

WSH Institute Report:

Economic Cost of Work-related Injuries and Ill-health in Singapore



Workplace Safety and Health Institute, Singapore

The study report here was undertaken by the following WSH Institute researchers.

LOKE Yoke Yun, *BSc*

TAN Wee Jin, *BSocSci*

Kathiresan MANICKAM, *PhD*

Peggy HENG, *BSocSci*

Caleb TJONG, *BSc*

LIM Guan Kheng, *BEng*

Samuel LIM, *PhD*

GAN Siok Lin, *MBBS, MSc (Occ Med), FAMS (Occ Med)*

Jukka TAKALA, *DSc*

Acknowledgements

We would like to thank Richard Webster, Shandre M. Thangavelu and Lun Kwok Chan who provided guidance in developing the cost model. We would also like to thank officers from Singapore's Ministry of Health, Ministry of Social and Family Development and Ministry of Manpower who contributed actively in the discussions during the data collection process.

Publication Date: Oct 2013

Content

	Executive Summary	4
1	INTRODUCTION	6
2	SINGAPORE MODEL	8
	2.1 International Studies	
	2.2 Development of the Singapore Model	
	2.3 Approach for the Singapore Model	
	2.4 Considerations taken in Computation	
	2.4.1 Considerations for Calculation	
	2.4.2 Burden of Disease and Disorder Attributed to Work	
	2.5 The Analysis and Sources of Data	
	2.5.1 Cost to Employers	
	2.5.2 Cost to Workers	
	2.5.3 Cost to Community	
3.	ESTIMATED COST	16
	3.1. Costs borne by Workers, Employers and the Community	
	3.2. GDP Equivalent	
	3.3. Enhancing Productivity with Higher Level of WSH Performance	
4.	CONCLUSIONS AND RECOMMENDATIONS	18
	4.1. Conclusions and Recommendations	
	4.2. Future work	
5.	REFERENCES	19
6.	APPENDICES	22
	Appendix 1: Abbreviations	
	Appendix 2: Comparison of Economic Models	
	Appendix 3: Definitions and Values	
	Appendix 4: Sensitivity Analysis	

Executive Summary

Background

The International Labour Organization (ILO)¹ estimated that about 2.3 million workers die from occupational accidents and diseases worldwide every year. This is equivalent to 4 per cent of annual global GDP², or USD2.8 trillion, being lost to direct and indirect costs of accidents and diseases. Other researchers have also reported that about 5 per cent of the burden of all diseases and injuries in established market economies could be attributed to work.³

Singapore economic cost model for work injuries and ill health

The Workplace Safety and Health (WSH) Institute reviewed the methodologies and cost models from different countries when developing this preliminary economic cost model for Singapore. In this model, the WSH Institute determined the cost of work-related injuries and ill health that would be borne by employers, workers and the community. Cost items linked to staff turnover, training of replacement workers, loss of worker output, insurance premium and legal costs incurred were computed as cost borne by employers. The cost borne by workers included expenses beyond that covered by compensation for medical treatment and rehabilitation as well as net loss of future earnings. Cost items like social payouts, cost of investigation, inspection and WSH promotion activities, loss of human capital for fatal cases and medical subsidies were considered as cost borne by the community. This model does not take into account the cost from property damage and human pain and suffering.

¹ IXIX World Congress on Safety and Health at Work: Istanbul Turkey, 11-15 September 2011.

http://www.ilo.org/wcmsp5/groups/public/@ed_protect/@protrav/@safework/documents/publication/wcms_162662.pdf

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

³ ILO Governing Body. Occupational safety and health: Synergies between security and productivity. 2006.

<http://www.ilo.org/public/english/standards/relm/gb/docs/gb295/pdf/esp-3.pdf>

Estimated SGD 10.45 billion (equivalent to 3.2% GDP) lost in 2011 to work injuries and ill health

The total cost of work-related injuries and ill health to workers, their employers and the community for Singapore is estimated to be SGD 10.45 billion, equivalent to 3.2% of the nation's GDP for 2011. The costs borne by different economic agents were estimated to be: SGD 2.31 billion (22.1%) by employers; SGD 5.28 billion (50.5%) by workers, and S\$2.87 billion (27.4%) by the community.

Benefits from the study

This study provides deeper insights on the potential costs of work-related injuries and ill health in Singapore. As this computation breaks the cost down into individual cost items, it enables the relevant stakeholders to identify and prioritise potential levers to reduce the cost of poor WSH practices in a more strategic and evidence-based approach.

WSH Institute will continue to refine this WSH economic cost model for Singapore, so that the individual cost items attributable to work-related injuries and ill health can be more accurately computed.

1 Introduction

The extent of the costs of a work-related injury is often not fully understood. Take the example of a worker suffering from partial incapacity as a result of a work-related injury. At the age of 35 with a monthly salary of \$2,500, this worker would have lost an estimated \$200,000 in future earnings if he is unable to return to work (lifetime cost). For his company, the immediate loss of production output, rehiring costs, and retraining costs is estimated to amount to \$22,000. This illustrates the potential high cost of injuries.

The International Labour Organisation (ILO)⁴ estimated that about 2.3 million workers die from occupational accidents and diseases worldwide every year. ILO further estimated that 4 per cent of annual global GDP⁵, or USD 2.8 trillion, is lost due to the direct and indirect costs of such accidents and diseases (such as lost working time, workers' compensation, interruption of production, and medical expenses). It was estimated that about 5 per cent of the burden of all diseases and injuries in established market economies is attributable to work.⁶

Many studies relating to the economic cost of workplace injuries and diseases have been conducted. Leigh⁷ estimated that the national cost of work-related injuries and diseases in USA amounted to USD 250 billion (1.8% GDP). Safe Work Australia estimated that the costs of work-related injuries and illnesses for Australia were AUD 57.5 billion (5.9% GDP)⁸ for 2005–06 and AUD 60.6 billion (4.8% GDP) for 2008–09.⁹

⁴ IXIX World Congress on Safety and Health at Work: Istanbul Turkey, 11-15 September 2011.

http://www.ilo.org/wcmsp5/groups/public/@ed_protect/@protrav/@safework/documents/publication/wcms_162662.pdf

⁵ International Labour Organisation (ILO). World Day for Safety and Health at Work 2009 'Facts on safety and health at work'. 2009

⁶ ILO Governing Body. Occupational safety and health: Synergies between security and productivity. 2006.

<http://www.ilo.org/public/english/standards/relm/gb/docs/gb295/pdf/esp-3.pdf>

⁷ Leigh JP. Economic Burden of Occupational Injury and Illness in the United States. The Milbank Quarterly 2011;89(4):728–72.

⁸ Australian Safety and Compensation Council. The cost of work-related injury and illness for Australian employers, workers and the community: 2005–06. (2009). Retrieved from the Safe Work Australia website:

<http://safeworkaustralia.gov.au/AboutSafeWorkAustralia/WhatWeDo/Publications/Pages/SR200903InjuryAndIllness2005To2006.aspx>

⁹ Australian Safety and Compensation Council. The Costs of Work-related Injury and Illness for Australian Employers, Workers and the community: 2008–09 (2012). Retrieved from the Safe Work Australia website:

<http://www.safeworkaustralia.gov.au/AboutSafeWorkAustralia/WhatWeDo/Publications/Pages/cost-injury-illness-2008-09.aspx>

The costs of work injuries and illnesses may be broadly divided into direct and indirect costs. Direct costs include workers' compensation payments, medical expenditures and legal costs. Examples of indirect costs include training replacement employees, lost productivity and costs associated with lower employee morale and absenteeism.

Many companies still approach safety expenditure as a necessary element of compliance with government regulations and guidelines, rather than a contributory factor to the economic viability of their organizations. They are hence reluctant to invest in safety and health beyond the bare minimum as they feel it would erode their bottom-line and reduce their competitiveness. A 2010 survey by the WSH Council¹⁰ found that barely half (49%) of the companies in Singapore set aside an annual budget for safety programmes. Further, only 30% of the managers surveyed believed that good safety performance would improve business revenue/ net profits.

With the awareness of the economic impact of work injures and ill-health, all stakeholders will be more motivated to improve WSH standards and benefit from the enhanced productivity generated.

¹⁰ Based on the final report on the findings of the National Workplace Safety and Health Survey 2010.

2 Singapore Model

2.1 International Studies

In the USA, Leigh⁷ estimated that the national cost of occupational injuries and diseases is USD 250 billion (1.8% GDP) in 2007. This model did not consider the subjective component (e.g. emotional harm) and other intangible factors. The estimates were conservative because only a single category in the model was used to represent all direct costs of a fatal occupational injury. In the studies published by Safe Work Australia, the estimated cost of work-related injury and illness was AUD 57.5 billion (5.9% GDP)⁸ for the financial year 2005–06 and AUD 60.6 billion (4.8% GDP) for the financial year 2008–09. The methodology used measured only the human cost and similarly did not consider the subjective component to estimate the cost of work-related injury and illness. It adopted an “ex-post” approach, measuring costs for a case after it had occurred. Using an incidence approach also provided a proxy for on-going cost of cases from previous reference years.⁹ A comparison of the different economic models used by USA, UK, Australia and EU is given in Appendix 2.

The total cost of a workplace injury is often underestimated because some costs may be indirect, are not immediately felt, or simply difficult to quantify, such as loss of reputation. For example, apart from the direct costs of accidents such as worker compensation, there are also indirect costs on the loss of skilled workers, delays in production, accident investigation costs, associated legal costs, equipment damage/replacement costs, costs to reschedule work, recruitment and the training of new staff, loss of corporate image etc. A study by the Stanford University¹¹ estimated that the indirect costs due to such losses could be 4 times higher than the direct costs.

Similarly, work-related ill health also causes huge suffering and loss. However, they remain largely invisible compared to work-related accidents, even though they are estimated to kill six times as many people each year¹². Occupational diseases can also be economically very costly. The cost of work-related diseases in the EU is estimated to be at least €145 billion per year¹³. In the US, insurance companies reportedly paid

¹¹ Stanford University. (1982). Improving construction safety performance. Department of Civil Engineering Technical Report No. 260. http://constructionsafetyconsultant.com/articles/report_a_3.pdf

¹² “The Prevention of Occupational Diseases.” International Labour Organization, 2013.

¹³ Ibid

US\$21.6 billion for asbestos-exposure cases alone for the period 1990–2000, while another USD 32 billion was paid out by prosecuted enterprises¹⁴.

Some have also argued that poor countries and poor companies cannot afford to invest in safety initiatives. However, empirical evidence shows that this is not true. Based on a study by the World Economic Forum¹⁵ and data from the International Labour Organisation, the most competitive countries are also the safest ones. This demonstrates that safety, competitiveness and long-term productivity are interlinked. Investment in safety need not be at the expense of being competitive. From the study, it can be deduced that no country has been able to achieve high competitiveness with poor WSH standards.

At the enterprise level, many companies have also reaped the business benefits of better workplace safety and health. For instance, a pharmaceutical manufacturing company in the UK invested in health promotion services (e.g. sports facilities, health screening) and rehabilitation and treatment services (e.g. physiotherapy, counselling, return to work programmes). They reportedly saved £200,000 a year in employee health insurance, enjoyed 53% reduction in ergonomic-related cases and reduced their number of work-related stress cases. Employees also noted significant improvements in concentration and productivity at work, while absence rates dropped to become 31% lower than the UK average¹⁶.

There are also many such examples in Singapore. One company in the construction sector reported productivity gains from saving more than \$80,000 and 2,000 man-hours after it replaced traditional scaffold structure with a re-useable working platform built into the metal column formwork. Workers no longer needed to erect and dismantle any scaffold structure, achieving the twin purposes of saving cost and eliminating the risks of working on scaffolds. The actual gains could be even higher if indirect costs were also included¹⁷.

¹⁴ Ibid

¹⁵ World Economic Forum The Global Competitiveness Report 2012 – 2013
http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2012-13.pdf

¹⁶ <http://www.hse.gov.uk/business/casestudy/astrazeneca.htm>

¹⁷ Source: WSH-related best practices on WSH Council website.
<https://www.wshc.sg/wps/portal/resources?action=detailedInfoStop&fInfoStopID=487>

2.2 Development of the Singapore Model

An extensive background research comparing the methodologies and economic models from different countries was carried out. WSH Institute also consulted with Safe Work Australia¹⁸, which had earlier published the study 'The Cost of work related injury and illness for Australian employers, workers and the community: 2008-09' and discussed its relevance to the Singapore context.

To ensure that the economic model is robust and relevant factors were taken into consideration, WSH Institute had set up 2 working groups: an international advisory group and an internal working group. The international advisory group comprises of international advisors from Australia and Finland who have experience in developing economic models in their countries and thus contributed their knowledge to the economic model for Singapore. The internal working group comprised of experts who have knowledge of WSH-related statistics and were aware of the WSH climate in Singapore. These members have knowledge of the trending of workplace incidents and accidents in different workplace sectors including marine, construction, logistics and transport and manufacturing. WSH Institute also consulted with various departments from the Ministry of Manpower (MOM)¹⁹ as well as other government agencies including MAS, MOH, MSF, HPB, DOS and IRAS for their inputs to the Singapore model.

Taking into consideration the methodologies and economic cost models from different countries and in consultation with the international advisory group, the internal working group as well as representatives from government agencies, the WSH Institute developed a preliminary economic model to estimate the economic cost of work injures and ill health for Singapore.

2.3 Approach for the Singapore Model

The Access Economics²⁰ review of the relevant literature identified two key approaches for measuring annual work injuries and ill health: the incidence approach and the prevalence approach. The incidence approach measures only new cases occurring

¹⁸ Mr. Richard Webster, Assistant Director of Data and Analysis for Safe Work Australia, was in Singapore in Jan 2013. During his time here, he was engaged in discussions with key stakeholders and subject experts in Singapore on his study.

¹⁹ Departments that were consulted include the Manpower Planning and Policy Division, Workplace Policy and Strategy Division and Occupational Safety and Health Division of MOM.

²⁰ Access Economics (2004) Costs of Workplace Injury and Illness to the Australian Economy: Reviewing the Estimation Methodology and Estimates of the level and distribution of costs, Reports for the National Occupational Health and Safety Commission, March 2004.

during the reference year, whereas the prevalence approach measures all new and existing cases at a given point in time in the reference year. The incidence approach measures the costs associated with workers injured or who had suffered ill health as a proxy for on-going cost of cases from previous reference years.

The WSH Institute reviewed the methodologies and cost models from different countries when developing a working model for Singapore. The study methodology was adapted from similar studies done by other countries. Similar to Australia, our model measures only human cost and does not take into account the cost of property damage, and human pain and suffering. The analysis is based on cost incurred after an incident had occurred. The expected future cost of new cases in the reference year is used as a proxy for on-going cost of cases from previous years.

In this model, the Institute determined the cost of work-related injuries and ill health that would be borne by employers, workers and the community (Figure 1). Cost items linked to staff turnover, training of replacement workers, loss of worker output, insurance premium and legal cost incurred were computed as costs borne by employers. The costs borne by workers included loss of future earnings, additional expenses for medical treatment and rehabilitation, beyond that covered by compensation under the Work Injury Compensation Act. Cost items like social payouts, cost of incident investigation, workplace inspection and promotion activities by MOM and WSH Council, loss of human capital for fatal cases, and medical subsidies were considered as costs borne by community. All the cost items considered are mutually exclusive to ensure that there will be no multiple counting.

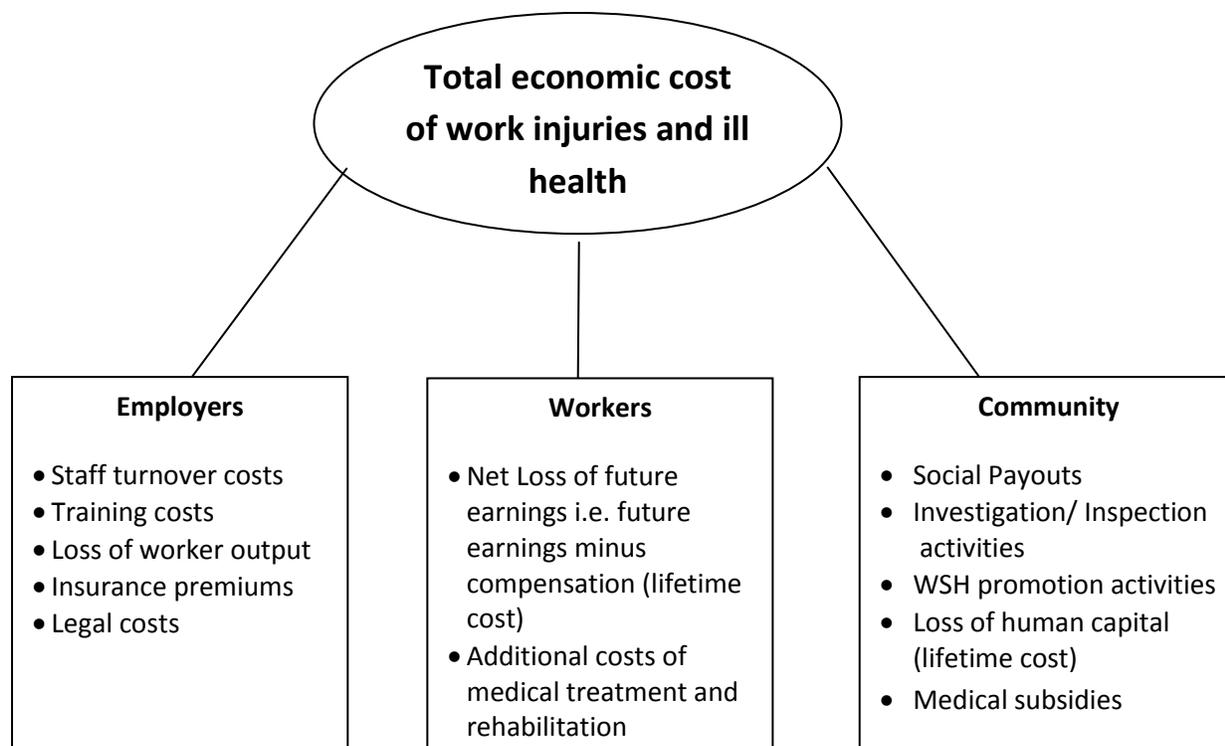


Figure 1: Cost items borne by employers, workers and the community

2.4 Considerations taken in Computation

2.4.1. Considerations for Calculation

Estimating the number of work-related injuries and ill health

Other than using reportable workplace injuries and occupational diseases figures released by the WSH Council²¹, WSH Institute also considered other sources of information. Based on the findings of an internal MOM survey in 2008, 1.5% of employed local residents claimed to have suffered a work injury in the past 12 months (from the date of the survey) and 6.9% of them claimed to have suffered a work-related ill health problem²². These findings, coupled with figures from work injury compensation data, provide the projections used in the model.

²¹ Workplace Safety and Health Report 2011
<https://www.wshc.sg/wps/themes/html/upload/announcement/file/WSH%20Stats%20Report%202011.pdf>

²² The 95% Confidence Interval for work injury and ill health were [1.1%, 1.9%] and [6.1%, 7.7%] respectively.

Estimating the loss of future earnings

For estimating the loss of future earnings, injured workers were grouped into 3 categories: (i) Workers with permanent incapacity, (ii) Workers with partial incapacity and (iii) Workers with work-related injuries or ill health that resulted in death. Appropriate weights were attributed to each category, corresponding to the likeliness of returning to work, as well as adjusting for reduced work capacity.

2.4.2 Burden of Disease and Disorder Attributed to Work

Attributable fractions (AF) are the proportion of cases that would not have occurred in the absence of work exposure. AFs were used to determine the burden of disease. Studies adapted by ILO for global estimates state that the total AF²³ for work-related causes was 6.7% (2005). The AF method is widely used to assess work-relatedness of a wide range of diseases and disorders.

A study used by the World Health Organization (WHO) and health professionals, as reported in the Global Burden of Disease and Injury by Murray and Lopez (WHO/World Bank)²⁴, estimated that 5% of the global burden is related to work in 'Established Market Economies' group of countries as classified by World Bank. While these two estimates are not the same as economic burden, they correlate closely with the costs of work-related problems. This work-related burden appears to increase gradually by economic progress and national development while the traditional causes of sickness and mortality, such as communicable diseases, are decreasing. Many highly populated developing countries where the communicable diseases and other traditional problems are still important have somewhat lower level of burden attributed to work. This corroborated well with the ILO estimate for costs of occupational injuries and illnesses – 4% of annual global GDP.

The circumstances in Singapore are similar to those of other highly developed countries. As a result of having overcome most communicable diseases as a cause of death, the relative importance of non-communicable diseases and disorders is constantly increasing. Some diseases that have a clear linkage to work are: work-related cancers, circulatory diseases, chronic respiratory diseases, musculoskeletal disorders and psychosocial factors at work, among others. For this study, the number of

²³ Attributable fractions are fractions of a disease or injury which would not have occurred had the factor been non-existent in the population in question, They are calculated based on data about existing exposures to known factors of work-related diseases and their proven impact on exposure - outcome relationship and morbidity to these diseases.

²⁴ Elgstrand K. and Petersson N.F. OSH for Development. Royal Institute of Technology, Sweden. 2010.

workers who suffered from work-related ill health resulting in death is estimated using the AF methodology.

2.5 The Analysis and sources of data

Multiple sources of data were used in this analysis, as shown in Table A2 in Appendix 3.

2.5.1 Cost to Employers

For the cost borne by employers, cost items included staff turnover cost, training costs, loss of worker output, insurance premiums and legal costs.

Staff turnover cost included the administration cost of advertising, interviewing and hiring of a new worker to replace an injured or diseased worker.

Training costs were estimated based on the net amount incurred after deducting cost recovered from the Skills Development Fund (SDF)²⁵. It included course fees, other monetary allowances given to trainees and cost of training materials incurred in providing structured On-The-Job-Training (OJT).²⁶ The training cost for resident and foreign workers was assumed to be the same.

For the loss of worker output, it refers to the loss of productivity which the employer has to bear due to the injured or diseased worker being unable to work. Insurance premiums, another factor used in the computation, were included to account for payment expended for injured or diseased workers. Lastly, the computation of legal costs were based on the WSH Act Contraventions of the 43 companies or employers who were either fined or imprisoned in 2011.²⁷

2.5.2 Cost to Workers

²⁵ As required by law under the Skills Development Levy (SDL) Act in Singapore, all employers are required to pay a monthly SDL for each of their employees working in Singapore. SDL is then channelled to the Skills Development Fund, where employers can enjoy grants to support staff training.

²⁶ 'Labour Cost and Medical Benefits 2009'. This survey is conducted by conducted by Manpower Research and Statistics Department (MRSD), Ministry of Manpower (MOM).

²⁷ List of Offenders Convicted under Workplace Safety and Health Act, 2011

The cost borne by workers includes net loss of future earnings and additional costs of medical treatment and rehabilitation.

Net loss of future earnings measures the difference between the expected future earnings had the incident not occur and the worker's expected future earnings following a work-related injury or disease. This difference is then discounted using present value calculations to reflect the monetary value of the earnings loss to the current reference year.²⁸

Additional medical costs incurred relate to specialized medical treatment required due to a work-related injury or ill health. This was estimated based on the average hospital inpatient bill size for both medical and surgical specialties.²⁹ For the resident workers, the average medical cost of subsidized class wards of B2 and C were considered. For non-resident workers, the average cost of class ward A and B1 was considered as these classes of wards are not subsidized. For the cost item on rehabilitation, the Tan Tock Seng Hospital (TTSH) rehabilitation study was used as a proxy to estimate the rehabilitation cost for injured workers. This study was conducted to approximate the costs and benefits of injured workers who receive standard care and case-manager based care from a societal perspective.³⁰

2.5.3 Cost to Community

Lastly, social payouts, investigation, inspection and WSH promotion activities as well as the loss of human capital (lifetime cost) and medical subsidies formed the basis of the cost accrued to the community.

The amount of disbursements of long term assistance administered by Ministry of Social and Family Development (MSF) was used as a proxy for the social payout for the workers who sustained occupational injuries or illness. The cost item on investigation, inspection and WSH promotion activities was the cost incurred by MOM and WSHC as these are preventive measures to reduce work related accidents and illnesses. For the loss of human capital cost item for fatal cases – this was based on the 6000 man-days loss per fatality. Medical subsidy is taken as the difference between unsubsidised and subsidized wards.

²⁸ The analysis of the net loss of future earnings takes into account factors such as inflation, savings rate, labour productivity rate and compensation received.

²⁹ 'Average hospital inpatient bill size' indicates the cost of medical and surgical specialities for the respective hospital class wards. http://www.moh.gov.sg/content/moh_web/home/statistics/healthcare_institutionstatistics/average_hospitalinpatientbillsizetables.html

³⁰ This is a research project initiated by Occupational Safety and Health Division (OSHD), Ministry of Manpower (MOM), to evaluate the practicality, effectiveness and cost-benefits of a case-manager based system. This report has not been released for publication.

3 Estimated Cost

3.1 Costs borne by Workers, Employers and the Community

Following the methodology discussed in Chapter 2, this section summarizes the estimated economic cost of work-related injuries and ill health in Singapore.

Excluding lifetime costs, the cost for work injuries and ill health sustained for 2011 is estimated to cost Singapore **\$2.62 billion, with employers bearing 88.2%** of cost, employees 9.5% and the community 2.3%.

If lifetime cost is included, i.e, net loss of future earnings and loss of human capital (see Figure 1), the total cost of work injuries and ill health is estimated to be **S\$10.45 billion** for the year 2011. Workers bore about half of these costs (51%) while the rest was shouldered by the employers (22%) and the community (27%). Table 1 illustrates the breakdown of cost items accrued to each economic agent.

Table 1: Cost borne by the various economic agents

	Cost Items (S\$ billion)	Total Cost (S\$ billion)
Employers	- Staff Turnover Costs	2.31 (22.1%)
	- Training Costs	
	- Loss of Output	
	- Insurance Premiums	
	- Legal Costs	
Workers	- Net Loss of Future Earnings (Future Earnings less Compensation)	5.28 (50.5%)
	- Additional costs of Medical Treatment	
	- Rehabilitation Costs	
Community	- Social Payouts	2.87 (27.4%)
	- Investigation/ Inspection Costs	
	- Fatal Loss of Human Capital	
	- Medical Subsidy	
Total	S\$10.45 billion	

Workers who suffer from partial incapacity may return to work in a reduced capacity, lower paying jobs, possible impediments in career advancement. For those with total incapacity, there would be no return to work at all, implying a total loss of possible future earnings from the date of incapacity. Taken as a whole, these losses and the cost of additional medical and rehabilitation treatment amounted to S\$5.28 billion – greater than the combined cost borne by both employers and community.

3.2 GDP-equivalent of the Costs

The estimated cost of S\$10.45 billion from this study is equivalent to 3.2% of the Singapore GDP in 2011. This is comparable to similar studies done by other countries, e.g. Australia (4.8%) and the ILO (4.0%).

3.3 Enhancing Productivity with Higher Level of WSH Performance

While it should be noted that the costs do not represent the proportion of GDP lost as a result of work-related injuries and ill health, it does indicate **foregone economic activity**. This inevitably hampers the country's productivity push.

With Singapore's growth being dependent on the country's ability to maximise labour, capital, work practices and innovation to achieve greater output, a workforce suffering from a high incidence of ill health and workplace injuries would mean that it would take a significantly greater effort to increase productivity. At the same time, productivity gains and economic growth will be eroded by the costs sustained by the various economic agents from work-related injuries and ill health.

4 Conclusion & Recommendations

4.1 Conclusion and recommendations

The total economic cost was estimated to be **S\$10.45 billion** which is equivalent to **3.2% GDP for 2011**. The costs borne by different economic agents were: S\$2.31 billion (22.1%) by employers; S\$5.28 billion (50.5%) by workers, and S\$2.87 billion (27.4%) by the community. The bulk of the cost was borne by the workers.

The results provide deeper insights into the potential costs of work-related injuries and ill health in Singapore. As this computation breaks the cost down into individual cost items (see Figure 1), it provides the evidence for the relevant stakeholders to identify and prioritise potential levers to reduce the cost of poor WSH practices.

To further improve the economic viability and productivity of Singapore, there should be a concerted action by all stakeholders to reduce the total cost by reducing the number of work-related injuries and ill health in Singapore..

4.2 Future work

As this is the first economic model for Singapore, there will be refinements to the subsequent models so that the individual cost items and the overall GDP equivalent attributable to work-related injuries and ill health can be more accurately computed.

5 References

1. Access Economics (2004). *Costs of Workplace Injury and Illness to the Australian Economy: Reviewing the Estimation Methodology and Estimates of the level and distribution of costs*. Reports for the National Occupational Health and Safety Commission, March 2004.
2. Australian Safety and Compensation Council (2012). *The Costs of Work-related Injury and Illness for Australian Employers, Workers and the community: 2008–09*.
Retrieved from Safe Work Australia website:
<http://www.safeworkaustralia.gov.au/AboutSafeWorkAustralia/WhatWeDo/Publications/Documents/660/Cost%20of%20Work-related%20injury%20and%20disease.pdf>
3. Australian Safety and Compensation Council (2009). *The cost of work-related injury and illness for Australian employers, workers and the community: 2005–06*.
Retrieved from Safe Work Australia website:
<http://safeworkaustralia.gov.au/AboutSafeWorkAustralia/WhatWeDo/Publication/Pages/SR200903InjuryAndIllness2005To2006.aspx>
4. Elgstrand K. and Petersson N.F. (2012). *OSH for Development*. Royal Institute of Technology. 2012.
5. Gervais RL, Pawlowska Z, Bojanowski R, Kouvonen A, Karanika-Murray M, Broek, KV, Greef MD (2009). *Economic performance in small and medium-sized enterprises: a review*. EU-OSHA. 2009.
6. Hamalainen P, Saarela KL, Takala J (2009). *Global trend according to estimated number of occupational accidents and fatal work-related diseases at region and country level*. Journal of Safety Research 40 (2009), 125-139, Elsevier/NSC USA.
Retrieved from OSHA website:
<https://osha.europa.eu/en/press/articles/global-trend-according-to-estimated-number-of-occupational-accidents-and-fatal-work-related-diseases-at-region-and-country-level>
7. IXIX World Congress on Safety and Health at Work: Istanbul Turkey (2011). *ILO Introductory Report: Global Trends and Challenges on Occupational Safety and Health*. Retrieved from ILO website:

http://www.ilo.org/wcmsp5/groups/public/@ed_protect/@protrav/@safework/documents/publication/wcms_162662.pdf

8. ILO Governing Body (2006). *Occupational safety and health: Synergies between security and productivity*. Retrieved from ILO website:
<http://www.ilo.org/public/english/standards/relm/gb/docs/gb295/pdf/esp-3.pdf>
9. International Labour Organization (ILO) (2009). *World Day for Safety and Health at Work 2009 'Facts on safety and health at work'*. Retrieved from ILO website:
http://www.ilo.org/wcmsp5/groups/public/dgreports/dcomm/documents/publication/wcms_105146.pdf
10. International Labour Organization (2011). *ILO Introductory Report: Global Trends and Challenges on Occupational Safety and Health*. Retrieved from ILO website:
http://www.ilo.org/wcmsp5/groups/public/@ed_protect/@protrav/@safework/documents/publication/wcms_162662.pdf
11. International Labour Organization (2013). *"The Prevention of Occupational Diseases."*
12. Health and Safety Executive (HSE). *AstraZeneca Case Study*. Retrieved from HSE website:
<http://www.hse.gov.uk/business/casestudy/astrazeneca.htm>
13. Health and Safety Executive (HSE) *Costs to Britain of workplace injuries and work-related ill health: 2009/10 update*. Retrieved from HSE website:
<http://www.hse.gov.uk/statistics/pdf/cost-to-britain.pdf>
14. Leigh JP (2011). *Economic Burden of Occupational Injury and Illness in the United States*. Retrieved from *The Milbank Quarterly* 2011; 89(4):728–72.
15. MOM, *Report on Labour Force in Singapore (2011)*. Retrieved from MOM website:
http://www.mom.gov.sg/Documents/statistics-publications/manpower-supply/report-labour-2011/mrsd_2011LabourForce.pdf
16. MOM Foreign Workforce Numbers. Retrieved from MOM website:
<http://www.mom.gov.sg/statistics-publications/others/statistics/Pages/ForeignWorkforceNumbers.aspx>

17. MOM 'Labour Cost and Medical Benefits 2009'. This survey was conducted by conducted by Manpower Research and Statistics Department (MRSD), Ministry of Manpower (MOM).
18. MOM, List of Offenders Convicted under Workplace Safety and Health Act, 2011.
Retrieved from MOM website:
<http://www.mom.gov.sg/Documents/safety-health/reports-stats/List%20of%20Offenders%20Convicted%20under%20WSHA%20-%202011.pdf>
19. MOH 'Average hospital inpatient bill size' indicates the cost of medical and surgical specialities for the respective hospital class wards.
Retrieved from MOH website:
http://www.moh.gov.sg/content/moh_web/home/statistics/healthcare_institutions_tatistics/average_hospitalinpatientbillsizetables.html.
20. National Workplace Safety and Health Survey 2010.
21. Pezzulo L. and Crook A. (2006). *The economic and social costs of occupational disease and injury in New Zealand*. Retrieved from NOHSAC Technical Report 4. 2006.
22. Stanford University. (1982). *Improving construction safety performance*. Department of Civil Engineering Technical Report No. 260.
Retrieved from Safety construction website:
http://constructionsafetyconsultant.com/articles/report_a_3.pdf

6 Appendices

- Appendix 1: Abbreviations
- Appendix 2: Comparison of Economic Models
- Appendix 3: Definition and Values
- Appendix 4: Sensitivity Analysis

Appendix 1: Abbreviations

List of Abbreviations used in this Report

1. AF: Attributable Fractions
2. AUD: Australian Dollar
3. EU: European Union
4. DOS: Department of Statistics, Singapore
5. FDW: Foreign Domestic Workers
6. GDP: Gross Domestic Product
7. HPB: Health and Promotion Board, Singapore
8. HSE: Health and Safety Executive, UK
9. ILO: International Labour Organization
10. IRAS: Inland Revenue Authority of Singapore
11. MAS: Monetary Authority of Singapore
12. MOH: Ministry of Health, Singapore
13. MRSD: Manpower Research and Statistic Department, MOM
14. MSF: Ministry of Social and Family Development, Singapore
15. MOM: Ministry of Manpower, Singapore
16. OJT: On-the-Job Training
17. OSHA: Occupational Safety and Health Administration, USA
18. SDF: Skills Development Fund
19. SGD: Singapore Dollar

- 20. UK: United Kingdom
- 21. USA: United States of America
- 22. USD: United States Dollar
- 23. WHO: World Health Organization
- 24. WPR: Western Pacific Region
- 25. WSH: Workplace Safety and Health

Appendix 2: Comparison of Economic Models

Comparison of Economic Models from USA, UK, European Union, and Australia

Different countries have developed their respective economic models in order to estimate the total cost of occupational injuries and diseases. Table A1 provides a review of the economic models that have been developed by the USA, the UK, the EU and Australia.

Table A1: The economic models in the USA, the UK, the EU and Australia (AU)

Source	Estimated total cost of occupational injuries and diseases	Methodology	Definition of direct versus indirect costs
USA (Leigh, 2011) ¹³	USD 250 billion (1.8% GDP)	<ul style="list-style-type: none"> • Cost-of-illness estimates • Incidence method • Prevalence method 	<ul style="list-style-type: none"> • Medical costs for hospital stays and indirect costs such as current and future lost earnings etc. • Indirect costs were divided into morbidity and mortality categories.
UK (HSE, 2011) ²²	GBP 14 billion	Costs to Britain model ('the cost model')	NA
EU (EU-OSHA, 2009) ⁴	Literature review	Literature review	NA

<p>AU (Australian Safety and Compensation Council, 2009)³</p>	<p>AUD 57.5 billion (5.9% GDP)</p>	<ul style="list-style-type: none"> • Incidence approach • Lifetime cost approach • 'ex post' approach 	<ul style="list-style-type: none"> • Direct costs include payments to injured workers from workers' compensation jurisdictions etc. • Indirect costs include lost productivity and loss of current and future earnings etc.
<p>AU (Australian Safety and Compensation Council, 2012)²</p>	<p>AUD 60.6 billion (4.8% GDP)</p>	<ul style="list-style-type: none"> • Incidence approach • Lifetime cost approach • 'ex post' approach 	<ul style="list-style-type: none"> • Direct costs include workers compensation premiums paid by employers etc. • Indirect costs include the loss of productivity and the cost of overtime etc.

Appendix 3: Definitions and Values

Definition and Values of Cost Items

Table A2 shows the individual cost components borne by the respective economic agents: employers, workers and the community. The definitions of the cost components are included as well as the source of information, where applicable.

Table A2: Definition of cost items and the breakdown of individual costs

Cost Items	Definition and Sources of Cost Items	Estimated Total Value (\$ billion)
EMPLOYERS		
Turnover costs	Computed costs to the employer associated with hiring new employees to replace injured or absent workers. This includes advertising costs and the costs associated with time spent in the recruitment process.	2.31
Training costs	Computed costs to the employer associated with training existing staff and retraining new staff. This could arise both from legislative requirements as a result of work-related incidents or simply the need to train staff with new skills as a result of increased responsibility or changed duties.	
Loss of output	Estimated loss of productivity which the employer has to bear due to injured or diseased workers being unable to work.	
Insurance premium	Expenditure spent on insurance premium for injured or diseased workers. MAS Website. 'Premiums of Singapore Insurance Fund Business.' (Source: <i>Net premiums for direct insurers</i>) http://www.mas.gov.sg/statistics/insurance-statistics/annual-statistics/~/_media/resource/data_room/insurance_stat/2011/AG1_2011.ashx)	
Legal fines and penalties	Based on the 'List of Offenders Convicted under WSHA'. (Source: <i>WSH Act</i>) http://www.mom.gov.sg/workplace-safety-health/wsh-regulatory-framework/Pages/workplace-safety-health-act.aspx)	

WORKERS		
Net loss of future earnings (Future earnings minus compensation)	Computed earnings lost where the work-related injury or disease prevents natural career advancement and results in the worker being employed in a lower paid job, suffers a full incapacity or fatality	5.28
Additional costs of Medical Treatment	Medical costs in terms of the total hospital inpatient bill size for both medical specialities and surgical specialities for the respective medical wards. (Source: MOH Website) http://www.moh.gov.sg/content/moh_web/home/statistics/healthcare_institutionstatistics/average_hospitalinpatientbillsizetables/Public_Hospitals-Surgical_Specialties.html)	
Rehabilitation costs	Estimated cost incurred to help the injured workers to return to work.	
COMMUNITY		
Social Payouts	Social welfare payments in terms of disbursements for long term assistance. (Source: Annual report by MSF Comcare Fund) http://app.msf.gov.sg/Portals/0/Summary/publication/CSSD/Community%20Care%20Annual%20Report.pdf	2.87
Investigation/ Inspection costs/ WSH promotion	Estimated cost incurred by OSHD on workplace inspections, accident investigations and promotion of WSH activities.	
Loss of human capital (lifetime cost)	Estimated loss of human capital for fatal cases.	
Medical subsidies	Estimated taking into account the difference between unsubsidised and subsidised wards. (Source: MOH Website) http://www.moh.gov.sg/content/moh_web/home/statistics/healthcare_institutionstatistics/average_hospitalinpatientbillsizetables/Public_Hospitals-Medical_Specialties.html	
Total cost		10.45

Appendix 4: Sensitivity Analysis

With the computed cost of work-related injuries and ill health dependent on the estimated number of such cases, it is important to revisit the earlier assumptions used in its derivations and study the impact on overall cost estimates from changes in these assumptions.

While most parameters are computed via administrative data sources, the number of persons in the working population estimated to have suffered a work-related injury or ill health, a key variable used in the determination of the number of work-related injuries and ill health, was based on survey data. Findings of an internal MOM survey in 2008 found that 1.5% of employed local residents claimed to have suffered a work injury in the past 12 months (from the date of the survey) and 6.9% of them have had a work-related ill health problem.

Using a lower bound of 1.1% and an upper bound of 1.9% for work-related injuries and a lower bound of 6.1% and an upper bound of 7.7% for work-related ill health, results show a possible range of overall cost estimates varying between SGD 9.53 billion to SGD 11.37 billion, a deviation of 12% from estimates using the baseline parameter.