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

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EU Presidency Conference, Athens, 16-17 June 2014
Economic Costs - OVERVIEW

Introduction

What to measure – 3 options

Practical data – what is essential
Costs Study 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
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).\(^2\)

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\(^1\) XIX World Congress on Safety and Health at Work: Istanbul Turkey, 11-15 September 2011

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

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²VTT Technical Research Centre, Tampere, Finland
³Tampere University of Technology (TUT), Tampere, Finland

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 diseases 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
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 diseases is very low while non-communicable diseases are the overwhelming causes in those countries. Economic costs of work-related injury and illness vary between 1.8 and 6.0% of GDP in Singapore’s economic costs were estimated to be equivalent to 3.2% of GDP based on a preliminary study. If economic losses would take into account involuntary early retirement then costs may be considerably higher, for example, in Finland up to 15%
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**

- **Occupational injuries**
- **Genitourinary diseases**
- **Digestive diseases**
- **Respiratory diseases**
- **Circulatory diseases**
- **Neuropsychiatric conditions**
- **Malignant neoplasms**
- **Communicable Diseases**
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

Dr. J. Takala
Adjunct Professor, Senior Consultant to Ministry of Manpower, WSH Institute
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

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.
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: 6% (6%)
- Respiratory Diseases: 32% (28%)
- Mental Disorders: 0.3% (0.8%)
- Cancers: 4% (2.4%)
- Circulatory diseases: 8% (2.5%)
- Digestive systems diseases: 4% (1%)
- Genitourinary system: 0.3% (5.7%)
- Accidents and violence: 46% (53%)

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

- Communicable diseases: 6%
- Respiratory Diseases: 5.7%
- Mental Disorders: 1%
- Circulatory diseases: 2.5%
- Digestive systems diseases: 2.4%
- Genitourinary system: 0.8%
- Cancers: 28%
- Accidents and violence: 53%

EU28 192,000 deaths

Costs:

1. Magnitude of problems, injuries and diseases
2. How many days or years lost
3. Price of lost years
4. Other costs
Economic Models to Estimate Work-related Injuries and Ill-Health in US, UK, EU and AU
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

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.

## Comparison of US, UK, EU and AU models

<table>
<thead>
<tr>
<th>Factors</th>
<th>US</th>
<th>UK-HSE</th>
<th>EU-OSHA</th>
<th>Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methodology</td>
<td>- Cost-of-illness estimates</td>
<td>Costs to Britain model (‘the cost model’)</td>
<td>Literature review and Member State survey</td>
<td>- Incidence approach</td>
</tr>
<tr>
<td></td>
<td>- Incidence method</td>
<td></td>
<td></td>
<td>- Lifetime cost approach</td>
</tr>
<tr>
<td></td>
<td>- Prevalence method</td>
<td></td>
<td></td>
<td>- ‘ex post’ approach</td>
</tr>
</tbody>
</table>
Our study

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

Total Economic Cost of Work-related Injuries and Ill Health

Employers
Cost items:
- Staff turnover costs
- Training cost
- Loss of output
- Insurance premium
- Legal cost

Workers
Cost items:
- Net Loss of future earnings (Future earnings minus compensation)
- Medical cost
- Rehab cost

Community
Cost items:
- Social Payouts
- Investigation/Inspection costs/Promotion (OSHD budget)
- Loss of human capital
- Medical subsidy
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.

<table>
<thead>
<tr>
<th></th>
<th>Injuries</th>
<th>Ill health</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of resident</td>
<td>No. of resident</td>
</tr>
<tr>
<td></td>
<td>workers</td>
<td>workers</td>
</tr>
<tr>
<td>No. of foreign</td>
<td>workers</td>
<td>workers</td>
</tr>
<tr>
<td>workers</td>
<td>33,683</td>
<td>159,490</td>
</tr>
<tr>
<td>Total</td>
<td>56,603</td>
<td>219,739</td>
</tr>
</tbody>
</table>

\(^5\) ‘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.
### 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.

<table>
<thead>
<tr>
<th>Salary (per month) $</th>
<th>Injuries</th>
<th>Ill health</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Resident worker</td>
<td>Foreign worker</td>
</tr>
<tr>
<td>2540.21</td>
<td>1612.15</td>
<td>4351.44</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Fatal work related diseases, all</th>
<th>Permanent Residents and Citizens</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1360</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th></th>
<th>Mean (days)</th>
<th>Median (days)</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0 day</td>
</tr>
<tr>
<td>Injured Employed</td>
<td>13.2 (17.5)</td>
<td>3.0 (5.0)</td>
<td>100</td>
</tr>
<tr>
<td>Residents</td>
<td></td>
<td></td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10.8</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>Mean (days)</th>
<th>Median (days)</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
<td>0 day</td>
</tr>
<tr>
<td>Employed Residents</td>
<td>4.5 (6.0)</td>
<td>0.0 (2.0)</td>
<td>53.0</td>
</tr>
<tr>
<td>With Work-Related</td>
<td>(6.0)</td>
<td>(2.0)</td>
<td>7 days</td>
</tr>
<tr>
<td>Health Problems</td>
<td>[9.5]</td>
<td>[3.0]</td>
<td>2.3</td>
</tr>
</tbody>
</table>

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.
## Parts of Model Excel sheet

<table>
<thead>
<tr>
<th>No.</th>
<th>Cost Items</th>
<th>Total Value (B)</th>
<th>Calculations</th>
<th>Local</th>
<th>Injuries</th>
<th>Calculations</th>
<th>Foreign</th>
<th>Calculations</th>
<th>Local</th>
<th>Diseases</th>
<th>Calculations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Employer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Salary (Per Month)</td>
<td>$2265+(352/2897)</td>
<td>$2,540.21</td>
<td>E1*</td>
<td>$1,912.15</td>
<td>$3880+(352/2897)*3880</td>
<td>$4,351.44</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>No of persons estimated</td>
<td>224,5501*</td>
<td>33683</td>
<td>E1*</td>
<td>1179700*</td>
<td>22920</td>
<td>E1*</td>
<td>154940</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Non-Fatal Turnover costs (Based on 6 Months)</td>
<td>0.28 (E19+E20)*</td>
<td>$47,775,845.71</td>
<td>G1*G6</td>
<td>$168,557,357.38</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Fatalities</td>
<td>37</td>
<td>78</td>
<td>946</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Fatalities Turnover costs (Based on 6 Months)</td>
<td>0.03 (E1<em>E4</em>E6)</td>
<td>$563,926.36</td>
<td>G1<em>G4</em>E6</td>
<td>$24,698,770.15</td>
<td></td>
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<td>6</td>
<td>Training cost</td>
<td>437</td>
<td>437</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Non-Fatal Training costs</td>
<td>0.01 (E19+E20)*</td>
<td>$1,369,121.00</td>
<td>G6*</td>
<td>$2,821,272.00</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>8</td>
<td>Fatalities Training costs</td>
<td>0.00 (E4*E4)</td>
<td>$16,169.00</td>
<td>G4*G6</td>
<td>$34,086.00</td>
<td>$413,402.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>9</td>
<td>Insurance Premiums</td>
<td>0.24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Legal (Fines due to prosecution)</td>
<td>0.001</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>GDP /employed per Annum</td>
<td>$32,683,240,000</td>
<td>$94,915.57</td>
<td>$32,683,240,000</td>
<td>$94,915.57</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>12</td>
<td>Total Hours worked per employee per Annum</td>
<td>46.2Hrs*52Weeks</td>
<td>2402.4</td>
<td>2402.4</td>
<td>2402.4</td>
<td>2402.4</td>
<td></td>
<td>46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Cost of 1 Man-days lost per employee</td>
<td>(E11/E11)*8hrs</td>
<td>$316.07</td>
<td>(G11/G11)*8hrs</td>
<td>$316.07</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Loss of output (Based on Man-days lost)</td>
<td>1.75 (E13*E2)</td>
<td>$212,923,148.82</td>
<td>G2*</td>
<td>$97,435,106.09</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Total Employer Cost</td>
<td>2.31</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

### Individual

<table>
<thead>
<tr>
<th>No.</th>
<th>Cost Items</th>
<th>Total Value (B)</th>
<th>Calculations</th>
<th>Local</th>
<th>Injuries</th>
<th>Calculations</th>
<th>Foreign</th>
<th>Calculations</th>
<th>Local</th>
<th>Diseases</th>
<th>Calculations</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Discount Rate (Savings+productivity rate-Inflation)</td>
<td>2.6%</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>16</td>
<td>Salary (Per Annum)</td>
<td>E1*12</td>
<td>$30,482.51</td>
<td>G1*12</td>
<td>$19,345.74</td>
<td>$11*12</td>
<td>$52,217.27</td>
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</tr>
<tr>
<td>17</td>
<td>PV of loss of Salary for avg of 27 years (Permanent, no RTW)</td>
<td>0.36 (E19*E16)</td>
<td>$586,132.85</td>
<td>19.229*G16</td>
<td>$371,899.65</td>
<td>19.229*G16</td>
<td>$1,004,059.81</td>
<td></td>
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</tr>
<tr>
<td>18</td>
<td>PV of loss of Salary for 27 years (Reduced capacity, ≥10%PI)</td>
<td>0.36 (E19*E16)</td>
<td>$211,007.27</td>
<td>19.229*G16</td>
<td>$133,916.27</td>
<td>19.229*G16</td>
<td>$361,461.53</td>
<td></td>
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<td></td>
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<tr>
<td>19</td>
<td>Reduced capacity, (≥10%PI and mc days&lt;180 days)</td>
<td>(1142/12568)*E2</td>
<td>3061</td>
<td>(1142/12568)*</td>
<td>2083</td>
<td>(3/72)*12</td>
<td>6456</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>20</td>
<td>Permanent, no RTW (≥10%PI and mc days≥180 days)</td>
<td>(27/12568)*E2</td>
<td>72</td>
<td>(27/12568)*G2</td>
<td>49</td>
<td>(0/72)*12</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Total PV of loss of Salary for 27 years (Permanent, no RTW)</td>
<td>0.36 (E19*E18)</td>
<td>$42,235,165.38</td>
<td>19.229*E20</td>
<td>$18,227,492.65</td>
<td>19.229*G20</td>
<td>$0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Total PV of loss of Salary for 27 years (Reduced capacity, ≥10%)</td>
<td>0.36 (E19*E18)</td>
<td>$42,235,165.38</td>
<td>19.229*E18</td>
<td>$278,947,595.64</td>
<td>19.229*G18</td>
<td>$2,333,595,646.27</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Economic cost borne by various economic agents

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

*There is no double counting for each of the cost items category.*
# Example of cost items for injuries and ill health

<table>
<thead>
<tr>
<th></th>
<th>Cost Items</th>
<th>Cost of Injury</th>
<th>Cost of ill health</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Employers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Staff turnover costs</td>
<td>0.05</td>
<td>0.16</td>
</tr>
<tr>
<td></td>
<td>- Training cost</td>
<td>0.0024</td>
<td>0.0046</td>
</tr>
<tr>
<td></td>
<td>- Loss of output</td>
<td>0.36</td>
<td>1.39</td>
</tr>
<tr>
<td></td>
<td>- Insurance premium</td>
<td></td>
<td>0.24</td>
</tr>
<tr>
<td></td>
<td>- Legal cost</td>
<td></td>
<td>0.001</td>
</tr>
<tr>
<td><strong>Workers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Net Loss of future earnings</td>
<td>1.1</td>
<td>4.26</td>
</tr>
<tr>
<td></td>
<td>(Future earnings minus compensation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Medical cost</td>
<td>0.02</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>- Rehab cost</td>
<td>0.001</td>
<td>-</td>
</tr>
<tr>
<td><strong>Community</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Social Payouts</td>
<td>0.014</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Investigation/ Inspection costs/ promotion (OSHD budget)</td>
<td></td>
<td>0.014</td>
</tr>
<tr>
<td></td>
<td>- Fatal loss of human capital</td>
<td>0.2</td>
<td>2.6</td>
</tr>
<tr>
<td></td>
<td>- Medical subsidy</td>
<td>0.013</td>
<td>0.027</td>
</tr>
</tbody>
</table>
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
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 injuries 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.
Employment Rate (%) for various economies for age group 55 to 64 (Overall)

Source: OECD, Statistics Finland, WSH-Institute Singapore
## Price of premature retirement and early exclusion from employment

<table>
<thead>
<tr>
<th></th>
<th>Finland 2012</th>
<th>Singapore 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average retirement age</td>
<td>60.9yrs</td>
<td>61.2 yrs</td>
</tr>
<tr>
<td>Loss of years/person</td>
<td>4.1 yrs</td>
<td>3.8 yrs</td>
</tr>
<tr>
<td><strong>Proxy 1</strong>: Median income (SGD)</td>
<td>53,250 / 41,760</td>
<td>15.1 billion</td>
</tr>
<tr>
<td><strong>Proxy 2</strong>: Cost to employer (SGD)</td>
<td>80,590 / 50,112</td>
<td>22.8 billion</td>
</tr>
<tr>
<td><strong>Proxy 3</strong>: GDP/employed (SGD)</td>
<td>117,600 / 105,524</td>
<td>33.3 billion</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Finland 2012</th>
<th>Singapore 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average exit age</td>
<td>61.2yrs</td>
<td>61.2 yrs</td>
</tr>
<tr>
<td>Loss of years/person</td>
<td>3.8 yrs</td>
<td>3.8 yrs</td>
</tr>
<tr>
<td><strong>Proxy 1</strong>: Median income (SGD)</td>
<td>53,250 / 41,760</td>
<td>7.5 billion</td>
</tr>
<tr>
<td><strong>Proxy 2</strong>: Cost to employer (SGD)</td>
<td>80,590 / 50,112</td>
<td>9.0 billion</td>
</tr>
<tr>
<td><strong>Proxy 3</strong>: GDP/employed (SGD)</td>
<td>117,600 / 105,524</td>
<td>18.9 billion</td>
</tr>
</tbody>
</table>

### 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)

**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)
## The "Balance of Horror"

<table>
<thead>
<tr>
<th></th>
<th>EU:</th>
<th>200 bill. € / year</th>
<th>Finland:</th>
<th>2 billion € /y</th>
<th>Singapore:</th>
<th>?</th>
</tr>
</thead>
</table>

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

### Training
- OHS
- WA promotion
- Recreation and culture
- Corporate fitness
- Communication

### Early retirement
- Sick-leaves
- Accidents
- Permanent disability

#### Presenteeism

Source: Prof. G. Ahonen, adaptation Dr. J. Takala
Deaths in men in 2010 by age, Western Europe

- Cancer, AF=13.8%
- CVD, AF=14.4%
- Injuries
- Communicable, AF=4.8%

AF= Attributable Fraction, re work

GBD= Global Burden of Disease
DALYs in women in 2010 by age, Western Europe

http://www.healthmetricsandevaluation.org/gbd/visualizations/regional
Deaths, Western Europe, selected causes by GBD

Attributable Deaths

0-6 days
7-27 days
28-364 days
1-4 years
5-9 years
10-14 years
15-19 years
20-24 years
25-29 years
30-34 years
35-39 years
40-44 years
45-49 years
50-54 years
55-59 years
60-64 years
65-69 years
70-74 years
75-79 years

Occupational injuries
Occupational cancer
Deaths U.K. Selected causes by GBD

UK: 8,010 deaths/year

Occupational cancer
UK: 8,010 occ. cancer deaths/year

UK: 118,374 DALYs re occ. cancer
Deaths and Lost Years through GBD/WHO and/or ILO
YLLs, U.K. selected causes by

\[ YLL = N \times L \]  
Years of Lost Life, \( N = \) deaths, \( L = \) lost years

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

\[ YLD = I \times DW \times L \]  
Years Lived with Disability

\[ DALY = YLL + YLD \]  
Disability Adjusted Life Years

498,604 YLLs re occ. injuries
375,105 YLLs re occ. cancer
PERCEIVED AND REAL RISKS

PERCEIVED RISK

Airline accident
Mobile phones
Terrorist attack
Violent robbery
Avian flu
Stock exchange crash
Glass of wine

REAL RISK

Heat wave
WAR activities, anywhere
Traffic Accident
Work-related
Work-related
Work-related
Work-related
Cancer
Circulatory diseases

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

PERCEIVED RISK
- Mobile phones
- Terrorist attack
- Violent robbery
- Avian flu
- Stock exchange crash
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REAL RISK
- Heat wave
- Cancer
- Circulatory diseases
- Work-related
- Traffic Accident
- WAR activities, anywhere

Evidence 2 Policy
Evidence 2 Practice

Trends – change of mindset

Occupational Diseases Are Common

Common Diseases are Occupational
Thank You
References

1. XIX World Congress on Safety and Health at Work: Istanbul Turkey, 11-15 September 2011
   http://www.tandfonline.com/doi/pdf/10.1080/15459624.2013.863131