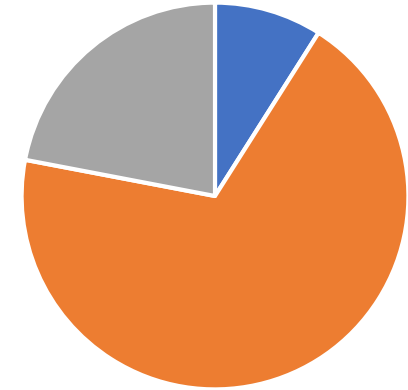
■ Direct cost ■ Indirect cost ■ Intangible cost

Germany



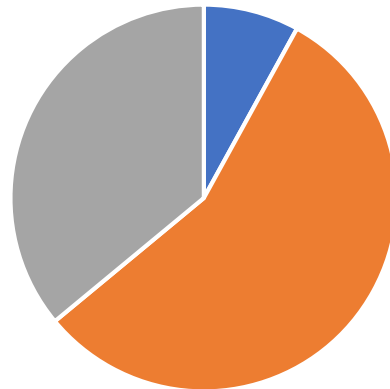
■ Direct cost ■ Indirect cost ■ Intangible cost

The Netherlands



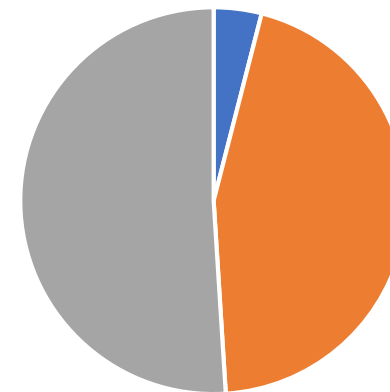
■ Direct cost ■ Indirect cost ■ Intangible cost

Italy



■ Direct cost ■ Indirect cost ■ Intangible cost

Poland

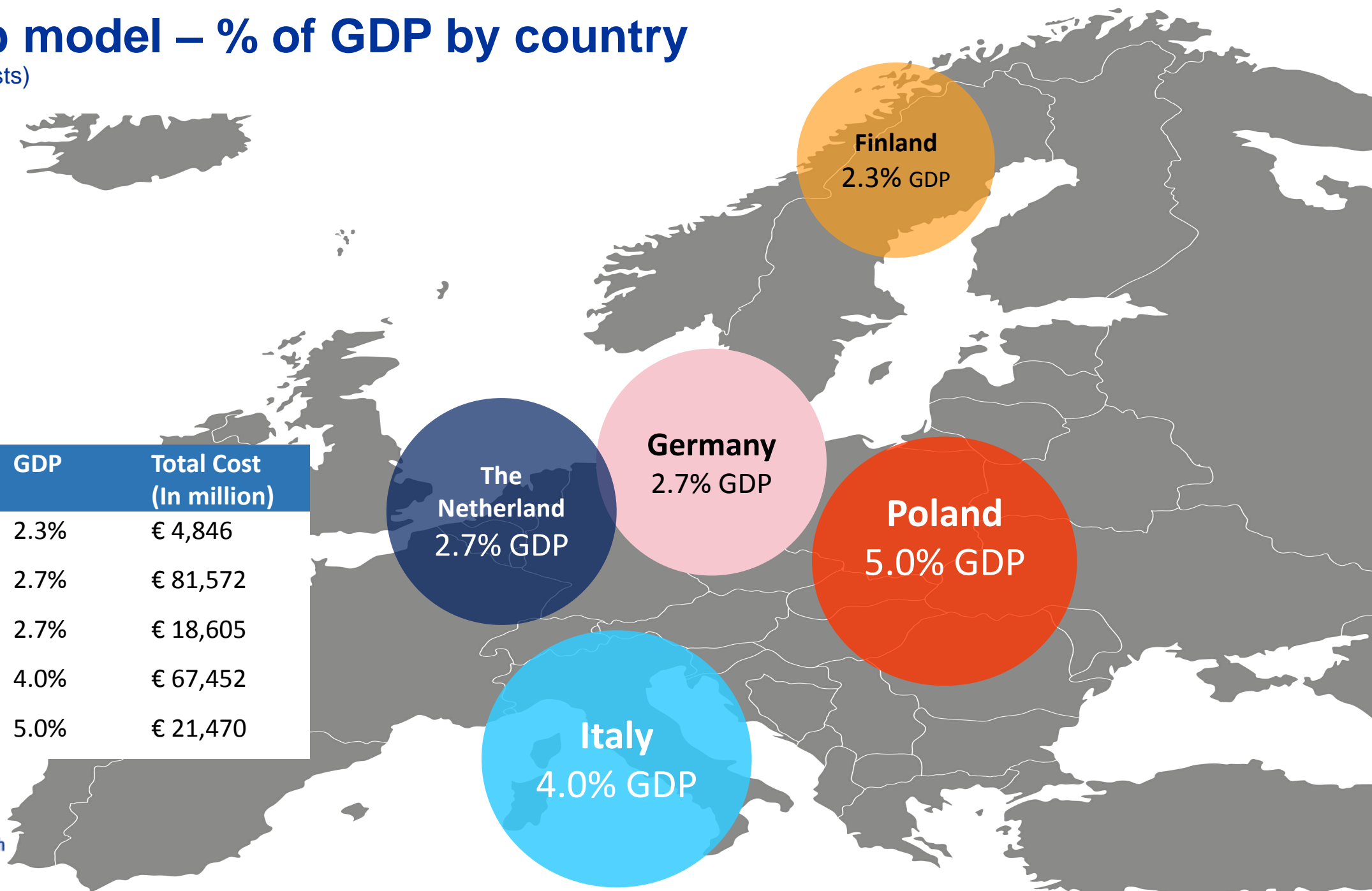


■ Direct cost ■ Indirect cost ■ Intangible cost

Bottom-up model – % of GDP by country

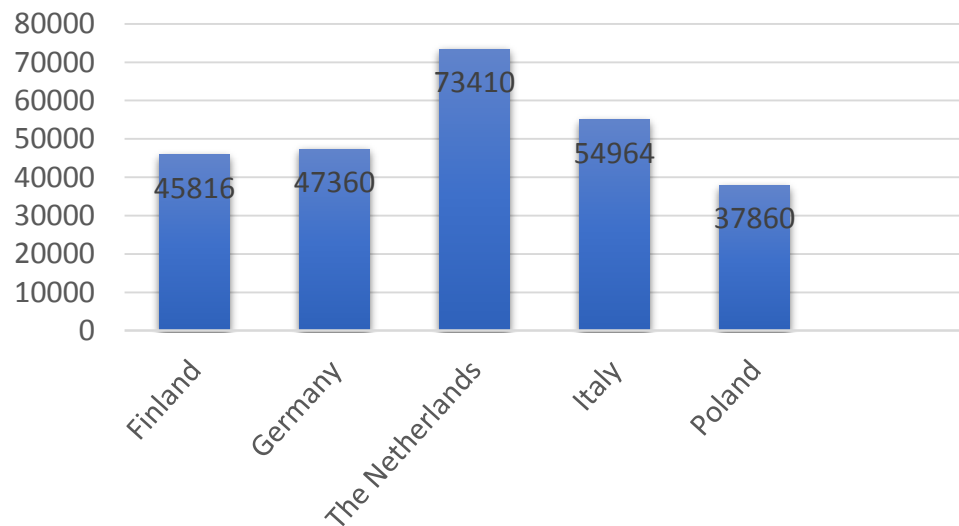
(without intangible costs)

Country	GDP	Total Cost (In million)
Finland	2.3%	€ 4,846
Germany	2.7%	€ 81,572
The Netherland	2.7%	€ 18,605
Italy	4.0%	€ 67,452
Poland	5.0%	€ 21,470

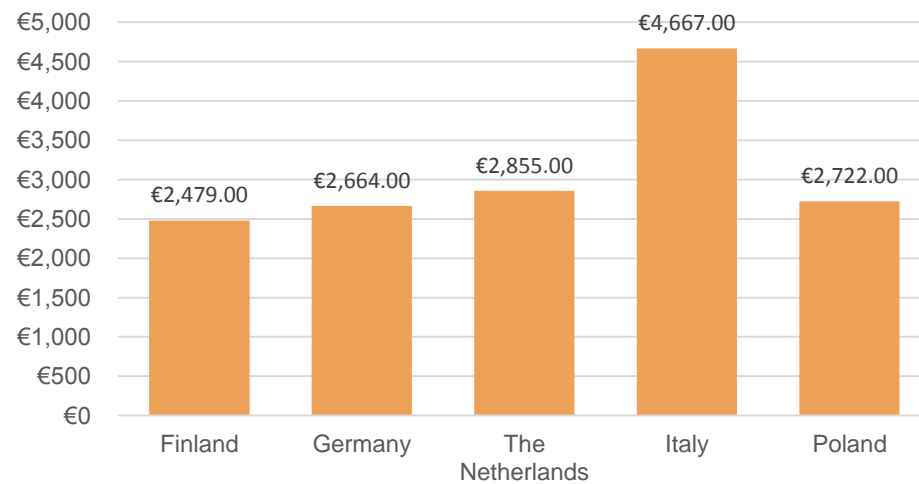


Bottom-up model – per case and per employed person

Per case cost in Euro



Per employed person



Bottom-up model – costs by stakeholder

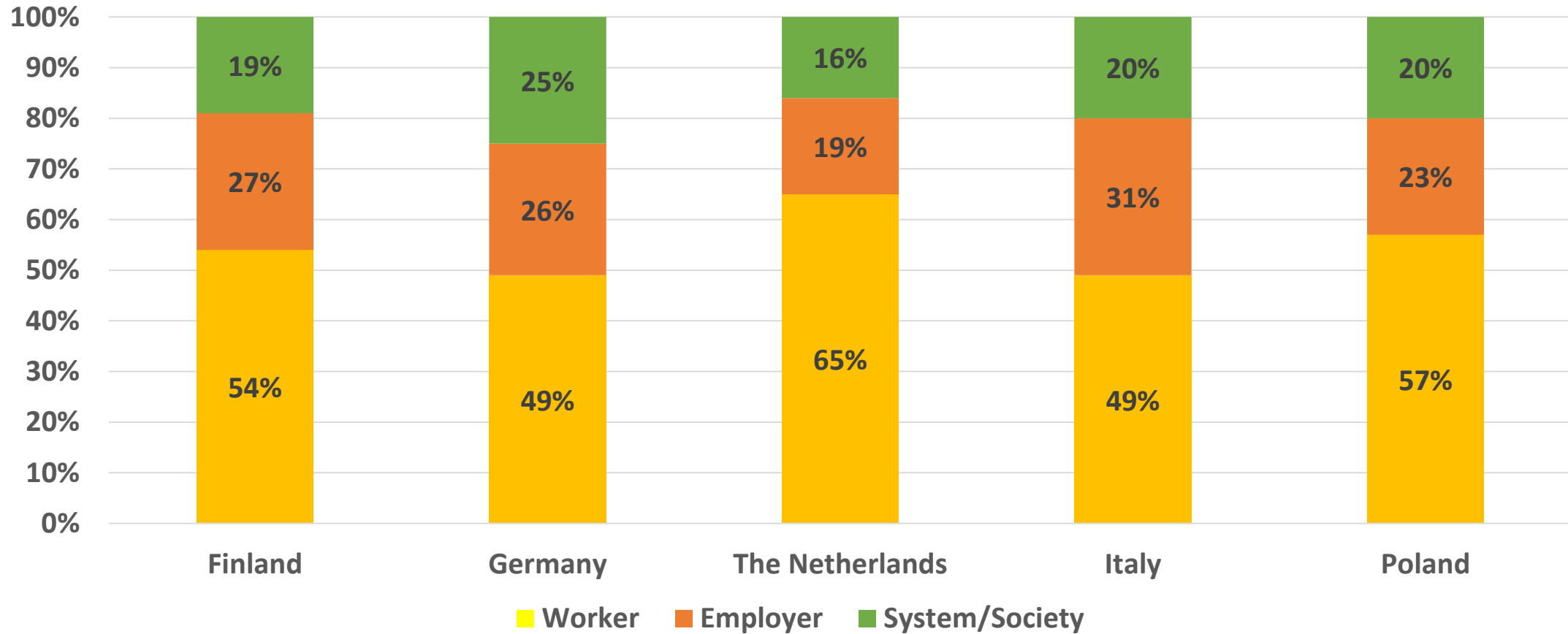
Country	Employer		Worker		System/Society	
	In million €	%	In million €	%	In million €	%
Finland	€ 1,325	22%	€ 3,800	63%	€ 916	15%
Germany	€ 21,534	20%	€ 64,813	61%	€ 20,782	19%
The Netherlands	€ 3,484	15%	€ 17,235	73%	€ 3,032	13%
Italy	€ 20,632	20%	€ 70,391	67%	€ 13,821	13%
Poland	€ 5,007	11%	€ 34,421	79%	€ 4,353	10%

Bottom-up model – costs by stakeholder (total costs)



Bottom-up model – costs by stakeholder (without intangible costs)

Chart Title



Top-down model

Top-down model - elements

DALY = Disability Adjusted Life Year

The DALY is a measure of overall disease burden, expressed as the number of years lost or lived with disabilities due to ill-health, disability or early death, calculated by disease

DALY = sum of life years lost to premature mortality + healthy life years lost to disability

Attributable fraction = part of the disease that is caused by occupational exposure

Monetary value of a DALY according to several monetization approaches

Sources:

DALYs by disease, sex, age and country from the World Health Organisation (WHO) Global Health Estimates.

Attributable fractions derived from the Global Burden of Disease study as registered by the Institute for Health Metrics and Evaluation (IHME), and from the literature.

Monetary values derived from the literature.

Top-down model – cost estimation

n of DALYs
disease #1

X

Attributable fraction
disease #1

n of DALYs
disease #2

X

Attributable fraction
disease #2

n of DALYs
disease #n

X

Attributable fraction
disease #n

=

Total
work-
related
DALYs

X

Monetary
value of
a DALY

Top-down model – monetization approaches

Human capital approach

Based on the loss of economic productivity due to ill health, disability or premature mortality

Willingness-to-pay

Based on the preference of survey respondents to pay for health gains

Value of statistical life

Based on a value of the total remaining lifetime in case of no accident or illness

Top-down model - estimation of costs

	Finland		Germany		The Netherlands		Italy		Poland	
DALYs:										
Total occupational DALYs	64,516		1,236.855		248,464		853.817		507,068	
Percentage of total DALYs	4.2%		4.9%		5.7%		5.1%		4.0%	
Occupational DALYs per 10,000 employed persons	265		308		299		380		315	
Costs:										
	million €	% of GDP	million €	% of GDP	million €	% of GDP	million €	% of GDP	million €	% of GDP
Human capital approach										
Minimum	1,419	0.7%	24,597	0.8%	5,290	0.8%	13,530	0.8%	2,692	0.6%
Average	3,106	1.5%	55,429	1.8%	11,879	1.7%	31,475	1.9%	6,929	1.6%
Median	2,291	1.1%	39,712	1.3%	8,708	1.3%	23,865	1.4%	4,656	1.1%
Maximum	7,393	3.5%	138,404	4.5%	30,114	4.4%	69,671	4.2%	17,037	4.0%
WTP approach										
Minimum	1,637	0.8%	32,324	1.1%	3,276	0.5%	20,929	1.3%	5,118	1.2%
Average	5,814	2.8%	66,251	2.2%	14,613	2.1%	42,895	2.6%	9,676	2.3%
Median	4,335	2.1%	66,251	2.2%	13,953	2.0%	42,895	2.6%	8,863	2.1%
Maximum	17,453	8.3%	100,177	3.3%	30,767	4.5%	64,861	3.9%	15,861	3.7%
VSLY/VOLY approach										
Minimum	4,214	2.0%	60,609	2.0%	9,649	1.4%	52,304	3.2%	12,790	3.0%
Average	9,345	4.5%	191,939	6.3%	38,016	5.6%	133,789	8.1%	43,836	10.2%
Median	8,633	4.1%	166,943	5.5%	33,248	4.9%	126,876	7.7%	31,026	7.2%
Maximum	19,425	9.3%	420,489	13.8%	77,016	11.3%	256,120	15.5%	119,149	27.7%

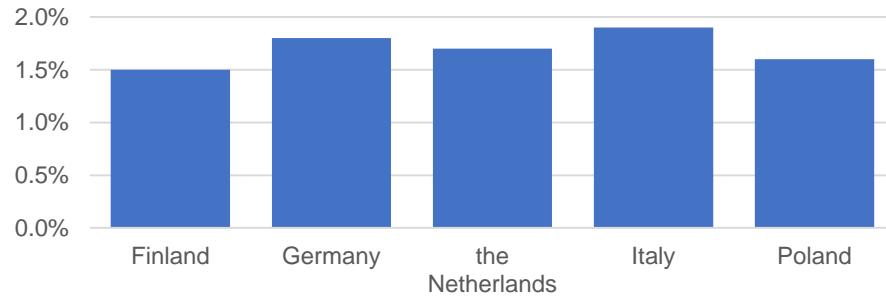
Top-down model - estimation of costs

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VSLY/VOLY approach	9,345	4.5%	191,939	6.3%	38,016	5.6%	133,789	8.1%	43,836	10.2%

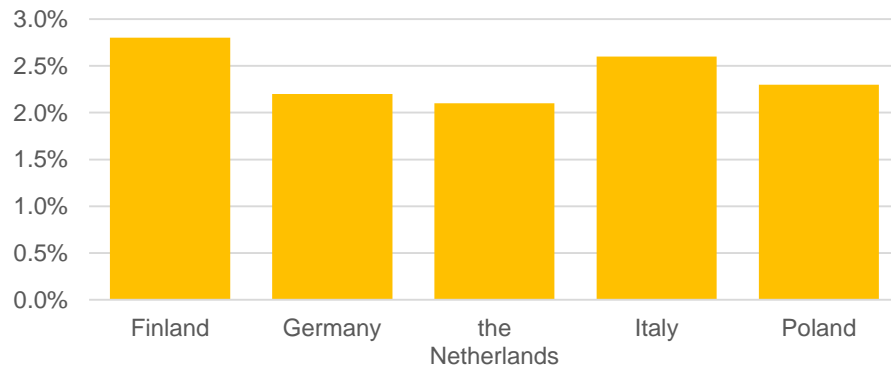
Top-down model - estimation of costs % of GDP

12%

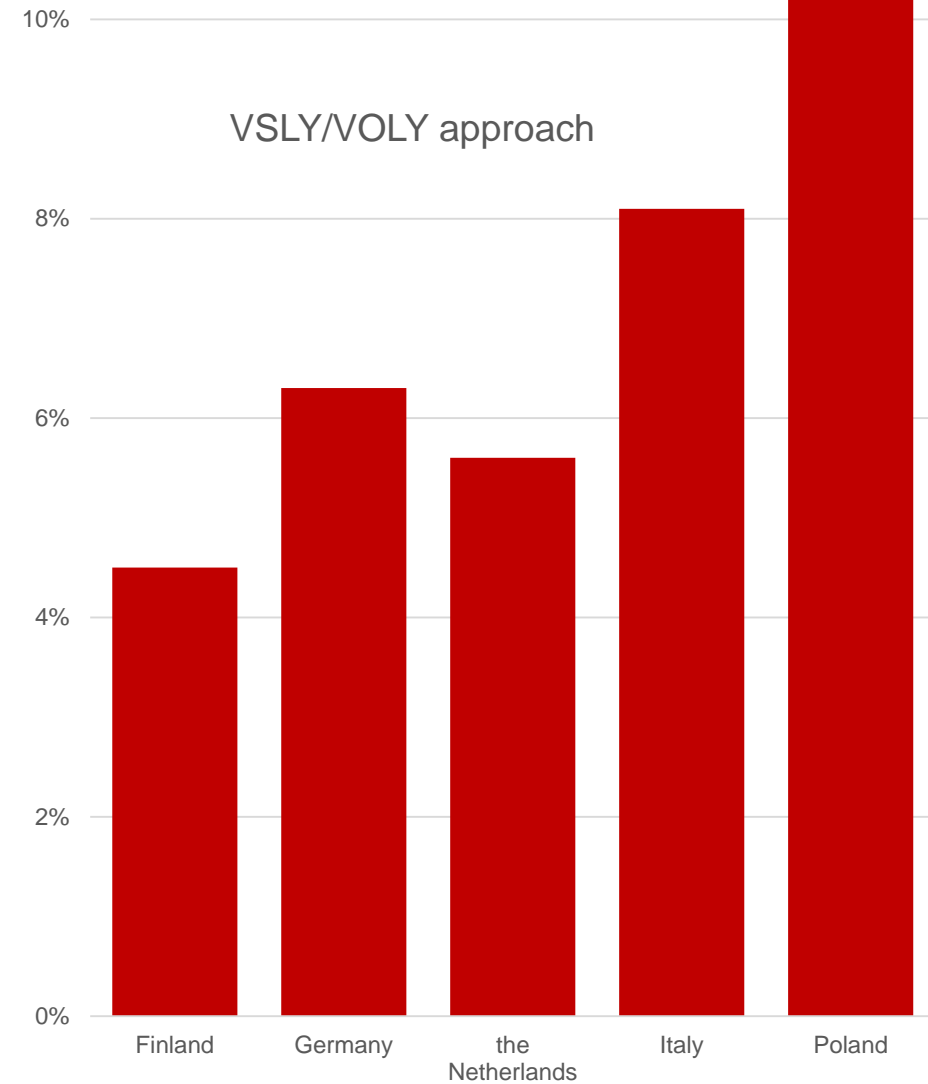
Human capital approach



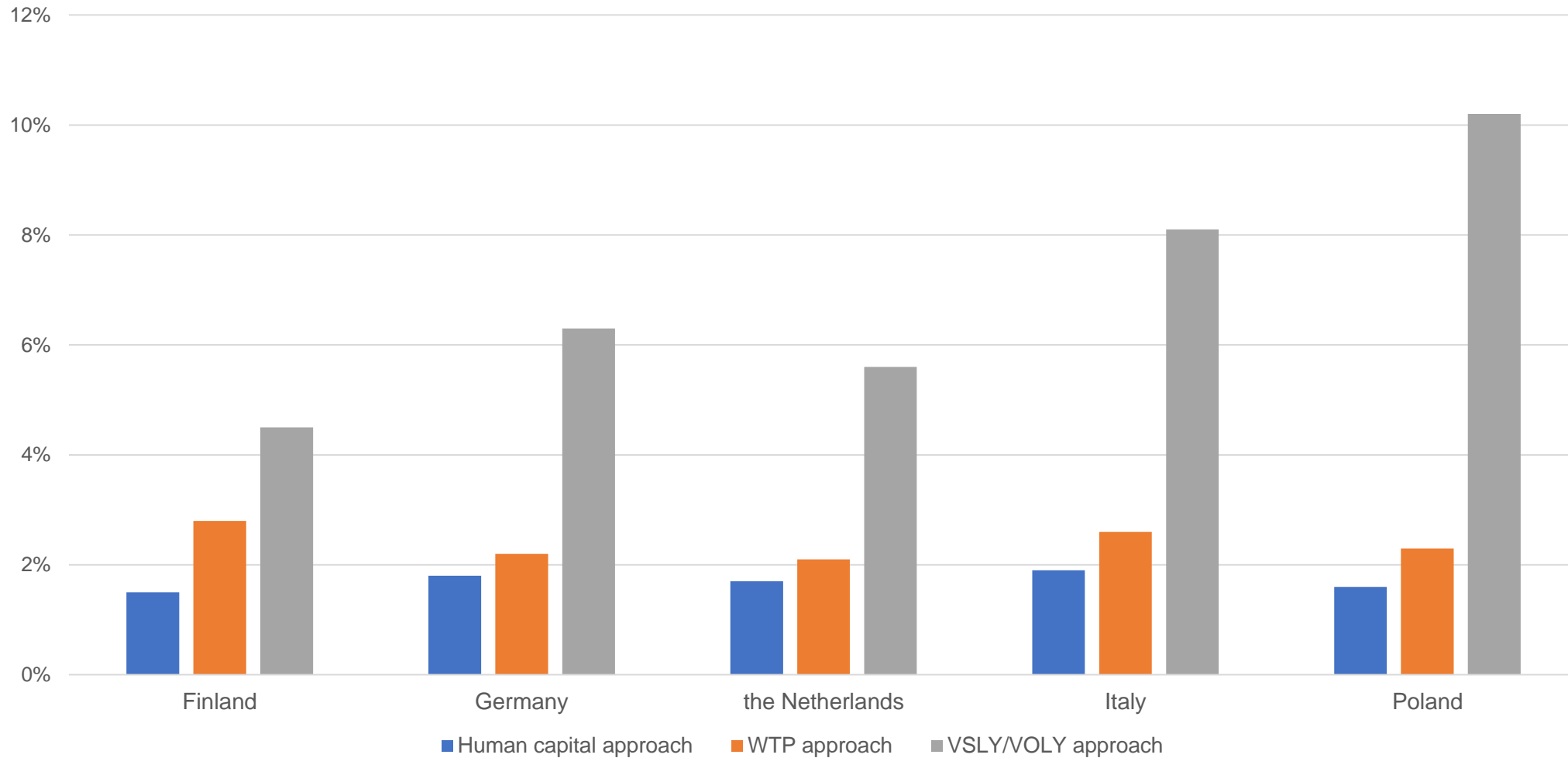
WTP approach



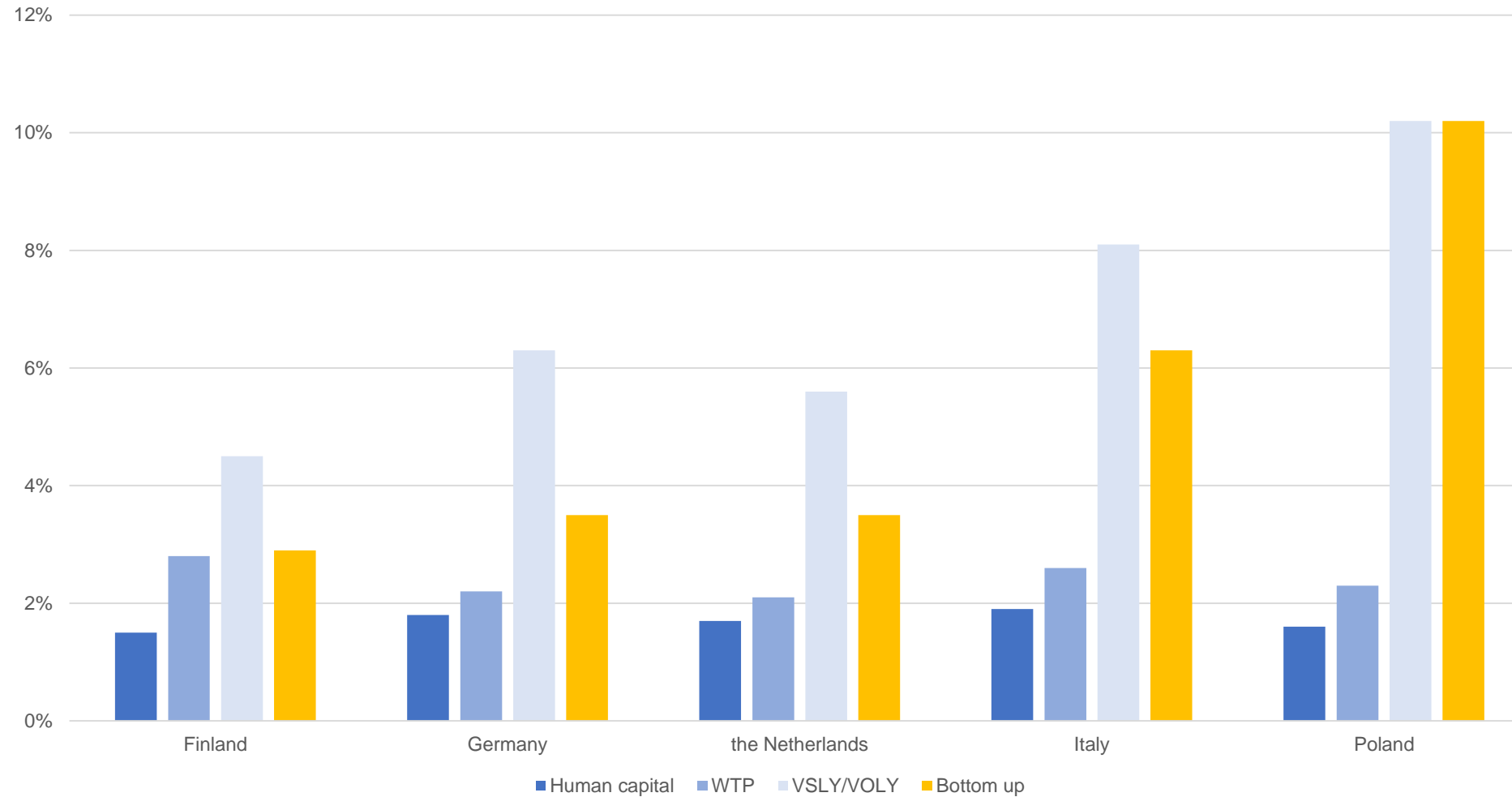
VSLY/VOLY approach



Top-down model - estimation of costs % of GDP



Comparison of the models (% of GDP)



Conclusions

- **Top-down or bottom-up model?**

A bottom-up model is more precise and gives more insight into different cost components. However, data availability and reliability can be a huge problem and it is a very time consuming activity

- **Life and health impacts**

Important part of the cost estimation in both models. If they are not monetized they probably will be ignored. However, there is no consensus on the approach to estimate their value

- **Implications for future projects**

The count of work-related cases should be improved. Also country specific data on healthcare costs should be easier to obtain. Finally, it would be helpful to come to a consensus on the way to value life and health impacts