Economic Cost of Work-related Injuries and Ill-Health in Singapore, and Application Elsewhere

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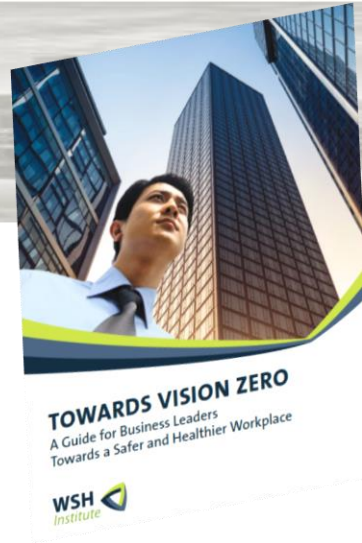
Economic Costs - OVERVIEW



Introduction

What to measure – 3 options

Practical data – what is essential

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Costs Sudy in Singapore

- Comparison of economic cost of work injuries and ill health in US, UK, EU and Australia
- Our study
  - Objective
  - Our approach
  - Our economic model
  - Costs borne by economic agents
  - Expected outcomes
- Recommendations and way forward

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Facts

- The ILO estimates that each year about 2.3 million workers die from occupational accidents and diseases[1].
- 1 million workers will suffer a workplace accident at the end of the day.
- It is estimated that **4% of annual global GDP** (US$2.8 trillion), is due to direct and indirect costs of occupational accidents and diseases (e.g lost working time, workers' compensation, the interruption of production and medical expenses).[2]

[1] *XIX World Congress on Safety and Health at Work: Istanbul Turkey, 11-15 September 2011*

[2] *International Labour Organisation (ILO). World Day for Safety and Health at Work 2009 'Facts on safety and health at work'. April 2009.*

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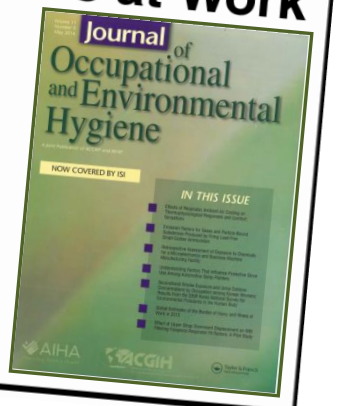
Global Estimates of the Burden of Injury and Illness at Work in 2012



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This article reviews the present indicators, trends, and recent solutions and strategies to tackle major global and country problems in safety and health at work. The article is based on the Yant Award Lecture of the American Industrial Hygiene Association (AIHA) at its 2013 Congress. We reviewed employment figures, mortality rates, occupational burden of disease and injuries, reported accidents, surveys on self-reported occupational illnesses and injuries, attributable fractions, national economic cost estimates of work-related injuries and ill health, and the most recent information on the problems from published papers, documents, and electronic data sources of international and regional organizations, in particular the International Labor Organization (ILO), World Health Organization (WHO), and European Union (EU), institutions, agencies, and public websites. We identified and analyzed successful solutions, programs, and strategies to reduce the work-related negative outcomes at various levels. Work-related illnesses that have a long latency period and are linked to ageing are clearly on the increase, while the number of occupational injuries has gone down in industrialized countries thanks to both better prevention and structural changes. We have estimated that globally there are 2.3 million deaths annually for reasons attributed to work. The biggest component is linked to work-related diseases, 2.0 million, and 0.3 million linked to occupational injuries. However, the division of these two factors varies depending on the level of development. In industrialized countries the share of deaths caused by occupational injuries and work-related communicable dis- low while non- are key issues in changing the workplace culture. Vision Zero is a useful concept and philosophy in gradually eliminating any harm at work. Legal and enforcement measures that themselves support companies and organizations need to be supplemented with economic justification and convincing arguments to reduce corner-cutting in risk management, and to avoid short- and long-term disabilities, premature retirement, and corporate closures due to mismanagement and poor and unsustainable work life. We consider that a new paradigm is needed where good work is not just considered a daily activity. We need to foster stable conditions and circumstances and sustainable work life where the objective is to maintain your health and work ability beyond the legal retirement age. We need safe and healthy work, for life.

Keywords burden of injury and illness at work, global estimates, mortality, occupational accidents, occupational exposures, work-related disease

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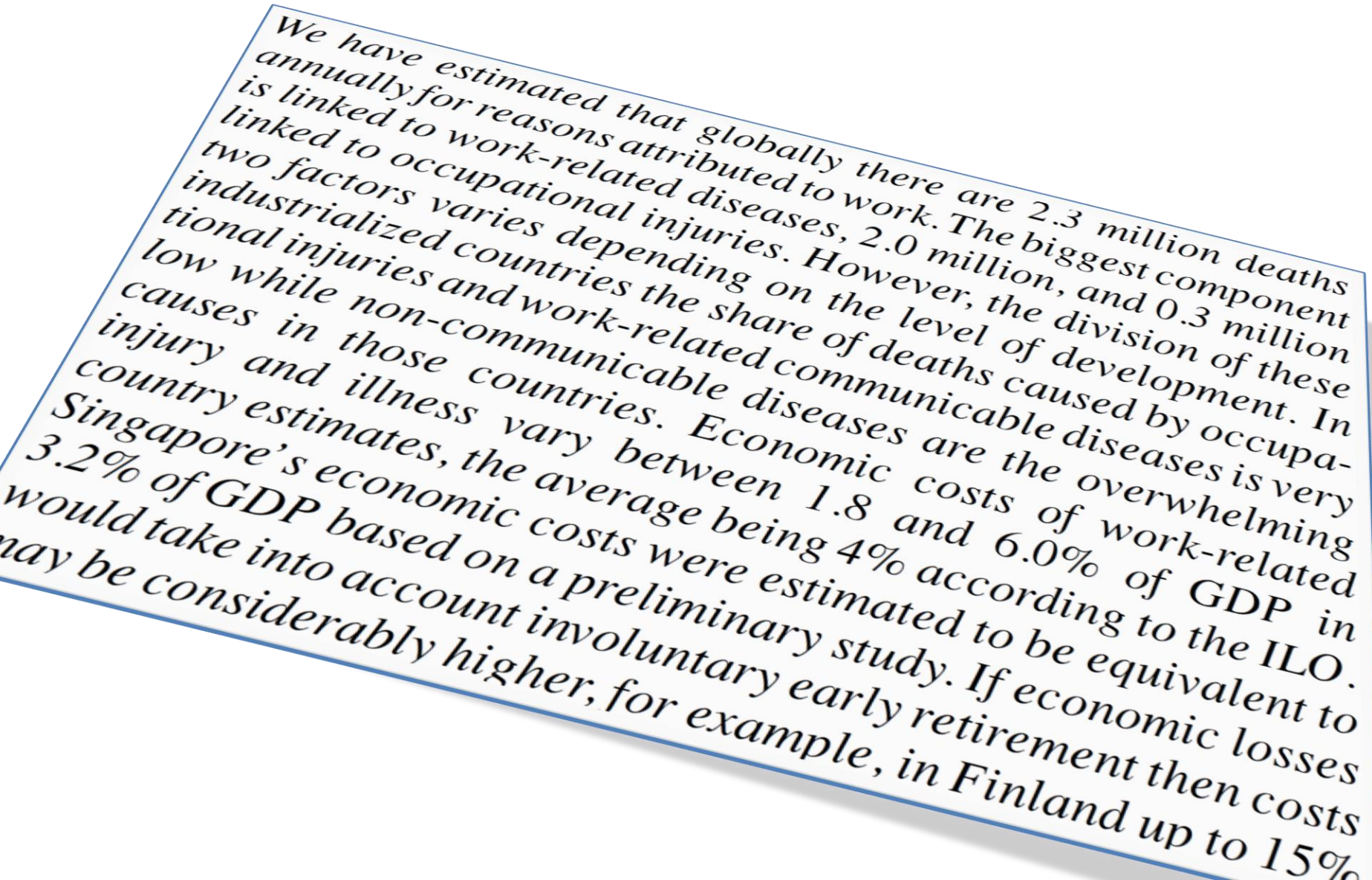
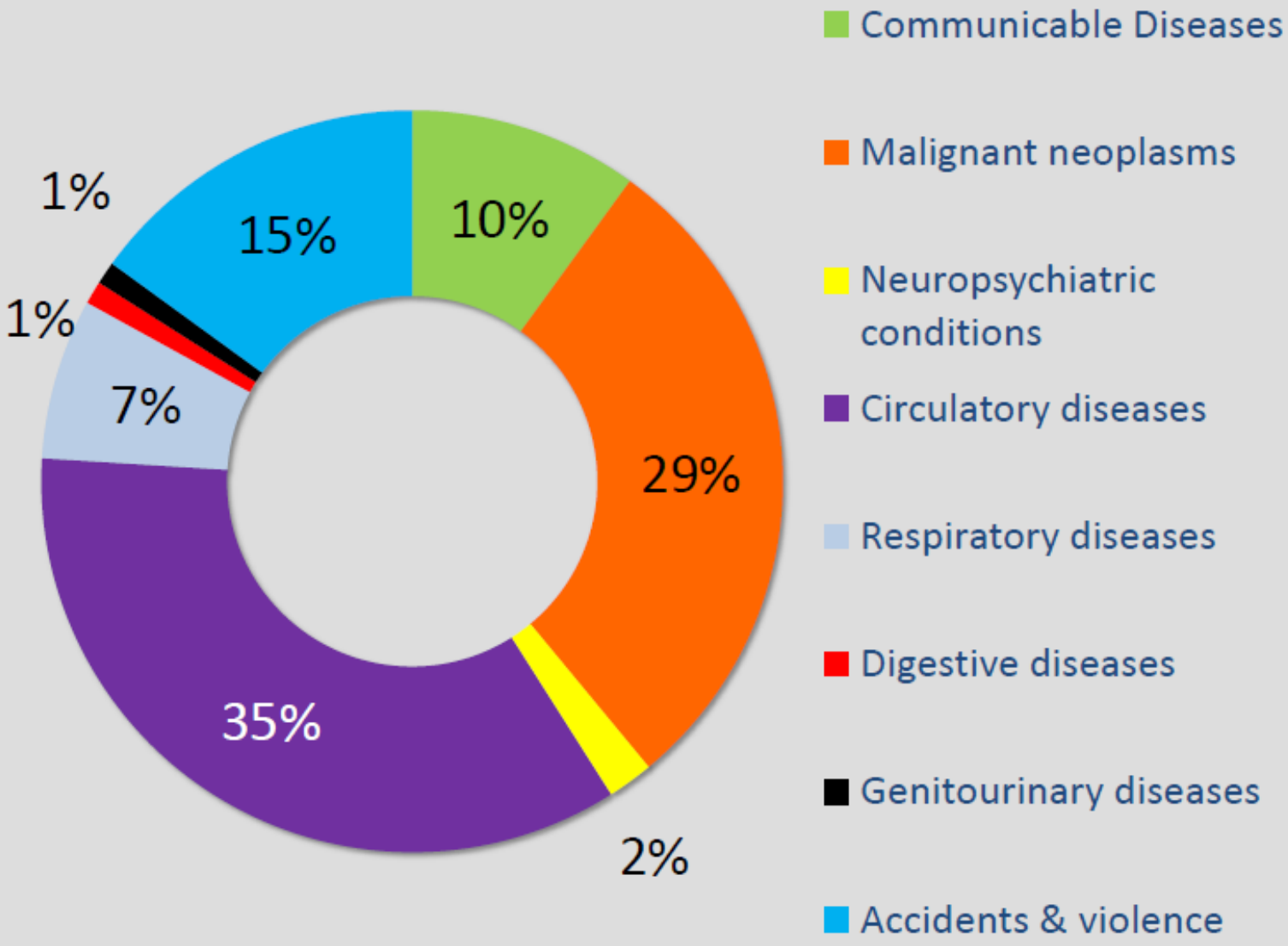
***COSTS*: http://www.wshi.gov.sg/files/Economic%20Cost%20of%20Work-related%20Injuries%20and%20Ill-health%20in%20Singapore.pdf**

***JOEH* http://www.tandfonline.com/doi/pdf/10.1080/15459624.2013.863131**

http://www.wshi.gov.sg/files/Economic%20Cost%20of%20Work-related%20Injuries%20and%20Ill-health%20in%20Singapore.pdf

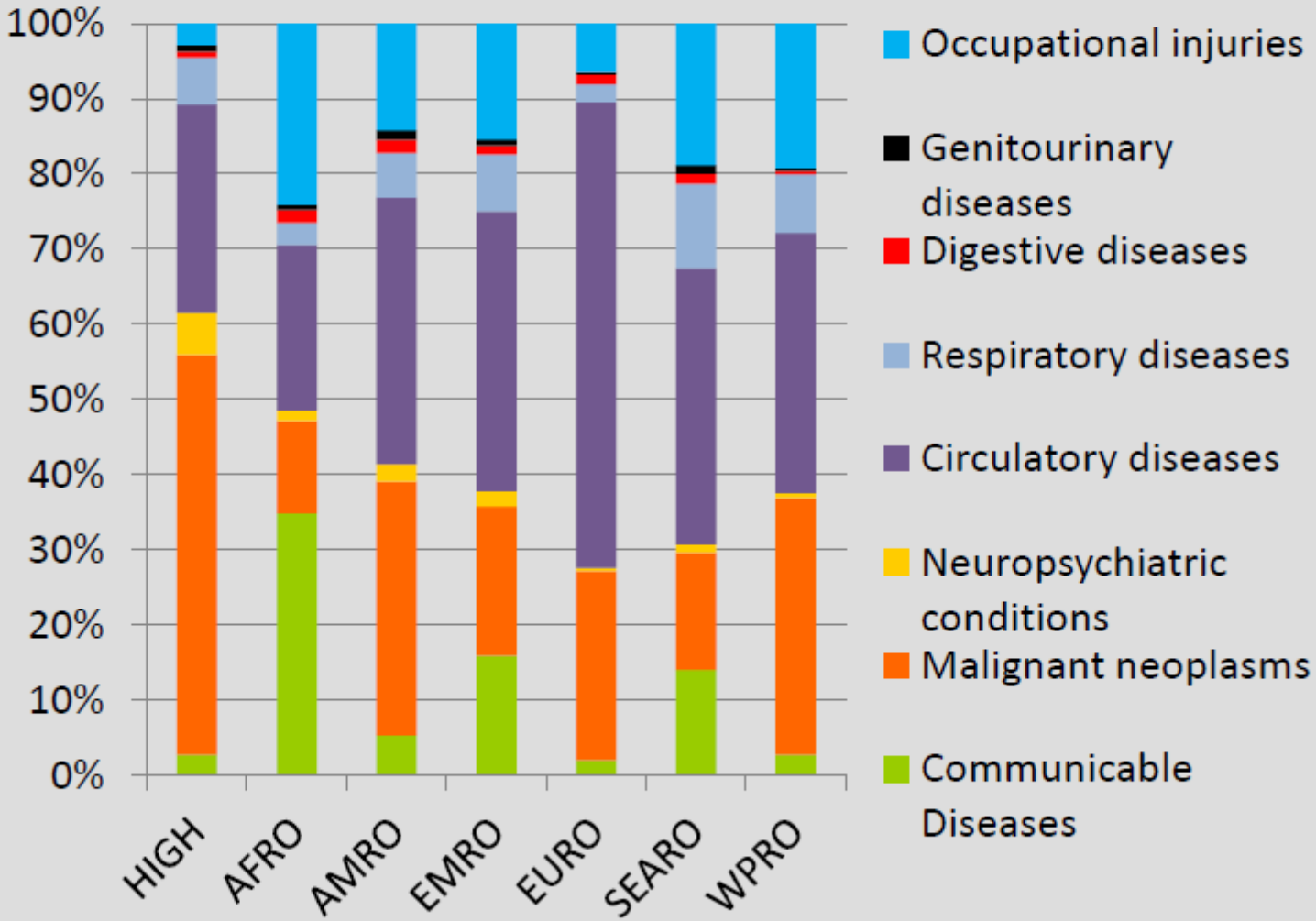


% Work-related mortality

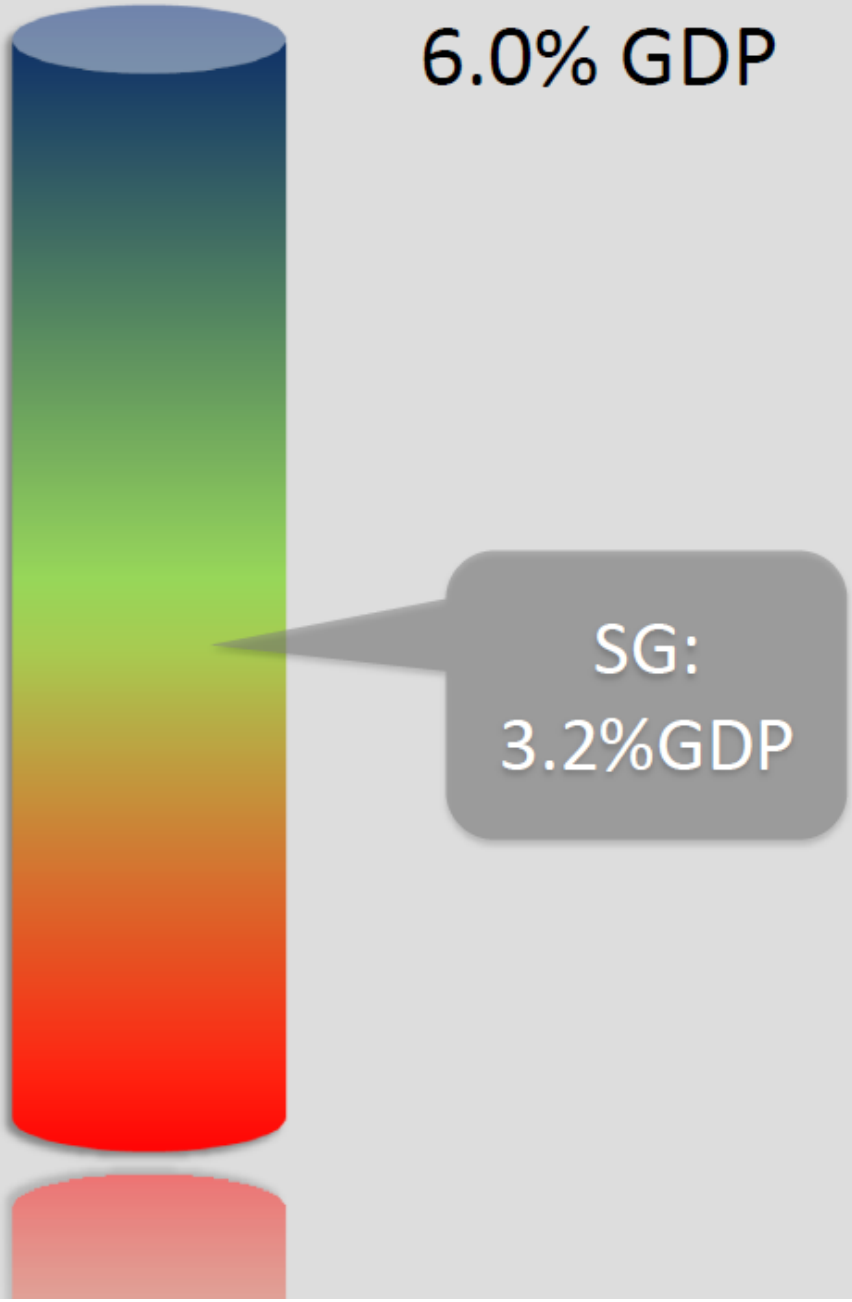


Industrialised countries had a higher burden from cancers, at 53% and a much smaller attribution from accidents and infectious conditions each at 3%.

Distribution of Work-related illness by WHO regions



Economic costs of work-related injury and illness vary between 1.8 – 6 % of GDP in country estimates, averaged at 4 %. Singapore economic costs were estimated to be equivalent to 3.2% of GDP.



European Estimates of Work-related Injury and Ill-health

based on the Global Methodology prepared for the International Labour Organization

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Dr. J. Takala
Adjunct Professor, Senior Consultant to Ministry of Manpower,
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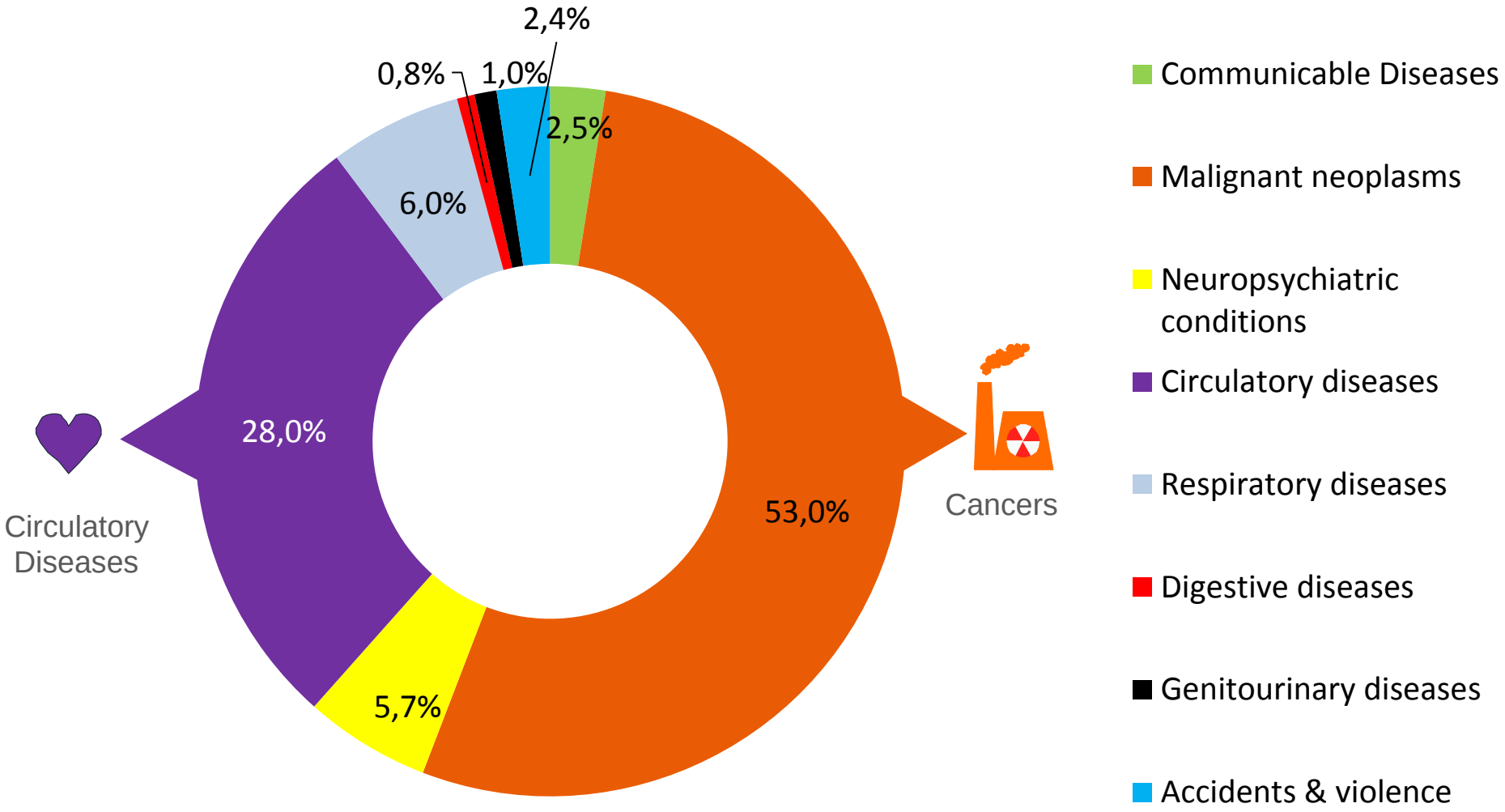
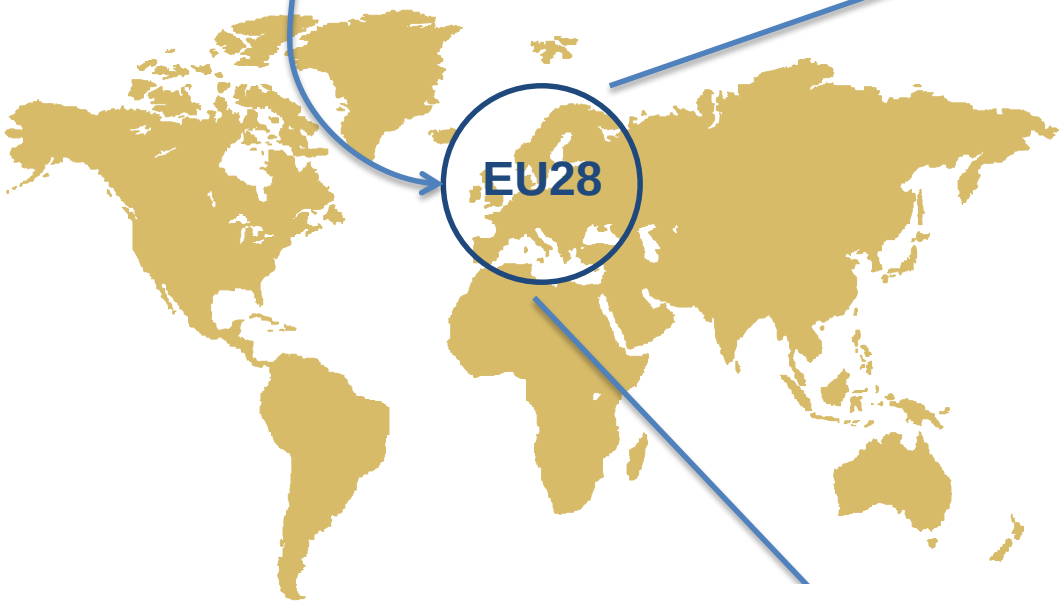
% Work-related Deaths caused by Illness in EU28



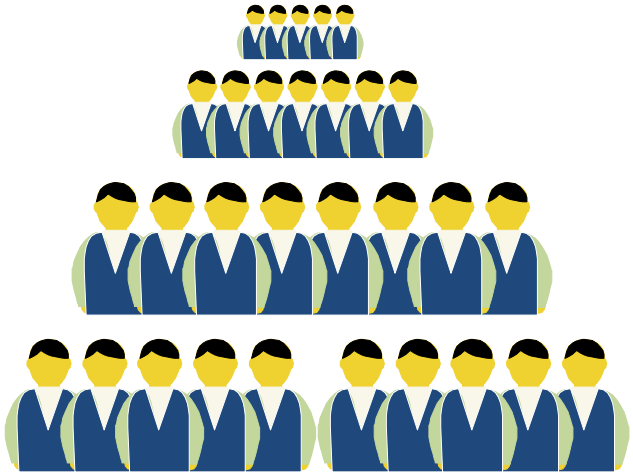
In EU28, cardiovascular and circulatory diseases accounts for 28% and cancers at 53%. They were the top illnesses responsible for 4/5 of deaths from work-related diseases. Occupational injuries and infectious diseases together amount accounts for less than 5%.

Globally, 2.3 Million Deaths caused by Work

192,200 Work-related Deaths



4,700 Fatal Accidents



187,500 Fatal Work-related Illness

There were 192,200 work-related deaths in the EU28, from years 2010 and 2011.

2.4% (or 4,692 deaths) were caused by workplace accidents. The reminder, 97.6% were due to illness that were work-related.

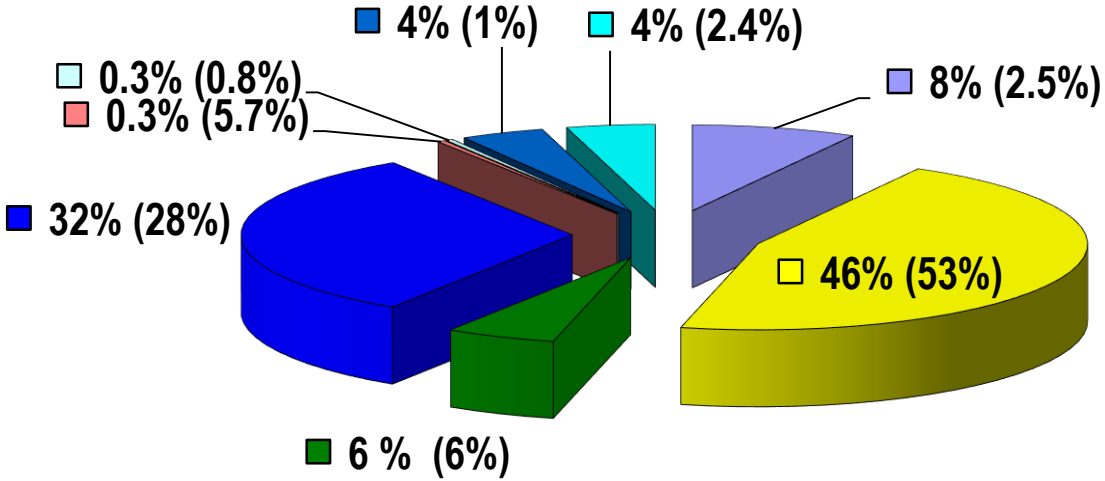
 = 100 workers

 = 1,000 workers

 = 10,000 workers

Work-related Annual Deaths –
Singapore and EU distribution of fatal injuries and illnesses, EU in brackets

Deaths attributed to work, Singapore (Resid.) 834, EU: 192,000 (new!)

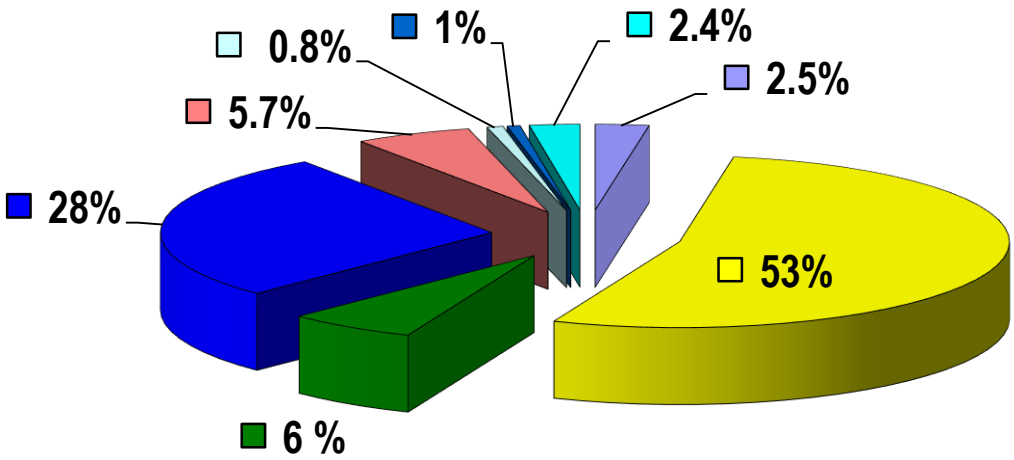


- Communicable diseases
- Cancers
- Respiratory Diseases
- Circulatory diseases
- Mental Disorders
- Digestive systems diseases
- Genitourinary system
- Accidents and violence

Sources: WSH Institute Singapore 2014, Hämäläinen P, Takala J, Saarela KL; TUT, ILO, WHO, EU-OSHA, WSH Institute Singapore, JOEH May 2014, ref. data: MOH/MOM and WHO A region

Work-related Annual Deaths –
EU distribution of fatal injuries and illnesses,

Deaths attributed to work, EU: 192,000 (new : June 2014!)



- Communicable diseases
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Sources: WSH Institute Singapore 2014, Hämäläinen P, Takala J, Saarela KL; TUT, ILO, WHO, EU-OSHA, WSH Institute Singapore, JOEH May 2014, ref. data: MOH/MOM and WHO A region

Costs:

1. Magnitude of problems, injuries and diseases
2. How many days or years lost
3. Price of lost years
4. Other costs

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Option 1

Economic Models to Estimate Work-related Injuries and Ill-Health in US, UK, EU and AU

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US Study

The total cost of occupational injuries and diseases was estimated to be **USD$250 billion (1.8% GDP)** in 2007.[3]

The study looked at:

- incidence of fatal and nonfatal injuries
- nonfatal illnesses and the prevalence of fatal diseases
- both medical and indirect (productivity) costs among US civilians in 2007

[3] *J.Paul Leigh. Economic Burden of Occupational Injury and Illness in the United States. The Milbank Quarterly, Vol. 89, No. 4, 2011 (pp. 728–772)*

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Australian study

The cost of work-related injury and disease to workers, employers and community was estimated to be **A$60.6 billion (4.8% GDP)** for the 2008-2009 FY.[4]

The study is a revised estimation of the total economic cost of work related injury to the Australian economy for the 2008–09 reference year, based on their Work Related Injuries Survey (WRIS) data for FY09-10.

[4] *Australian Safety and Compensation Council. The Costs of Work-related Injury and Illness for Australian Employers, Workers and the community: 2008-09. March 2012*

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Comparison of US, UK, EU and AU models

Factors	US	UK-HSE	EU-OSHA	Australia
Methodology	- Cost-of-illness estimates - Incidence method - Prevalence method	Costs to Britain model ('the cost model')	Literature review and Member State survey	- Incidence approach - Lifetime cost approach - 'ex post' approach

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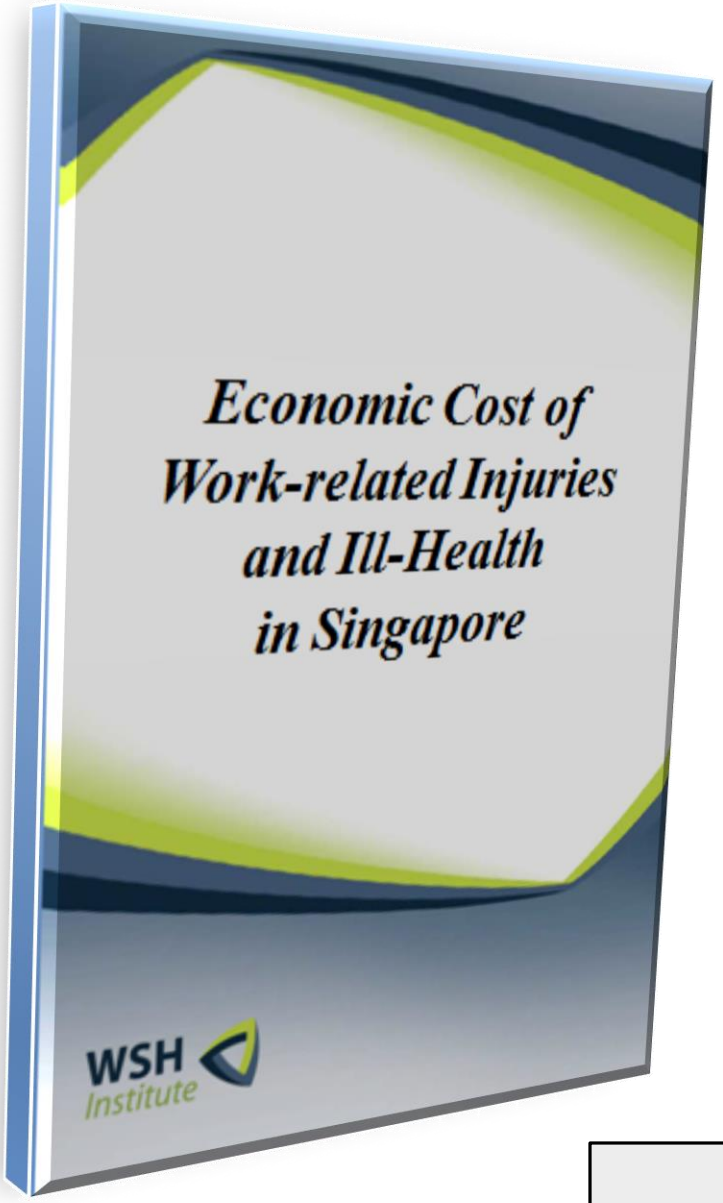
http://www.wshi.gov.sg/files/Economic%20Cost%20of%20Work-related%20Injuries%20and%20Ill-health%20in%20Singapore.pdf



Our study

- Objective
- Our approach
- Our economic model
- Costs borne by economic agents
- Expected outcomes

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Objective

To develop an appropriate model to estimate the economic costs of work-related injuries and ill health for various groups of stakeholders in Singapore for 2011.

Expected outcomes

- Estimation of economic costs of work-related injuries and ill health for workers, employers and community
- Better understanding of the primary and secondary factors contributing to economic costs of work-related injuries and ill-health
- Establishment of appropriate data sources for each factor
- Deeper understanding of the relationships among various factors, including different work-related injury and disease severity
- Evidence for prioritising appropriate solutions to improve productivity and WSH performance

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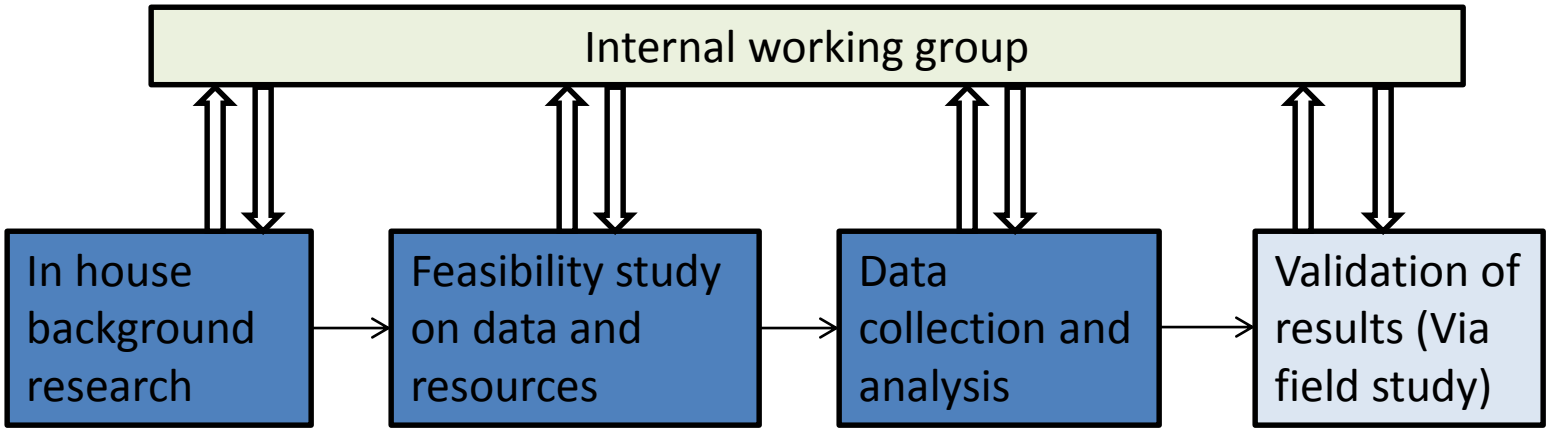
Our approach



- Internal working group in MOM consists of the following:
  (i) Economic unit (Dr Shandre), (ii) Finance Dept, (iii) MRSD, (iv) WICD, (v) PICS (Data management unit), (vi) Specs and (vii) WPSD

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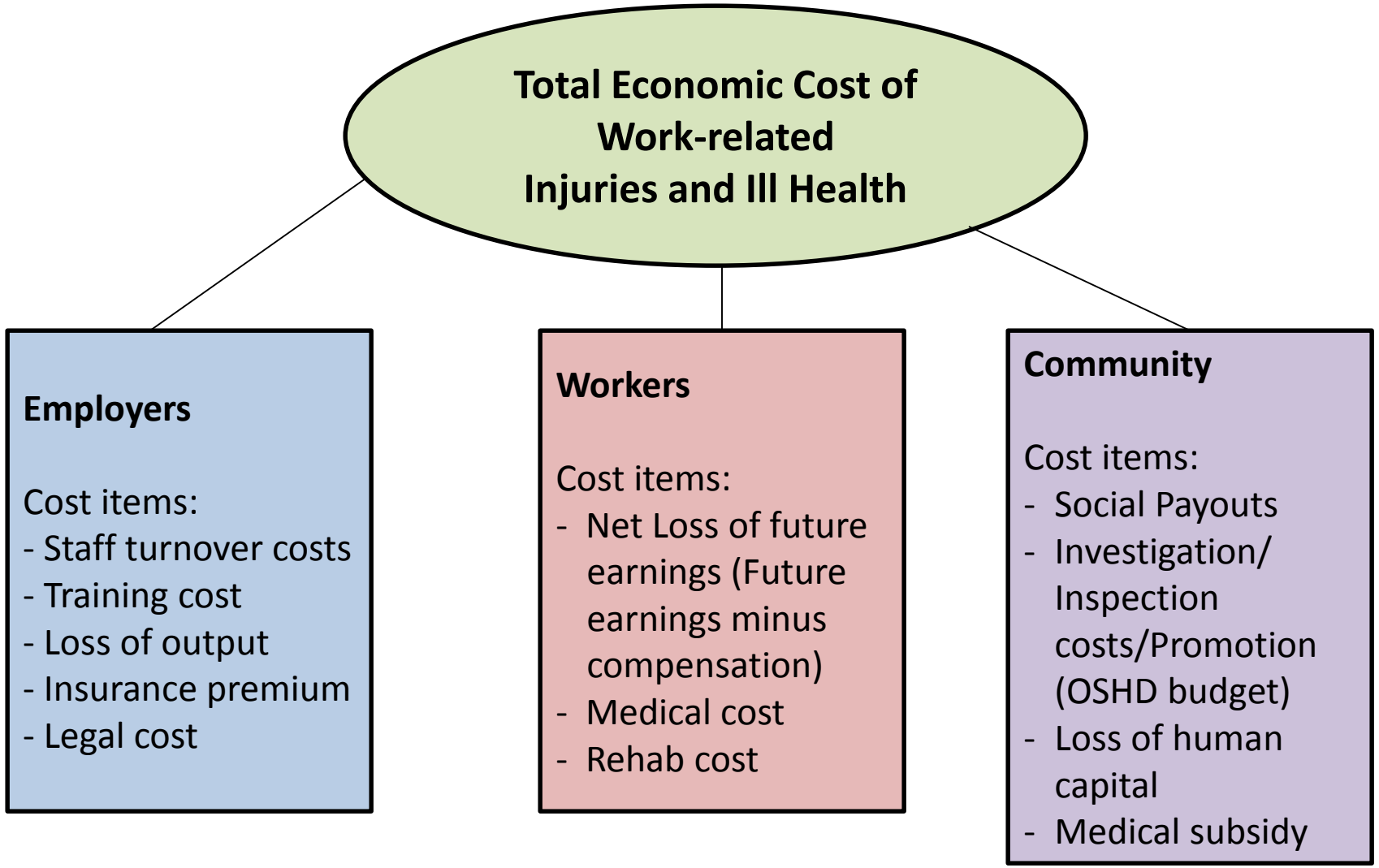
Our economic model



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Assumptions and considerations:

- Based on the findings of the OSH ad hoc survey in 2008[5], it was stated that **1.5%**; **95% CI, 1.1%,1.9%** of employed residents claimed to have work injury **6.9%; 95% CI, 6.1%, 7.7%** of employed persons suffered ill-health.

	Injuries		Ill health	
	No. of resident workers	No. of foreign workers	No. of resident workers	No. of foreign workers
	33,683	22,920	159,490	64,799
Total	56,603		219,739	

5 'Findings of Ad-hoc Survey on Occupational Safety and Health' is an internal report conducted by Manpower Research and Statistics Department (MRSD), Ministry of Manpower (MOM). This survey was conducted in 2008 on 4,869 economically active residents *to find out the number of persons who suffered work-related injuries and health problems at or during the course of work based on self reporting. The number of foreign workers were estimated using the ratio of injured local vs foreign workers from WIC data.*

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Assumptions and considerations:

- The salary data source for both injuries and ill health:

  > Resident workers- OSH ad hoc survey 2008 (adjusted to 2011).

  > Foreign workers- estimated based on the average salary ratio from WIC data .

	Injuries		Ill health	
Salary (per month)S$	Resident worker	Foreign worker	Resident worker	Foreign worker
	2540.21	1612.15	4351.44	2761.64

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Estimation of No. of fatal work-related diseases using ILO Attributable fraction (AF) method[6]

Fatal work related diseases, all	Permanent Residents and Citizens
1360	946

Fatal work related diseases, all Men	Perm Res. Men	Men	Fatal work related diseases all, Women	Perm Res. Women	Women
9	6	Communicable diseases	18	12	Communicable diseases
550	383	Malignant neoplasms	44	31	Malignant neoplasms
17	12	Neuropsychiatric conditions	5	3	Neuropsychiatric conditions
469	326	Circulatory diseases	182	127	Circulatory diseases
49	34	Respiratory diseases	4	3	Respiratory diseases
4	3	Digestive diseases	1	0	Digestive diseases
8	6	Genitourinary diseases	1	1	Genitourinary diseases
1106	769	Total	254	177	Total

6 *Fatal work related diseases were estimated based on year 2008 resident labour force published by Ministry Of Manpower (MOM) and the cause-specific mortality 2008 data for Western Pacific Region (WPR) A published by World Health Organization (WHO). The ratio of Singapore (men and women) to WPR A (men and women) was taken. AF from ILO was used to compute the number of fatal work related diseases (AF * Deaths) respectively*

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Table 1: Distribution of Employed Residents with Work-Related Injuries by Total Medical Leave Given, 2008

	Mean (days)	Median (days)	Proportion (%)							
			Total	0 day	1 day	2 days	3 days	4 days	5 days	6 days
Injured Employed Residents	13.2 (17.5)	3.0 (5.0)	100	24.6	7.7	15.4	10.8	3.1	1.5	-
				7 days	8 days	9 days	10 days	11-20 days	21-30 days	> 30 days
				10.8	1.5	3.1	1.5	7.7	6.2	6.2

Notes:

1. ' – ' : nil or negligible.
2. Distribution may not add up to 100% due to rounding.
3. Figures in brackets are based only on injured residents who were granted medical leave.

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Table 9: Distribution of Employed Residents with Work-Related Health Problems by Total Medical Leave Granted, 2008

	Mean (days)	Median (days)	Proportion (%)							
			Total	0 day	1 day	2 days	3 days	4 days	5 days	6 days
Employed Residents With Work-Related Health Problems	4.5 (6.0) [9.5]	0.0 (2.0) [3.0]	100	53.0	6.3	14.0	4.3	3.3	3.3	1.7
				7 days	8 days	9 days	10 days	11-20 days	21-30 days	> 30 days
				2.3	0.3	0.3	1.3	4.0	4.0	1.7

Note:
1. ' – ' : nil or negligible.
2. Figures in ( ) are based on residents with work-related health problems who sought medical consultation from a doctor.
3. Figures in [ ] are based on residents who were granted medical leave.
4. Distribution may not add up to 100% due to rounding.

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Parts of Model Excel sheet

A	B	C	D	E	F	G	H	I	
No.	Cost Items	Total Value (B)	Injuries				Diseases		
	Employer		Calculations	Local	Calculations	Foreign	Calculations	Local	Calc
1	Salary (Per Month)		$2265+((352/2897)*$2265	$2,540.21	E1*(1381/2176)	$1,612.15	*$3880+((352/2897)*$3880)*	*$4,351.44*	
2	No of persons estimated		2245501*1.5%	33683	1197900*1.5%*1.2756	22920	2245501*6.9%	*154940*	
3	**Non-Fatal Turnover costs (Based on 6 Months)**	**0.28**	(E19+E20)*E1*6	**$47,750,845.71**	(G19+G20)*G1*6	**$20,622,564.03**	(I19+I20)*I1*6	**$168,557,357.38**	
4	Fatalities			37		78		946	
5	**Fatalities Turnover costs (Based on 6 Months)**	**0.03**	E1*E4*6	**$563,926.36**	G1*G4*6	**$754,484.05**	I1*I4*6	**$24,698,770.15**	
6	Training cost			437		437		437	
7	**Non-Fatal Training costs**	**0.01**	(E19+E20)*E6	**$1,369,121.00**	(G19+G20)*G6	**$931,684.00**	(I19+I20)*I6	**$2,821,272.00**	
8	**Fatalies Training costs**	**0.00**	E4*E6	**$16,169.00**	G4*G6	**$34,086.00**	I4*I6	**$413,402.00**	
9	**Insurance Premiums**	**0.24**							
10	**Legal (Fines due to prosecution)**	**0.001**							
11	GDP /employed per Annum		$326832400000/3443401 people	**$94,915.57**	$326832400000/3443401 people	**$94,915.57**	$326832400000/3443401 people	**$94,915.57**	$/3
12	Total Hours worked per employee per Annum		46.2Hrs*52Weeks	2402.4	46.2Hrs*52Weeks	2402.4	46.2Hrs*52Weeks	2402.4	46
13	Cost of 1 Man-days lost per employee		(E11/E12)*8hrs	$316.07	(G11/G12)*8hrs	$316.07	(I11/I12)*8hrs	$316.07	
14	**Loss of output (Based on Man-days lost)**	**1.75**	20days*E13*E2	**$212,923,148.82**	20days*G13*G2	**$144,886,101.92**	20day*I13*I2	**$979,435,106.09**	
	Total Employer Cost	**2.31**							
	Individual								
15	Discount Rate (Savings+productivity rate-Inflation) 2.6%								
16	Salary (Per Annum)		E1*12	$30,482.51	G1*12	$19,345.74	I1*12	*$52,217.27*	
17	PV of loss of Salary for avg of 27 years (Permanent, no RTW (≥1		19.229*E16	$586,132.85	19.229*G16	$371,989.65	19.229*I16	$1,004,059.81	
18	PV of loss of Salary for 27 years (Reduced capacity, (≥10%PI ar		19.229*E16*0.36	$211,007.83	19.229*G16*0.36	$133,916.27	19.229*I16*0.36	$361,461.53	
19	Reduced capacity, (≥10%PI and mc days<180 days)		(1142/12568)*E2	3061	(1142/12568)*G2	2083	(3/72)*I2	6456	
20	Permanent, no RTW (≥10%PI and mc days≥180 days)		(27/12568)*E2	72	(27/12568)*G2	49	(0/72)*I2	0	
21	Total PV of loss of Salary for 27 years (Permanent, no RTW (≥1		E17*E20	$42,201,565.38	G17*G20	$18,227,492.65	I17*I20	$0.00	
22	Total PV of loss of Salary for 27 years (Reduced capacity, (≥10		E19*E18	$645,894,958.21	G19*G18	$278,947,595.64	I19*I18	$2,333,595,646.27	

Economic cost borne by various economic agents

	Cost Items	Item cost (S$ billion)	Total Cost (S$ billion)
Employers	- Staff turnover costs (based on 6 mths)	0.31	**2.31 (22.1%)**
	- Training cost (current)	0.01	
	- Loss of output (current)	1.75	
	- Insurance premium (current)	0.24	
	- Legal cost (current)	0.001	
Workers	- Net Loss of future earnings (Future earnings minus compensation) (Lifetime)	5.23	**5.28(50.5%)**
	- Medical cost (current)	0.05	
	- Rehab cost(current)	0.0015	
Community	- Social Payouts (current)	0.014	**2.87 (27.4%)**
	- Investigation/ Inspection costs (OSHD budget)/promotion (current)	0.014	
	- Fatal loss of human capital (Lifetime)	2.80	
	- Medical subsidy(current)	0.04	
Total	**S$10.45 billion (3.2%GDP loss)**		

** There is no double counting for each of the cost items category.*

Example of cost items for injuries and ill health

	Cost Items	Cost of Injury	Cost of ill health
Employers	- Staff turnover costs	0.05	0.16
	- Training cost	0.0024	0.0046
	- Loss of output	0.36	1.39
	- Insurance premium	0.24	
	- Legal cost	0.001	
Workers	- Net Loss of future earnings (Future earnings minus compensation)	1.1	4.26
	- Medical cost	0.02	0.03
	- Rehab cost	0.001	-
Community	- Social Payouts	0.014	
	- Investigation/ Inspection costs/ promotion (OSHD budget)	0.014	
	- Fatal loss of human capital	0.2	2.6
	- Medical subsidy	0.013	0.027

Discussion

- There are many rough edges to this 1st economic model and more refinements to the individual cost items and subsequent models would need to have a more realistic distribution for the respective economic agents. For eg. property damage.

- One consideration would be to quantify the cost of pain and suffering as an indirect cost component. Indirect costs are more difficult to identify and generally do not include estimates of pain and suffering.[7]

[7] *Lynne Pezzulo and Anthony Crook. The economic and social costs of occupational disease and injury in New Zealand. NOHSAC Technical Report 4. 2006*

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After study: Recommendations and way forward

- 3.2% GDP (S$10.41 billion) is lost due to work injuries and ill health. The costs borne by different economic agents are as follows:
  - employer is S$2.21 billion (21%);
  - individual is S$5.34 billion (51%)
  - community is S$2.87 billion (28%).

- This could be avoided if industries are motivated to invest in programmes promoting WSH. With the establishment of the importance of economic cost of work injures and ill health, business productivity will be enhanced.

- Need for equitable sharing of cost by employers, workers and community.

- Need to prioritise on preventing work related ill health.

- To conduct regular national surveys to collect data on burden and cost of work injuries and ill health.

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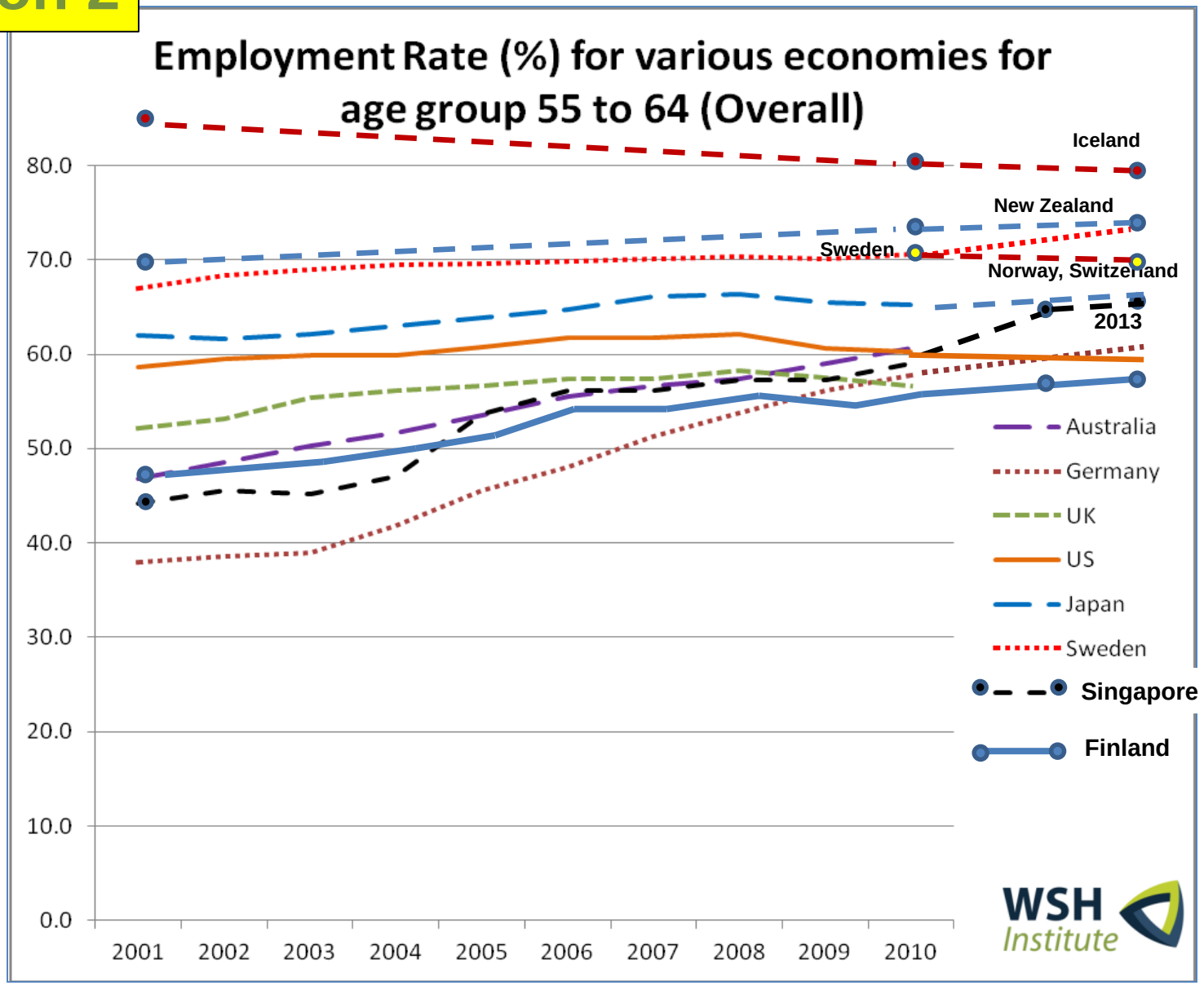
Option 2



Source: OECD, Statistics Finland, WSH-Institute Singapore

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Price of premature retirement and early exclusion from employment

	Finland 2012	Singapore 2012
69,070/ **47,160** (1) retirements/year	Average retirement age 60.9yrs, loss of 4.1 yrs/person	Average exit age 61.2 yrs, loss of 3.8 yrs/ person (3)
Proxy 1: Annual median income **53,250** SGD / **41,760** SGD	15.1 billion	7.5 billion
Proxy 2: Annual cost to employer **80,590** / **50,112** SGD (2)	22.8 billion	9.0 billion
Proxy 3: GDP/employed **117,600** / **105,524** SGD	**33.3 billion**	**18.9 billion**

Statistics, Finland: Pensions 2012, Salaries 2012,
Population of Finland: 5.2 million, Singapore: 5.18 million (2011)

(1) Estimate based on number of employed Singapore Residents aged 45 and above, Labour Force Report 2012

(2) Including worker compensation, pension, medical, soc.security expenses etc. paid by employers, Singapore estimate 120% of annual median gross salary (incl employer CPF)

(3) Estimate based on number of economically inactive Singapore Residents not working due to retirement, Labour Force Report 2012

Costs of accidents and diseases, 4.8% of GDP: Finland 12.8 billion USD, (based on latest Australian research on costs of poor work environment), **Singapore 10.5 billion SGD, www.wshi.gov.sg**
http://www.safeworkaustralia.gov.au/sites/swa/AboutSafeWorkAustralia/WhatWeDo/Publications/Pages/cost-injury-illness-2008-09.aspx

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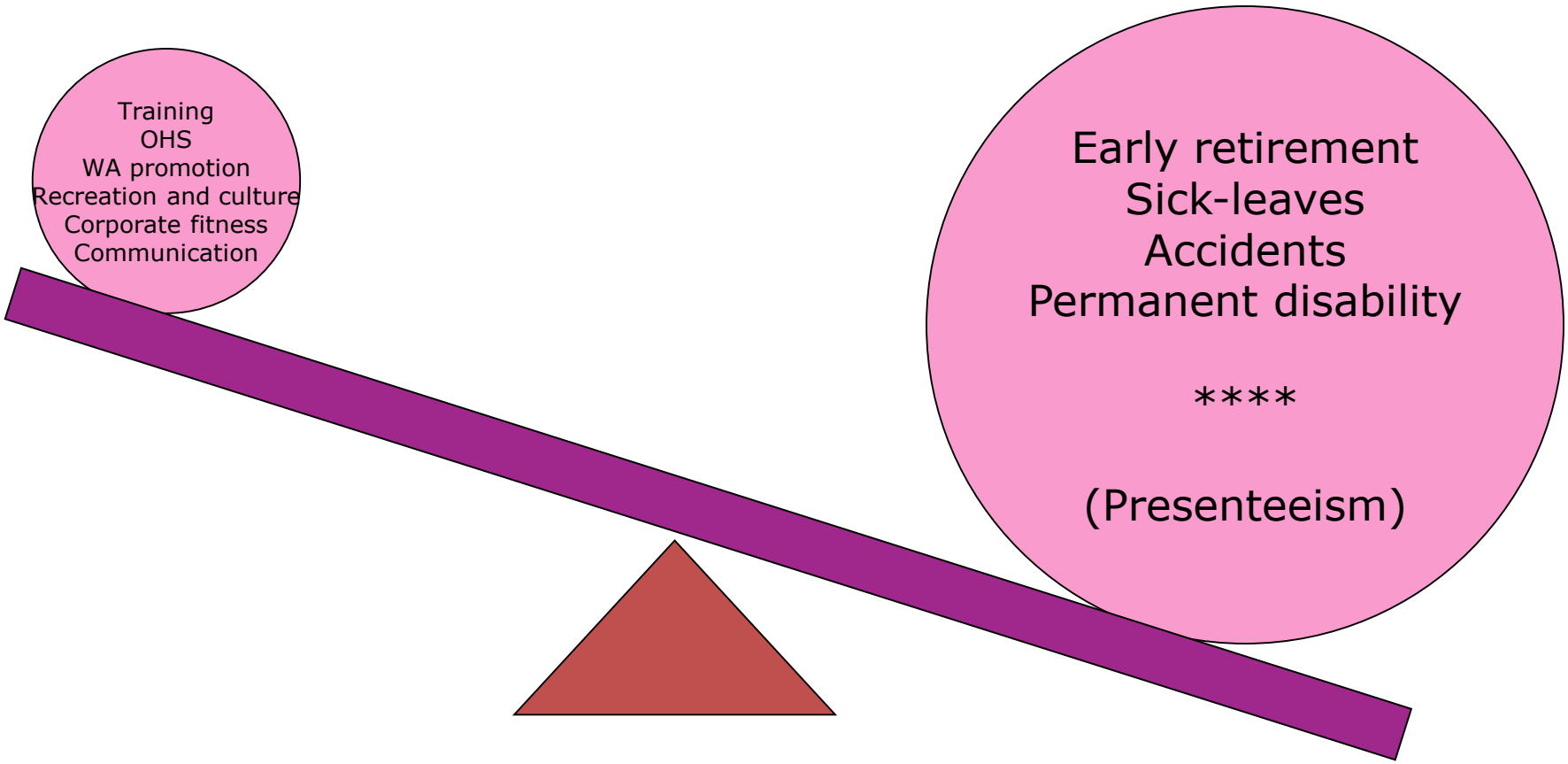
The "Balance of Horror"

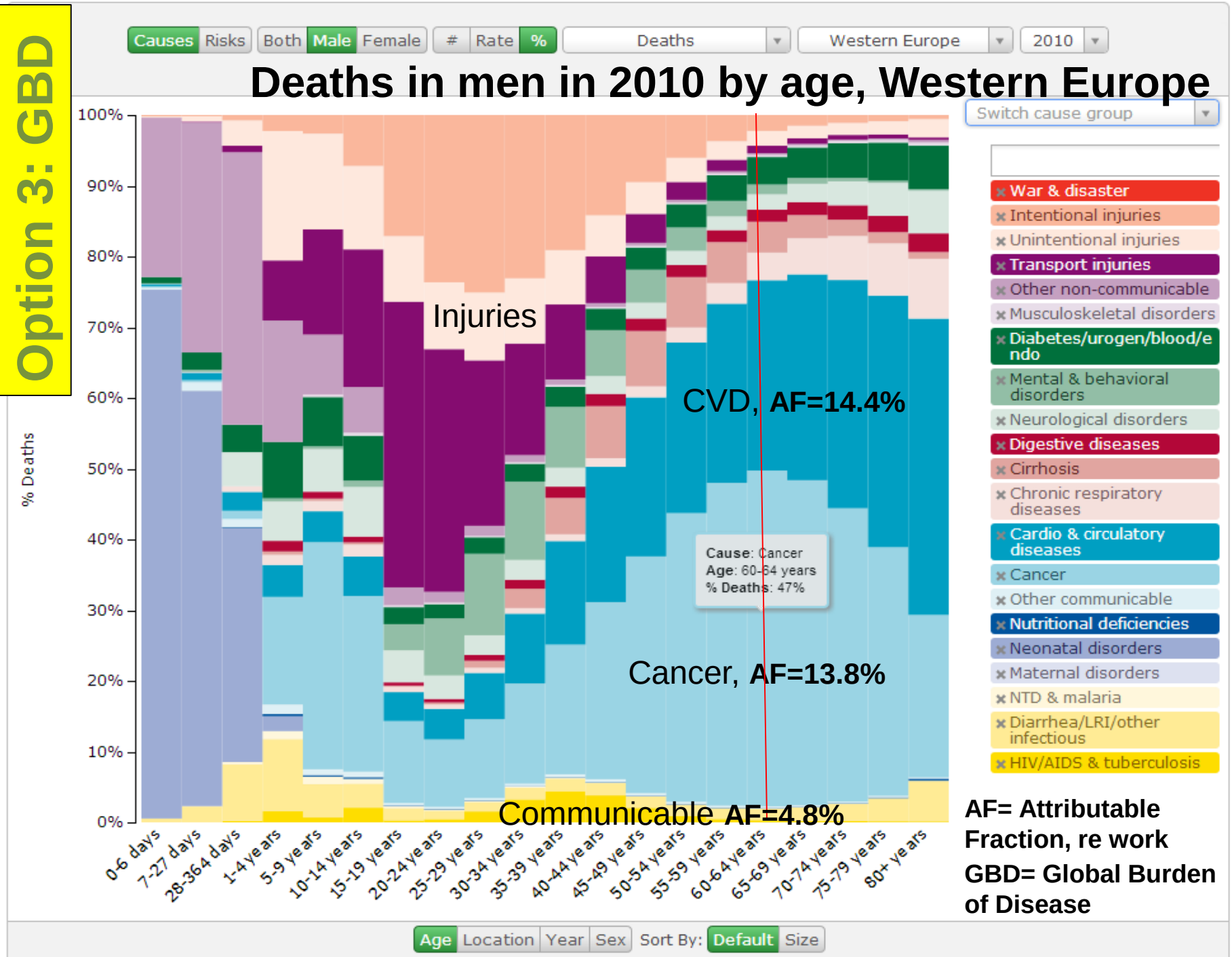
EU:	**200 bill. € / year**
Finland:	**2 billion € /y**
Singapore:	**?**

EU:	**3000 bill. € /year**
Finland:	**30 bill. € /y**
Singapore:	**?**



Source: Prof. G.Ahonen, adaptation Dr. J.Takala

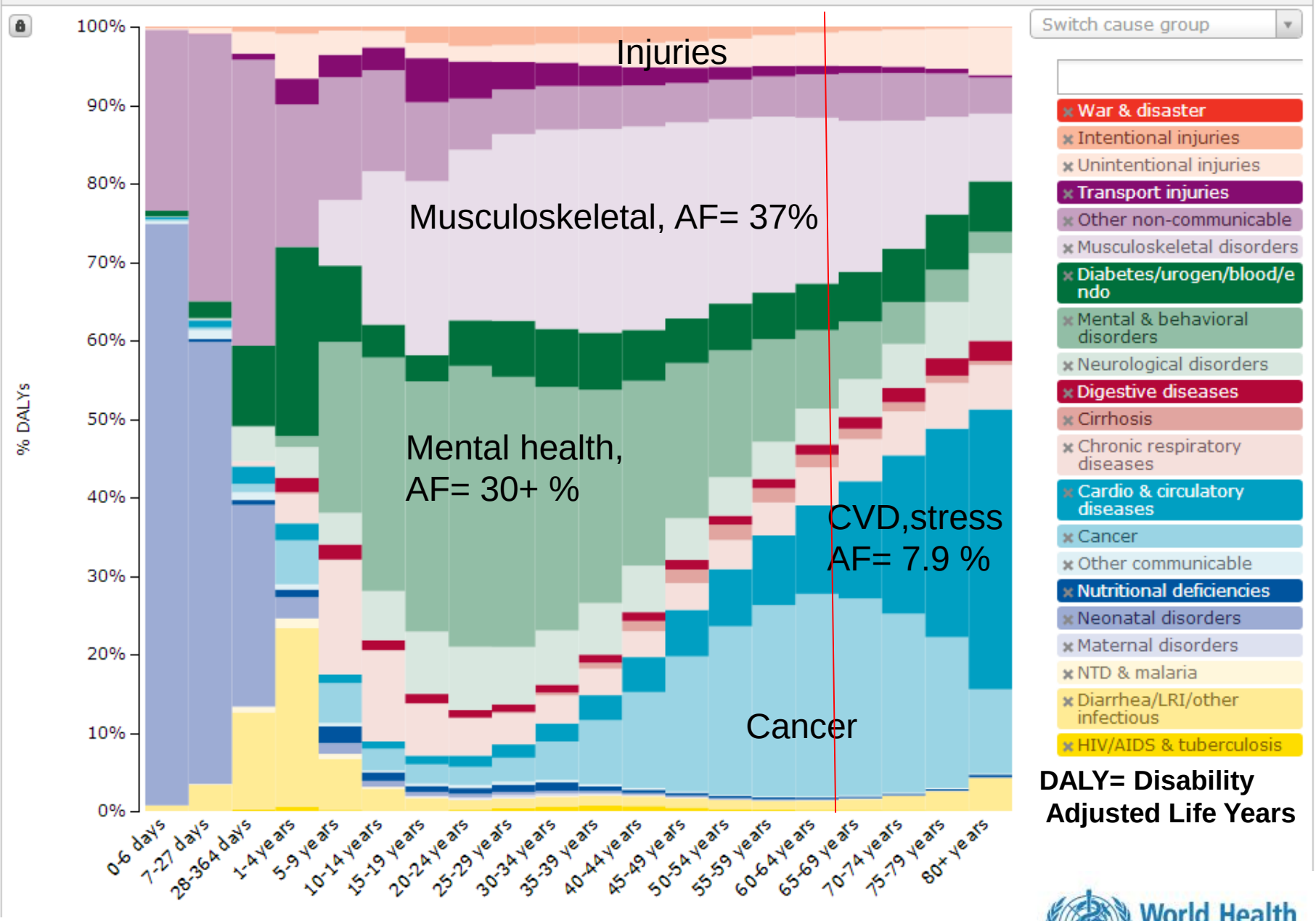
Option 3: GBD



AF= Attributable Fraction, re work

GBD= Global Burden of Disease

DALYs in women in 2010 by age, Western Europe



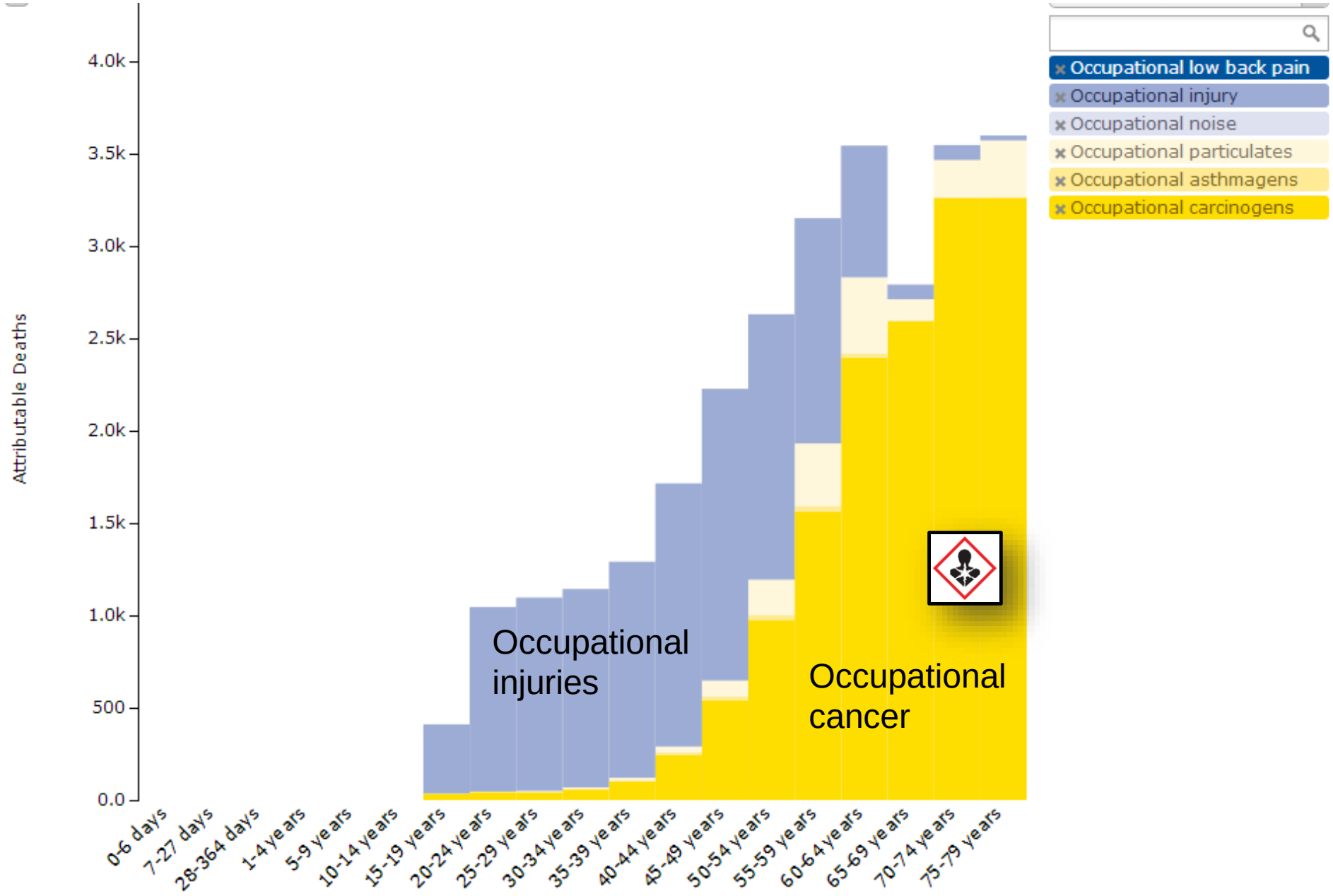
DALY= Disability Adjusted Life Years

http://www.healthmetricsandevaluation.org/gbd/visualizations/regional

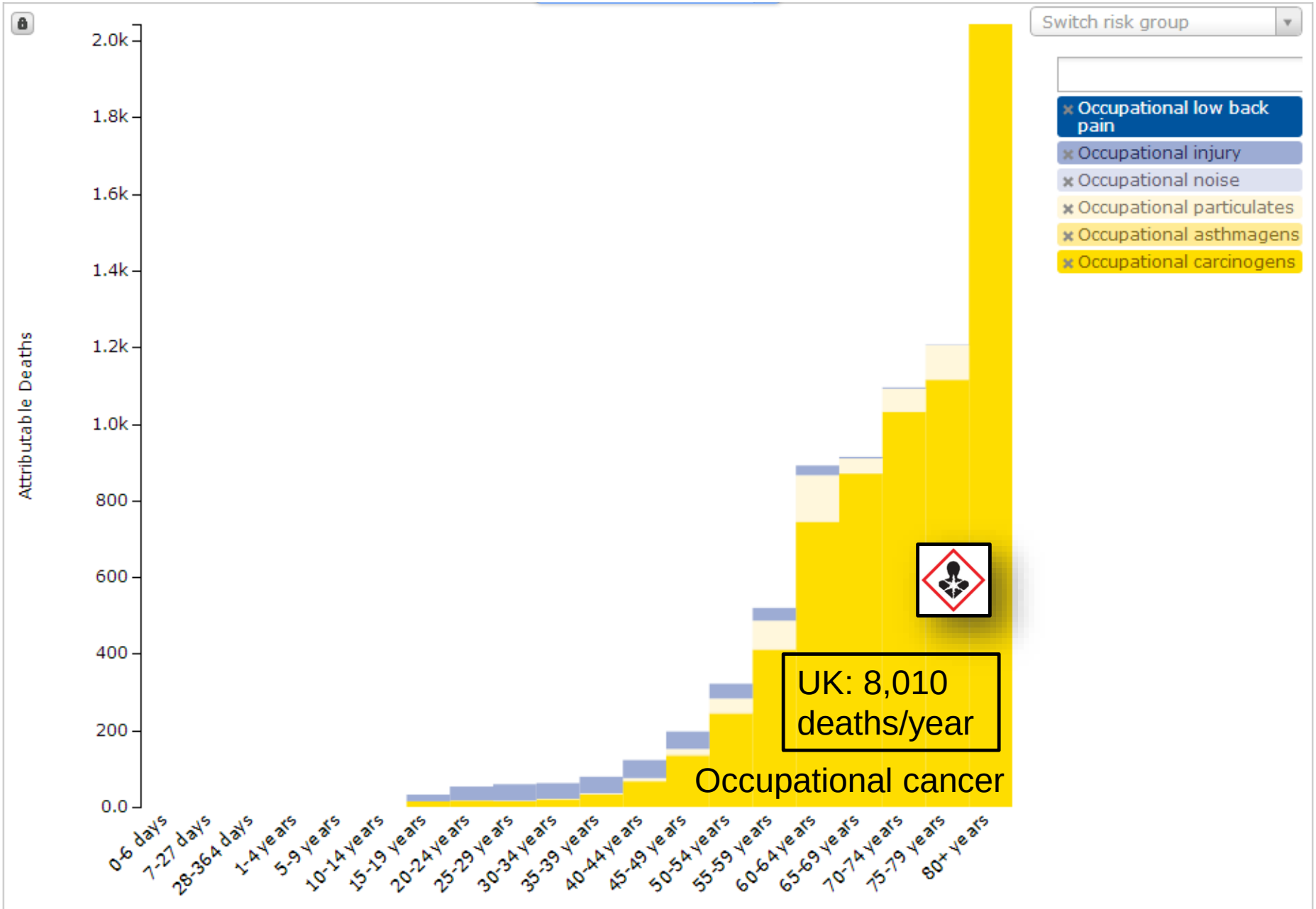
World Health Organization

Causes | Risks | Both | Male | Female | # | Rate | % | Deaths | Western Europe | 2010

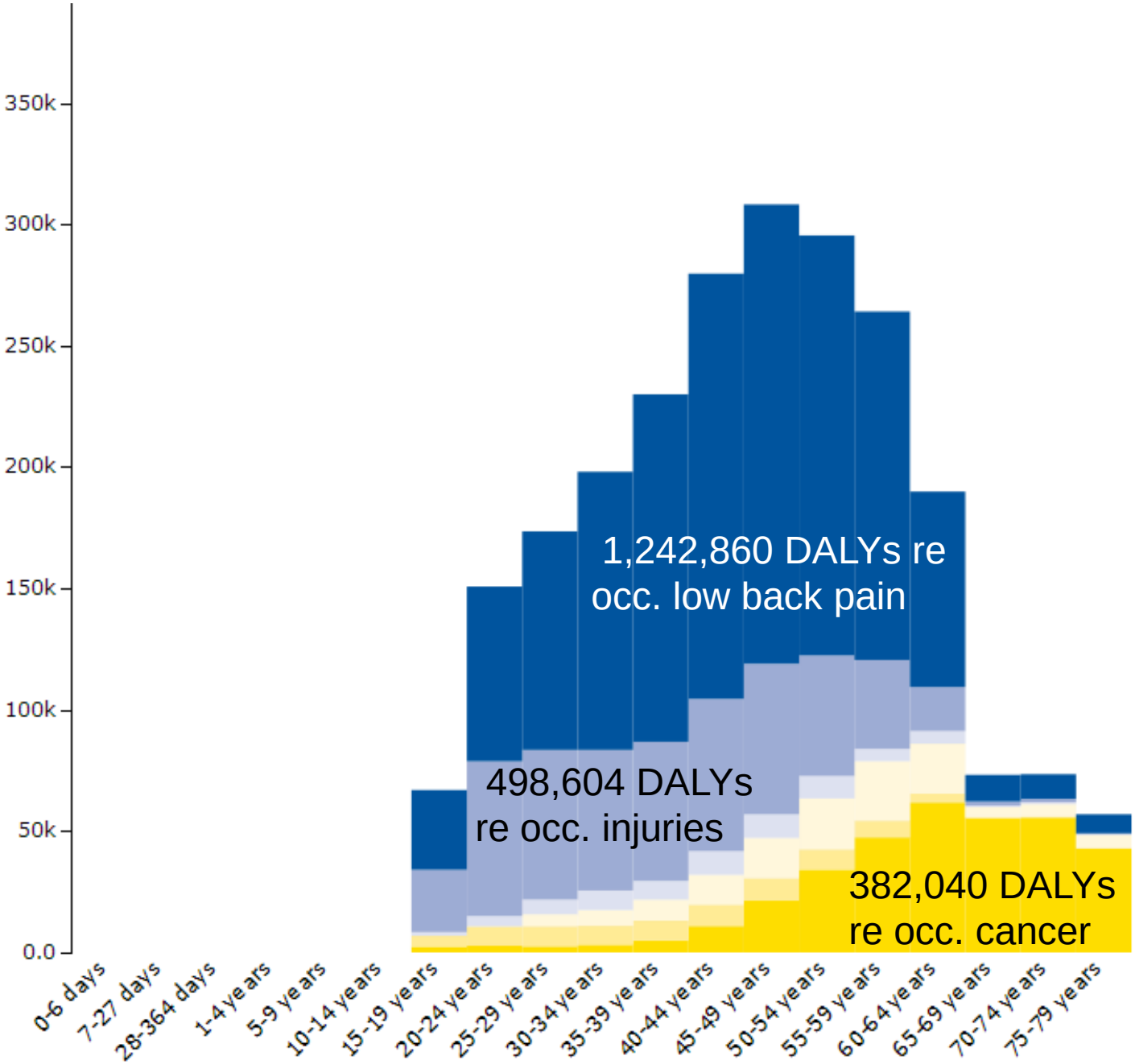
Deaths, Western Europe, selected causes by GBD



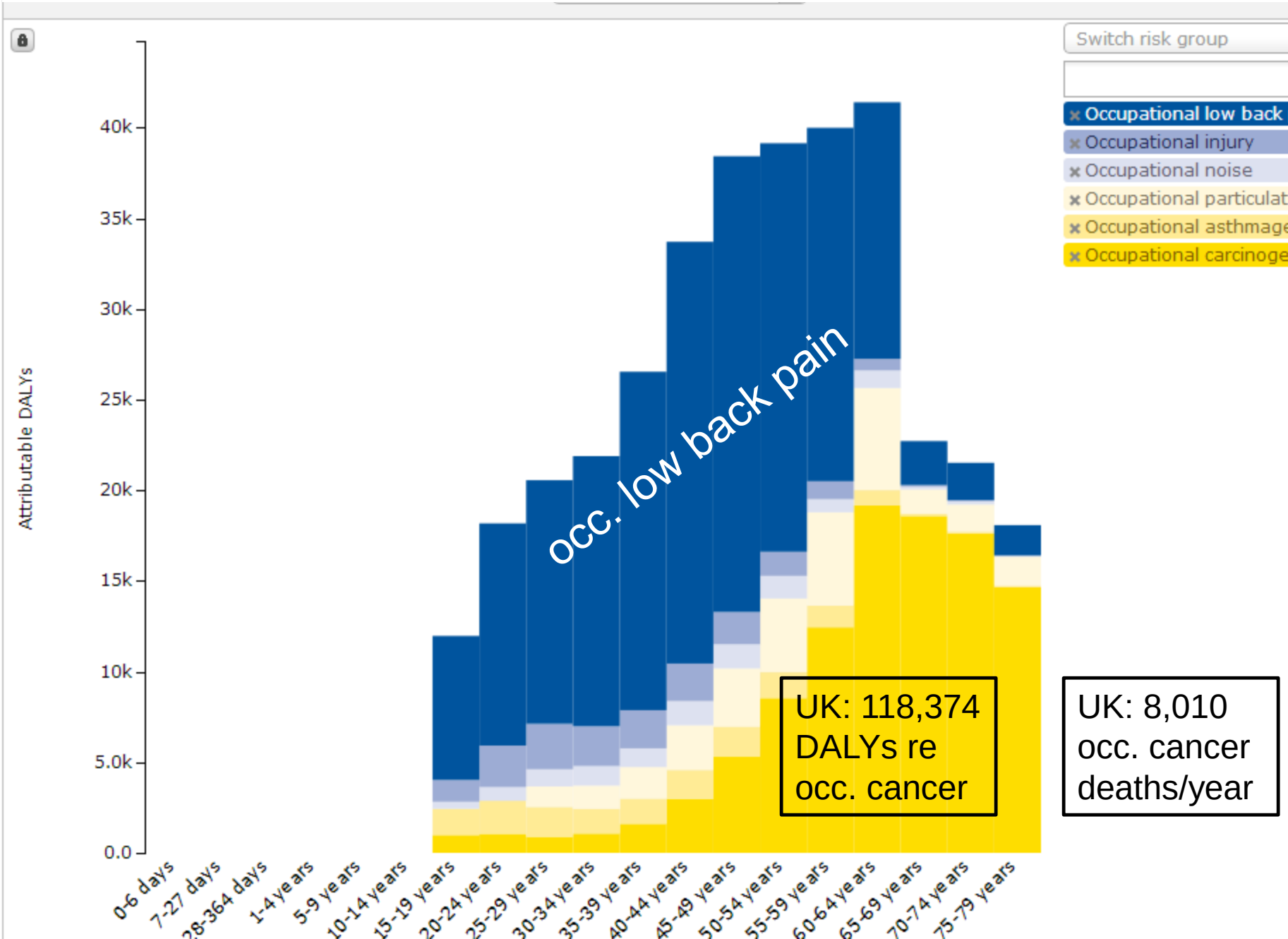
Deaths U.K. Selected causes by GBD



DALYs, Western Europe, selected causes by GBD



DALYs, U.K. selected causes by GBD



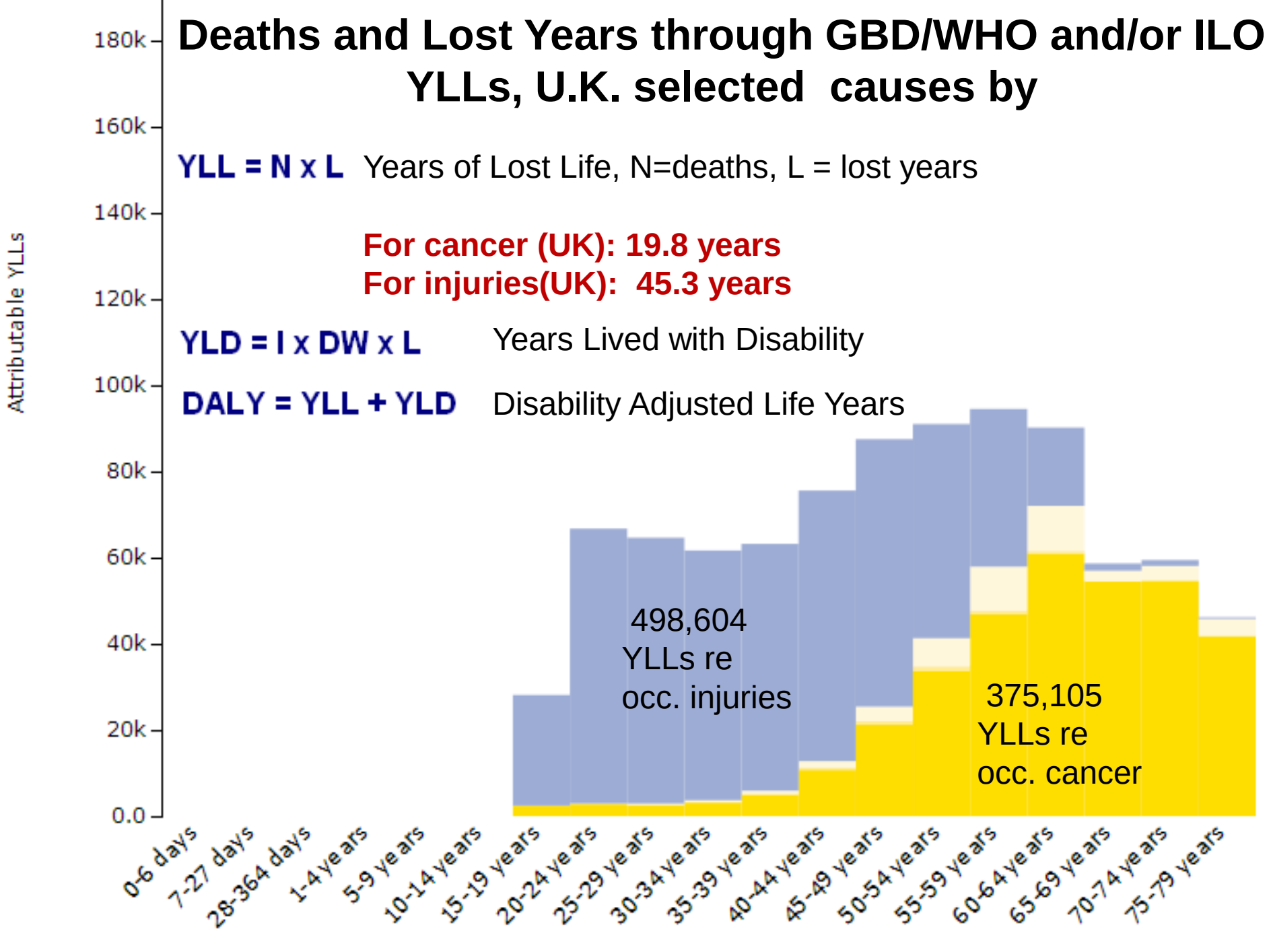
Deaths and Lost Years through GBD/WHO and/or ILO
YLLs, U.K. selected causes by

YLL = N x L Years of Lost Life, N=deaths, L = lost years

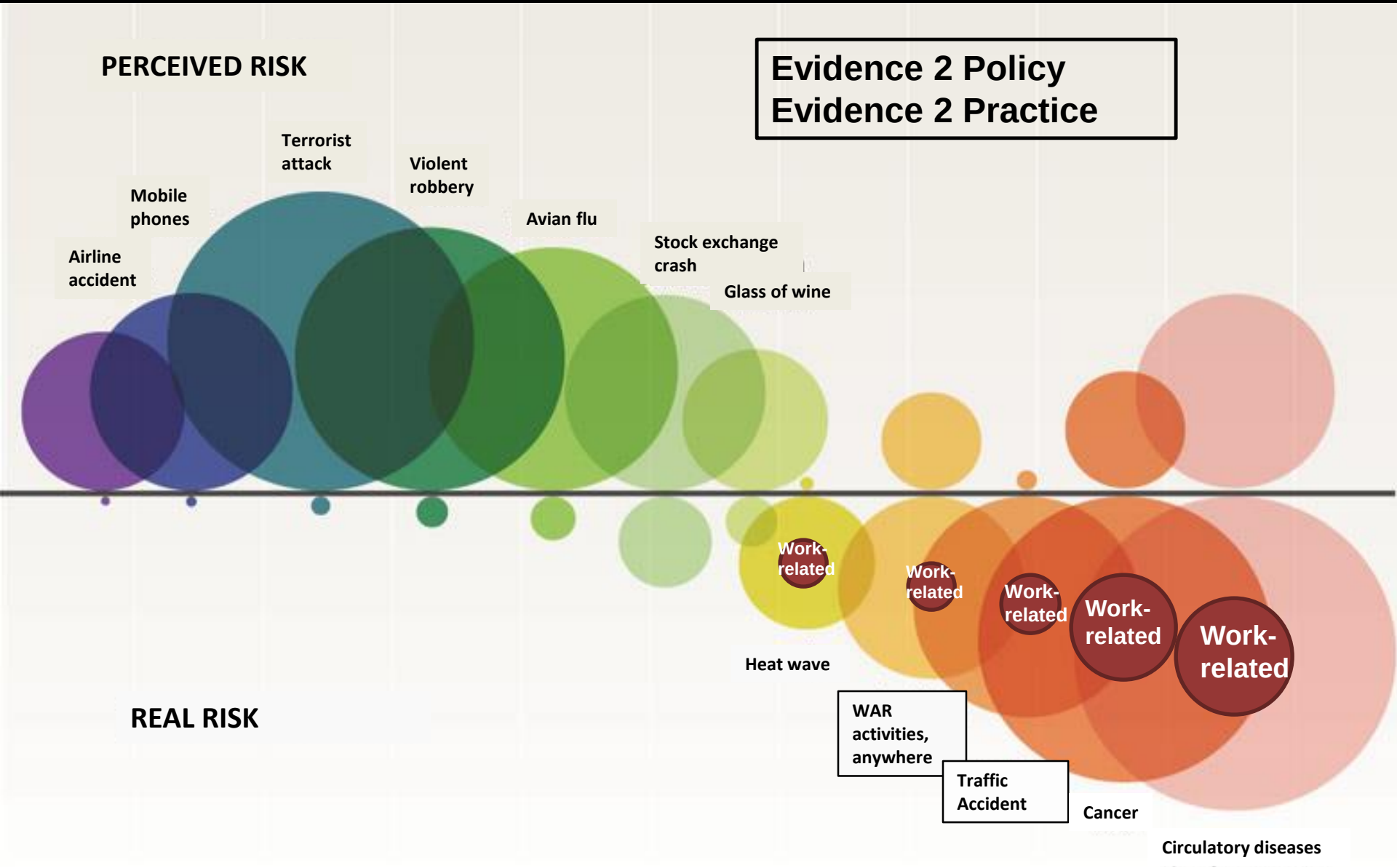
For cancer (UK): 19.8 years
For injuries(UK): 45.3 years

YLD = I x DW x L Years Lived with Disability

DALY = YLL + YLD Disability Adjusted Life Years



PERCEIVED AND REAL RISKS



Sources: S. Hertlich, M.Hamilo, S.kuvalehti (FI), *Journal Occ Env Hyg, 11: 326–337, May 9, 2014;* Takala J ao.

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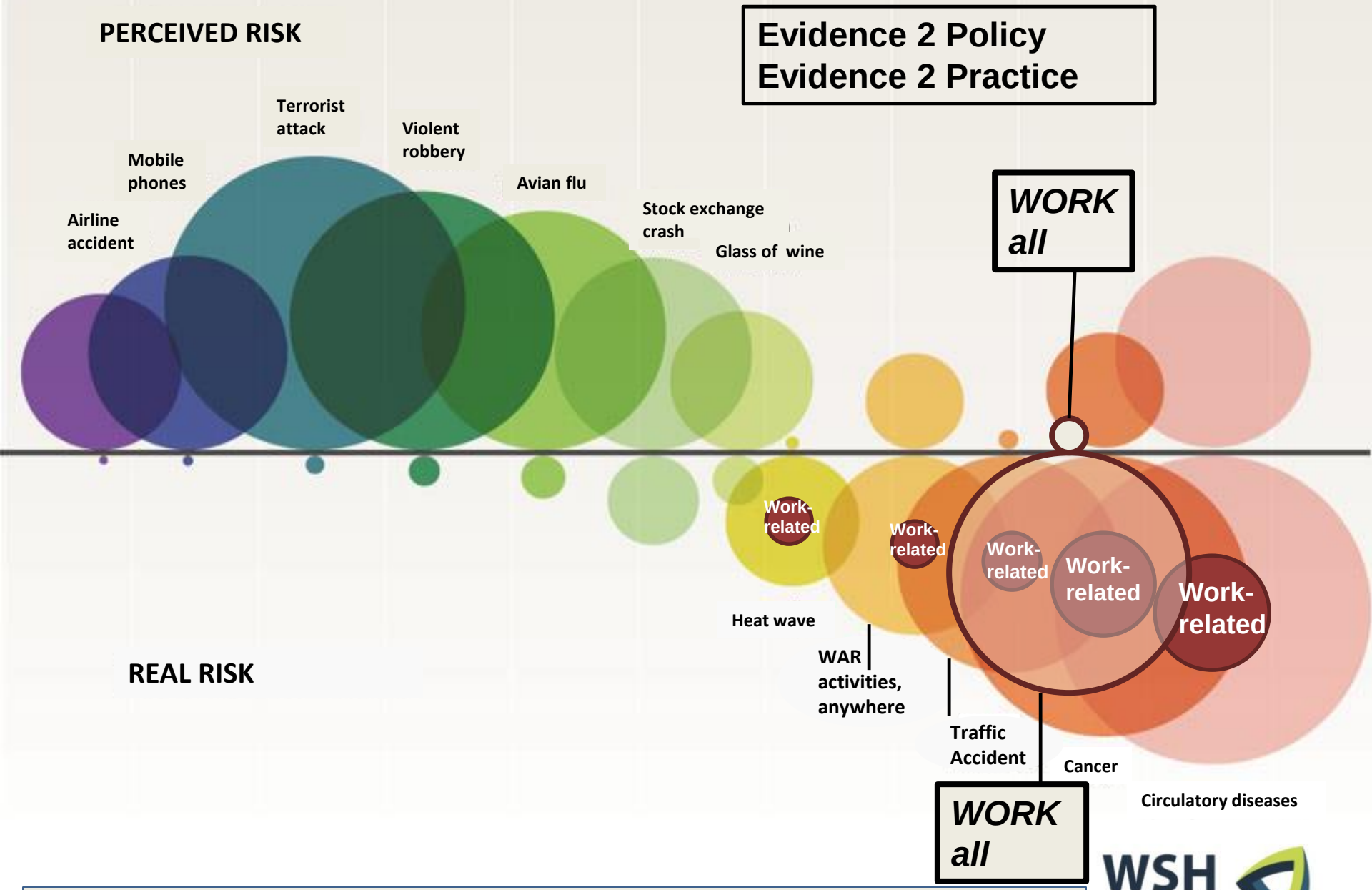
PERCEIVED AND REAL RISKS



Sources: S. Hertlich, M.Hamilo, S.kuvalehti (FI), *Journal of Occ Env Hyg, 11: 326–337, May 9, 2014;* Takala ao.

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Trends – change of mindset

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Conclusion

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