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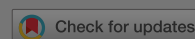
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Original Articles

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

Jukka Takala , Päivi Hämäläinen, Kaija Leena Saarela, Loke Yoke Yun, Kathiresan Manickam, Tan Wee Jin, ...show all

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Abstract

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 illness, and the economic cost of occupational injury and illness.

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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 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 country estimates, the average being 4% according to the ILO. 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% of GDP, while this estimate covers various disorders where work and working conditions may be just one factor of many or where work may aggravate the disease, injury, or disorders, such as traffic injuries, mental disorders, alcoholism, and genetically induced problems. Workplace health promotion, services, and safety and health management, however, may have a major preventive impact on those as well. Leadership and management at all levels, and engagement of workers 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.

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Keyword
occupational

INTRO

Based on different starting points the International Labor Organization (ILO) and the World Health Organization (WHO), have made estimates of occupational injuries and illnesses or burden of disease. ILO has made global estimates from the point of view of occupational burden and WHO from the health point of view. Both of them have come to the conclusion that of all fatalities in industrial countries some 5– 7%^(,) is attributed to work-related illnesses and occupational injuries. This percentage is somewhat smaller in developing countries where non-occupational health problems have a bigger share.⁽¹⁾ While new information gradually becomes available from various sources, and when work processes, work environment, and working populations change quantitatively and qualitatively, updates of the estimates become important. Better evidence is needed for policy and practices in countries, companies, and organizations. This article and related presentation provide the latest updated information for such purposes. The article is based on the Yant Award Lecture of the American Industrial Hygiene Association (AIHA) at its 2013 Congress.

Economic cost studies related to injuries and illnesses have been carried out using different methods. The most appropriate method has been the incidence approach where new injuries, diseases, and disorders occurring in a particular year are counted. Once this is known—e.g., by using the attributable fraction (AF) method—all direct and indirect costs can be calculated, including costs that are extended to the expected total work life starting from an incidence in the year under consideration. Usually long term disabilities, reduced work ability and capacity due to partial disabilities, premature retirement from work, and deaths cause a lion share of economic costs. Studies and estimates by many countries and the ILO have shown that economic costs of work-related illness and injury would be equivalent to a range from 1.8%–6% of GDP.

The objective of this article is to provide an overall view of the latest data and knowledge on workplace safety and health—as yet more evidence for policy and practice

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data for occupational injuries may be replaced by a proxy, a country, or an average of several countries that have closely resembling economic structures and methods of production and work cultures, and that have reported such data well.

Occupational injuries (accidents) are followed and recorded in many countries and the ILO, European Union (EU), and to some extent other regional organizations collect and record such national data. However, national systems are usually poorly standardized and international comparisons are difficult. The best recorded data involves fatal injuries and this is also the starting point for estimating the number of less severe injuries. The methodology on establishing more comparable estimates for occupational deaths and injuries has been described in several papers while the methodology has gradually been improved.⁽⁴⁻⁶⁾

Reliable and comparable occupational disease statistics based on compensated cases are not available at the global level. This lack has been compensated for by the population attributable fractions (AF) for work-related illnesses—a wider concept than the usually legally defined term of “occupational diseases.” The AFs are commonly used to measure the component or fraction of such illnesses and deaths that are related to work. Those fractions have been extensively studied in developed countries but very limited information from developing countries exists. WHO mortality tables by different regions provide background data and by using the AF component as a percentage, it is possible to provide a rough estimate of the fatalities for each disease or group of diseases. ILO and WHO data and complementary data from individual member states and from the EU have been used. These data are based on latest possible sources from the years 2008–2011. Updating is done regularly.⁽¹⁾

The most important AF values used by the ILO study were as follows⁽¹⁾ :

i. work-related cancer: AF = 8.4% (13.8% male, 2.2% female) of all cancer deaths

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iii. extern

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iv. circula

v. respira

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i. communicable diseases: AF = 8.8% (4.8% male, 32.5% female, the latter being high due to occupational infections in the health sector). This high AF value was adjusted for developing countries where health sector exposure is small compared to other exposures in agriculture and elsewhere, such as tropical diseases, bacteria, viruses, and vector-borne diseases.

Studies adapted by ILO for use as global estimates state that the overall AF for work-related causes was 6.7% (2005).⁽¹⁾ The AF method is widely used to assess work-relatedness of a broad range of diseases and disorders.

These AF values have been adapted from those used originally in Finland.⁽¹⁾ These have been used in other parts of the world, in particular, by ILO and in Australia,⁽¹⁾ New Zealand,⁽¹⁾ and Alberta, Canada.⁽¹⁾ Estimates based on these AF values have been reviewed to be the most representative globally⁽¹⁾ so far. While somewhat different AF values have been used, such as those by Steenland (2003),⁽¹⁾ new information has come much closer to the above-mentioned AF values used by the ILO. For example, Rushton et al.,⁽¹⁾ have demonstrated that occupational cancer in the U.K. kills 8010 people annually. After this study a group from the International Agency for the Research of Cancer (IARC), led by MacGormack⁽¹⁾ have shown that the number of mesothelioma cases can be used as an indication and proxy for asbestos exposures that do cause both mesothelioma and lung cancer. The number of deaths caused by lung cancer could be 2–10 times that of mesothelioma. So far much lower lung cancer estimates have been used in past studies. Asbestos alone causes 112,000 deaths annually (Takala/ILO/EU⁽¹⁾) and 90,000 deaths according to WHO⁽¹⁾ and Nishikawa et al.⁽¹⁾ A comparative list of AF values is given in the [Table I](#) enclosed.⁽¹⁾

Table 1 Examples of Attributable Fractions

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Figure 1



Employers

- Staff turnover costs
- Training cost
- Loss of output
- Insurance

The ILO has estimated that 4%% of annual global GDP, or US\$2.8 trillion, is lost due to the direct and indirect costs of occupational accidents and diseases, including lost working time, workers’ compensation, interruption of production, and medical expenses.⁽¹⁾

Many studies on the economic cost of workplace injuries and diseases have been conducted. Leigh⁽¹⁾ estimated that the national cost of work-related injuries and diseases in the United States amounted to US\$250 billion (1.8% of GDP). Safe Work Australia estimated that the costs of work-related injuries and illnesses for Australia were AU\$57.5 billion (5.9% of GDP)⁽¹⁾ for 2005–2006 and AU\$60.6 billion (4.8% GDP) for 2008–2009.⁽¹⁾ The European Agency for Safety and Health at Work made a Member State Survey on the estimated economic costs: some results are as follows⁽¹⁾

- Norway⁽¹⁾ 6.0% of GDP (not in the EU report)
- Sweden 4.0% of GDP
- Finland⁽¹⁾ 3.8% of GDP
- Italy 3.2%
- Denmark 2.7%
- New Zealand⁽¹⁾ 3.4% of GDP (financial cost, not in the EU report)

The report on New Zealand stated that only 10% of the financial cost is compensated and the cost of suffering and premature death was 77% of total costs while the financial costs were 21% of total costs and compensated costs were 2% of all costs.

Figure 2
KL; TUT, J, Saarela



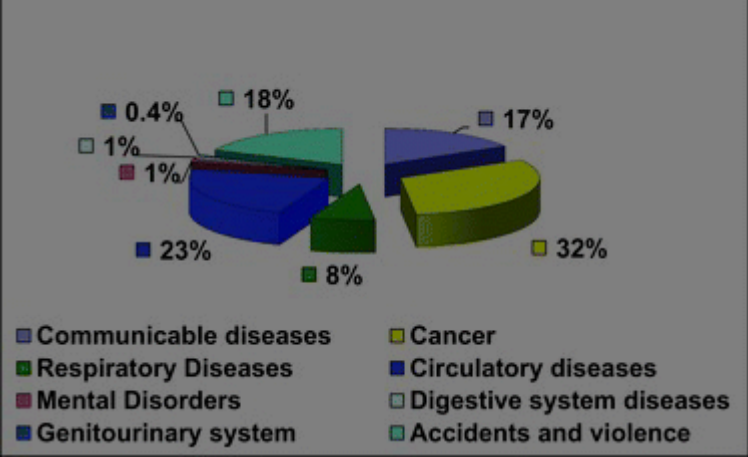
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In estimating the economic costs the Workplace Safety and Health (WSH) Institute in Singapore reviewed the methodologies and cost models from different countries and global estimates when developing a preliminary economic cost model for Singapore. In this model, [Figure 1](#), the 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 premiums, and legal costs incurred were computed as costs borne by employers. The costs borne by workers included expenses beyond those covered by compensation for medical treatment, rehabilitation, and loss of future earnings. Cost items like social payouts, costs of investigation, inspection, and promotion activities, and loss of human capital for fatal cases and medical subsidy were considered as costs borne by community. The adopted incidence model does not take into account the cost from property damage and human pain and suffering.

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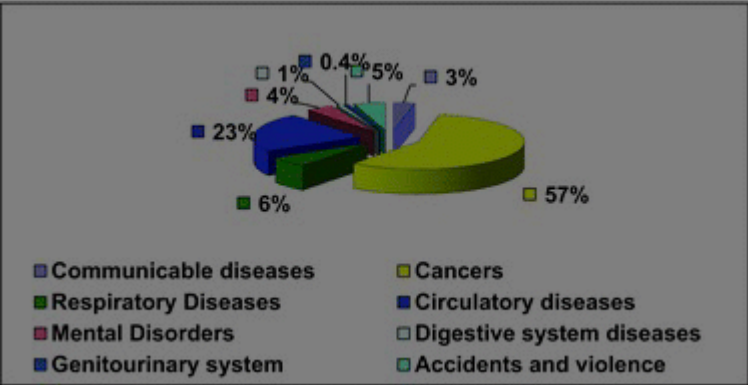
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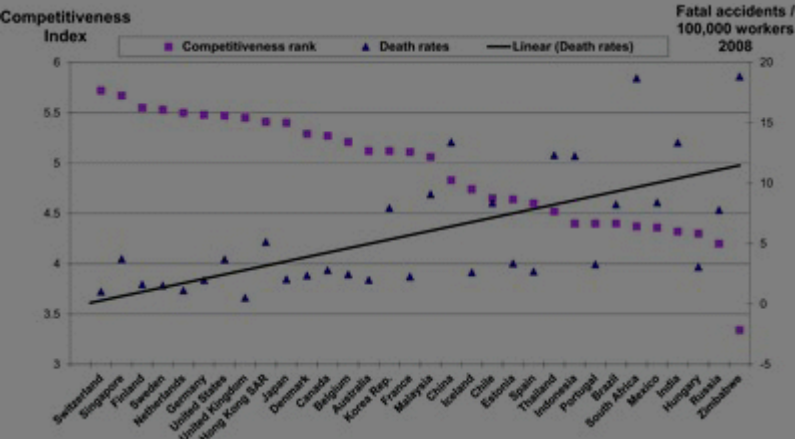
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Figure 3 Work-related annual deaths - EU and the pattern in other industrialized countries (Sources: Hämäläinen P, Takala J, Saarela KL; TUT, ILO, EU-OSHA).



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Figure 4 Inverse correlation of competitiveness and occupational safety (Source: WSH Institute and World Economic Forum Lausanne, Switzerland, 2012–2013 http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2012-13.pdf.



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However, while there has been a clear long-term declining trend for occupational injuries, in global terms this has been offset by the increase in occupational injury fatalities due to shifting of manufacturing, construction, mining, and agriculture in rapidly industrially progressing countries, in particular Asian countries.

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more important. Long-term latency disorders continue to grow and cause fatalities—for example lung cancer and circulatory diseases—and long-term absences caused by musculoskeletal disorders and psychosocial factors. These are ranked as major problems by enterprises and organizations in economic sectors employing a large number of people. These are ranked as major problems by enterprises and organizations in economic sectors employing a large number of people, such as government and municipal workers, health and education sectors.

Competitiveness and safety and health go hand-in-hand; the lower the number of accidents the higher is the competitiveness and productivity. [Figure 4](#) illustrates the link between competitiveness as measured by the World Economic Forum⁽¹⁾ in 2013, and total accident rates using data reported to the ILO.⁽⁶⁾ While ILO data are from the year 2008, the total global numbers have not changed radically from the past. The United States had 96,000 fatal work-related diseases and 5,300 fatal occupational injuries including an adjustment for under reporting, while the competitiveness ranking was the highest in the world in 2008; today the United States is ranked seventh. Canada had 11,330 fatal work-related illnesses and 479 fatal occupational injuries and its competitiveness ranking today is 12.

Regions follow WHO Regions except for the high-income countries and EU27 that are separately covered and excluded from corresponding WHO Regions in [Table II](#).

Table 2 Work- related Injuries and Diseases in the World


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High-income countries are listed in [Table III](#).

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[Figure 5](#)
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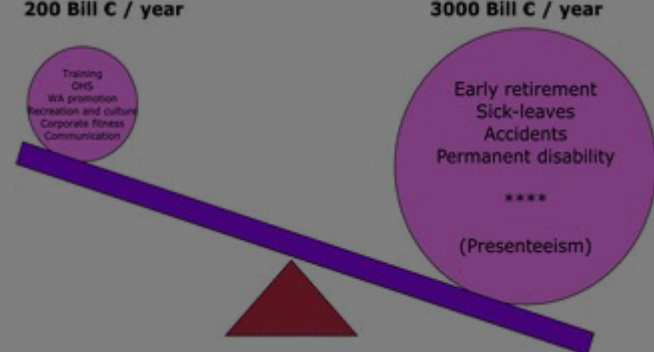
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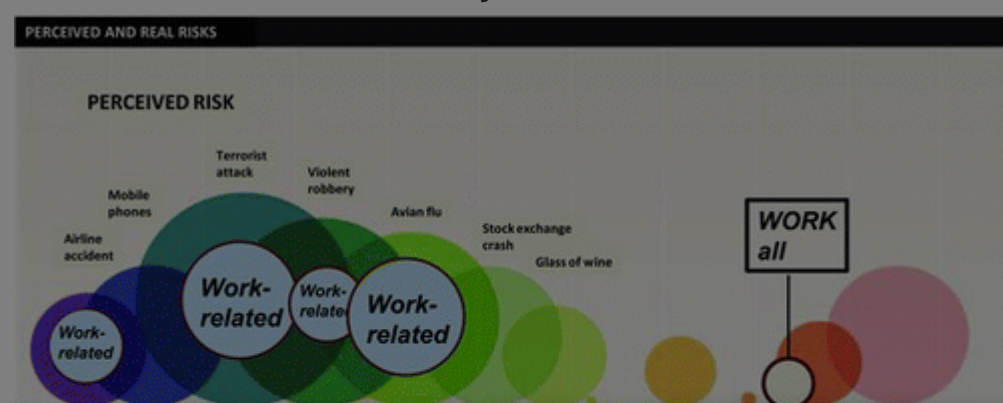
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The only region or group where the level of accident reporting is relatively close to expected numbers is the group of high-income countries. In contrast, most other regions have low levels of reporting. This will also provide a false picture to decision makers believing that there is no reason to be worried. This in turn will become not only an economic obstacle to increasing competitiveness and productivity but will continue to increase pressures for basic human rights. No country has shown a high level of competitiveness and productivity while maintaining poor safety records. Such links exist for companies and organizations as well while small- and medium-sized enterprises may not have firsthand feedback of poor working conditions in the form of accidents that are statistically not common in smaller populations.

Figure 6 Perceptions of people are different from reality (Sources: S. Hertlich, M. Hamilo, S. Kuvalehti [FI], WHO/ILO/J.Takala).



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The EU data related to occupational injuries have been separately studied by Eurostat through a self-reported injury and illness survey in all EU Member States. The result of this study concluded that in the EU27 there were 7 million occupational injuries, or 3.2% of the workforce, in 2007.⁽¹⁾ This validated perfectly the ILO estimate, mentioned previously, that arrived at 7.37 million occupational injuries based on ILO data from 2008, data collection must have been earlier than that. On the other hand 8.6% of workers in the EU-27 experienced a work-related health problem in the past 12 months, which corresponds to 20 million workers.

Economic costs in Singapore

The estimated cost in Singapore was 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%). Workers bore about half of these costs (51%) while the rest is shouldered by employers (22%) and the community (27%).

The circumstances in Singapore reflect 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.

As a whole the magnitude of economic costs in any country and region is radically different from those of the activities targeted to prevention. [Figure 5](#) demonstrates the imbalance between safety and health action and costs of work-related injuries and illnesses including those caused by absenteeism and involuntary early retirement in the EU.⁽¹⁾ The calculations are based on expenditure calculations by Ahonen⁽¹⁾ in Finland and adapted by authors of this article.

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ed to

1. Establishing a Research Agenda setting priorities for the continuous search for evidence for policy and practice⁽¹⁾

2. Building a Risk Observatory or Observatory for Workplace Landscape (OWL).⁽¹⁾

Often perceptions drive action more than real evidence and it is important to highlight the difference between media interest, public attention, and real evidence for policy and practice. Media, including social media, are vital for communication, for reaching large number of stakeholders, workers, small and medium-sized enterprises (SMEs), the informal sector, migrant workers, and vulnerable groups, and to foster a safety culture at places of work. [Figure 6](#) illustrates, however, that misperceptions in assessing risks exist. In particular statistical risks are not easy to assess correctly. Further, common everyday risks are underestimated and complicated technologically and risks not easily controlled by individuals are overrated.

Leadership, management, and systems thinking at all levels⁽¹⁾ and related worker engagement have been identified as key for efforts to ensure workplace safety and health.⁽¹⁾ Recent experiences from mega-projects such as the London Olympics construction effort were successful exactly because of emphasis on and continuous follow-up of these factors.⁽¹⁾

The numbers presented in [Tables I](#) and [II](#) are alarmingly high and often poorly understood, and their importance has been underestimated. One should also keep in mind that the targets or “goal posts” are gradually moving due to changes in work, workplace, and work force. A systems approach is necessary at all levels. An enterprise management system is the strategic component for an organization,⁽³⁹⁾ but an action program for risk assessment and priority setting for risk management is also needed. Collaboration between management and workers at the organizational (enterprise) level must be followed by a national-level mechanism, such as a tripartite advisory

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Labelling of Chemicals (GHS) labelling requirements. One groundbreaking and new longer-term concept, or philosophy, is Vision Zero. The idea is to change the values and mindset of all stakeholders from business as usual and ensure zero accidents, zero illnesses, zero exposures, zero violence, zero harassment, simply zero harm during an entire working life as the ultimate goal. So far it has been launched for selected special needs already, such as the Swedish traffic vision.⁽¹⁾

CONCLUSION

Key action programs should concentrate on finding solutions and reducing exposures for illnesses that have a long latency period. For each injury and illness there are many factors with influence on the negative outcomes. Cultures that start from committed and capable leadership in the organization need to be developed and presently known best practices as well as new innovations at an organization and country levels need to be identified and used. In addition to laws, enforcement, and health and safety services, media including social media should be better used for promotion of safety, health, and well-being at work.

Occupational injuries and work-related diseases and disorders are a bigger problem than estimated earlier. Longer-term risks are gradually increasing in importance at workplaces. A toolbox comprising: (i) legal measures, (ii) enforcement, (iii) knowledge and solutions, (iv) incentives, (v) awareness raising and campaigns, (vi) services available to enterprises and organizations such as occupational health services, and (vii) networking for best exchange of good practice is vital for any successful strategy for safety, health, and well-being at work.

A comprehensive toolbox model is the ILO Convention no.187 on the Promotional Framework for Occupational Safety and Health. It is all about decent work and health.

In the workplace and



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REFERENCES

1. International Labor Organization (ILO): Occupational Safety and Health: Synergies Between Security and Productivity. Geneva: WHO, 2006.
[Google Scholar](#)

2. Murray, C., and A. Lopez: Global Burden of Disease. Geneva: World Health Organization (WHO)/World Bank/Harvard School of Public Health, 1996.
[Google Scholar](#)

3. Elgstrand, K., and N. Petersson: “OSH for Development.” Stockholm, Sweden, Royal Institute of Technology, 2010. Available at https://osha.europa.eu/en/press/articles/review_osh_for_development (accessed May 16, 2013).
[Google Scholar](#)

4. Härmäläinen, P., J. Takala, and K.L. Saarela: Global estimates of occupational accidents. Safety Sci. 44:137–156 (2006).
 | [Web of Science ®](#) | [Google Scholar](#)

5. Takala, J.: “ILO Introductory Report: Decent Work-Safework”. . Available at <http://www.ilo.org/public/english/region/eurpro/moscow/areas/safety/docs/worldcongressreporteng.pdf> (accessed January 20, 2014).
[Google Scholar](#)

6. Härmäläinen, P., K.L. Saarela, and J. Takala: Global trend according to estimated number of occupational accidents and fatal work-related diseases at region and country level. [Google Scholar](#)



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8. Takala, J., M. Urrutia, P. Hämäläinen, and K.L. Saarela: The global and European work environment—Numbers, trends, and strategies. *Scan. J. Work Environ. Health* (7):15–23 (2009).

 | [PubMed](#) | [Web of Science ®](#) | [Google Scholar](#)

9. Nurminen, M., and A. Karjalainen: Epidemiologic estimate of the proportion of fatalities related to occupational factors in Finland. *Scan. J. Work. Environ. Health* 27(3):161–213 (2001).

 | [PubMed](#) | [Web of Science ®](#) | [Google Scholar](#)

10. Fritschi, L., and T. Driscoll: Cancer due to occupation in Australia. *Aust. N. Z. J. Pub. Health* 30(3):213–219 (2006).

 | [PubMed](#) | [Web of Science ®](#) | [Google Scholar](#)

11. Mannetje, A., and N. Pearce: Quantitative estimates of work-related death, disease and injury in New Zealand. *Scand. J. Work Environ. Health* 31(4):266–276 (2005).

 | [PubMed](#) | [Web of Science ®](#) | [Google Scholar](#)


12. Orenstein, M.R., T. Dall, P. Curley, J. Chen, A.L. Tamburrini, and J. Petersen: The Economic Burden of Occupational Cancers in Alberta. Calgary: Alberta Health Services. . Available at <http://www.albertahealthservices.ca/poph/hi-poph-surv-phids-economic-burden-occup-cancer-2010.pdf> (accessed June 10, 2013).

[Google Scholar](#)

13. Driscoll, T., J. Takala, K. Steenland, C. Corvalan, and M. Fingerhut: Review of estimates of the global burden of injury and illness due to occupational exposures. *Am. J. Ind. Med.* 48:491–502 (2005).

 | [PubMed](#) | [Web of Science ®](#) | [Google Scholar](#)

14. Steenland, K., and M. Fingerhut: The global burden of occupational injury and illness. *Am. J. Ind. Med.* 48:491–502 (2005).

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5. Rushton, L., S.J. Hutchings, L. Fortunato, et al.: Occupational cancer burden in Great Britain. Br. J. Can. 107:S3–S7 (2012).

 | [PubMed](#) | [Web of Science ®](#) | [Google Scholar](#)

6. McCormack, V., J. Peto, G. Byrnes, K. Straif, and P. Boffetta: Estimating the asbestos-related lung cancer burden from mesothelioma mortality. Br. J. Can. 106(3):575–584 (2012).

 | [PubMed](#) | [Web of Science ®](#) | [Google Scholar](#)

7. Takala, J.: Asbestos—Chrysotile, Trends and Numbers.” EFBWW Conference, European Parliament, Brussels, . June 30, 2011.

[Google Scholar](#)

8. World Health Organization (WHO): “WHO Mortality Database: World Health Organization Statistical Information System (WHOSIS).” . Available at <http://www.who.int/healthinfo/morttables/en/index.html> (accessed Dec. 10, 2006).

[Google Scholar](#)

9. Nishikawa, K., K. Takahashi, A. Karjalainen, et. al: Recent mortality from pleural mesothelioma, historical patterns of asbestos use, and adoption of bans: A global assessment. Environ. Health Perspect. 116(12):1675–1680 (2008).

 | [PubMed](#) | [Web of Science ®](#) | [Google Scholar](#)

10. Hämäläinen, P.: “Global Estimates of Occupational Accidents and Fatal Work-Related Diseases.” . Ph.D. thesis, Publication 917. Tampere, Finland: Tampere University of Technology, 2010.

[Google Scholar](#)

11. Morreim, E.H.: “The Asbestos Problem: A Review of the Literature.” . In: The Asbestos Problem: A Review of the Literature. Environmental Health Perspectives. 55(1):1–11 (1983).



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12. Leigh, J.: “Asbestos and Cancer.” . In: Asbestos and Cancer. Environmental Health Perspectives. 55(1):1–11 (1983).

23. Australian Safety and Compensation Council: "The Cost of Work-related Injury and Illness for Australian Employers, Workers and the Community." . Available at <http://www.safeworkaustralia.gov.au/sites/swa/about/publications/pages/sr200903injuryandillness2005to2006> (access-ed January 20, 2014) .

Google Scholar

24. Australian Safety and Compensation Council: "The Costs of Work-related Injury and Illness for Australian Employers, Workers and the Community." . Available at <http://www.safeworkaustralia.gov.au/sites/swa/statistics/cost-injury-illness/pages/cost-injury-illness> (accessed January 20, 2014).

Google Scholar

25. European Agency for Safety and Health at Work: ".". Available at <https://osha.europa.eu/en/publications/reports/302> (accessed May 16, 2013).

Google Scholar

26. Rognstad, K.: Costs of occupational accidents and diseases in Norway. Eur. J. Op. Res. 75(3):553-566 (1994).

Web of Science® | Google Scholar

27. Takala, J.: International agency efforts to protect workers and the environment. Int. J. Occup. Environ. Health 5(1):30-37 (1999).

PubMed | Google Scholar

28. L. Pezzullo and A. Crook: "The Economic and Social Costs of Occupational Disease and Injuries." . Available at

<http://www.osha-slc.org/publications/reports/302>

May 16, 2013

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29. Intern

Work.

content/uploads/2013/06/PEROSH_OSH-and-Competitiveness_G_Ahonen_FIOH.pdf

(accessed January 20, 2014).

[Google Scholar](#)

30. Schwab, K.: "The Global Competitiveness Report 2012-2013." Geneva: World Economic Forum, 2012. . Available at

http://www.weforum.org/docs/WEF_GlobalCompetitivenessReport_2012-13.pdf

(accessed June 17, 2013).

[Google Scholar](#)

31. Eurostat: "Statistics in Focus 63/2009: 8.6% of Workers in the EU Experienced Work-related Health Problems." Population and Social Conditions. . Available at

http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-SF-09-063/EN/KS-SF-09-063-EN.PDF (accessed May 16, 2013).

[Google Scholar](#)

32. Takala, J.: "Future Perspectives in Occupational Health and Safety," 5th International FOHNEU Congress, Tarragona, Spain, . Sept. 21, 2012.

[Google Scholar](#)

33. Ahonen, G.: "OSH and Corporate Competitiveness in a Global Context." PEROSH Seminar at European Parliament, Brussels, 2010.

[Google Scholar](#)

34. Chen, Y., S. Tan, and S. Lim: Singapore workplace safety and health research agenda: Research-to-practice. J. Safety Health Env. Res. 8(1):27-32 (2012)

[Google Scholar](#)

35. Obser... h Institute. .

Availa... s.html

(ac...
G...
36. "Lead... Available at
...
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(accessed May 16, 2013).

[Google Scholar](#)

37. “European Campaign on Leadership and Worker Participation,” European Union (EU)-Occupational Safety and Health Administration (OSHA). . Available at <http://www.healthy-workplaces.eu/en/hw2012> (accessed May 16, 2013).

[Google Scholar](#)

38. Takal, J.: Global estimates of traditional occupational risks. (1):62–67 (2005).

[Google Scholar](#)

39. Michaels, D.: “OSHA Saves Lives and Jobs.” United States Department of Labor. . Available at <http://social.dol.gov/blog/osha-saves-lives-and-jobs/> (accessed June 17, 2013).

[Google Scholar](#)

40. Levine, D, I., M.W. Toffel, and M.S. Johnson: Randomized government safety inspections reduce worker injuries with no detectable job loss. Science: 336 (6083), 907–911. . Available at <http://www.sciencemag.org/content/336/6083/907> (accessed June 17, 2013).

[Web of Science ®](#) | [Google Scholar](#)

41. “Vision Zero in Traffic.” . Available at http://en.wikipedia.org/wiki/Vision_Zero (accessed May 16, 2013).

[Google Scholar](#)

42. International Labor Organization (ILO): “Promotional Framework on Occupational Safety and Health.” Available at http://www.ilo.org/public/english/occupational/safety/occupational_safety_and_health_promotional_framework.htm (accessed May 20, 2014).

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