



FUTURE OF OCCUPATIONAL INJURIES

Simo Salminen^{1†} --- Donghyun Seo²

¹Finnish Institute of Occupational Health, Arinatie, Helsinki, Finland

²Korea Occupational Safety and Health Agency, South Korea

ABSTRACT

The aim of this review is to look at the future of occupational accidents by analysing a Finnish Delphi and a British scenario study on the future of occupational safety and health. We then present occupational injury trends from all around the world: Europe, Asia, Australia and New Zealand, Africa, and North America. The connection between economic booms and occupational injury rates was analysed on the basis of five studies from Europe and the United States. We also briefly assess violence at the workplaces. Then we hypothesize on the future trends of occupational accidents. Based on a review of the literature, we draw three conclusions. The first concerns the development of occupational injuries in post-industrialized countries. The second addresses the increase of occupational injuries in industrialized countries. The third conclusion suggests that violence at workplaces will increase in service societies.

© 2015 AESS Publications. All Rights Reserved.

Keywords: Occupational injuries, Occupational violence, Future, Trends, Continents, Economic cycle.

Contribution/ Originality

This study contributes based on the existing literature to the future of occupational injuries and violence. Many studies from different continents showed that in the long-term occupational injuries are decreasing in industrialized countries but violence at workplace is increasing. At the same time, in the developing countries like China and India the occupational accidents grows.

1. INTRODUCTION

The aim of this article is to review the recent trend in occupational injury around the world. Based on these trends, we assume the future of occupational injuries separately for industrialized and post-industrialized countries. As a part of occupational injury, violence at workplaces will be concerned.

† Corresponding author

DOI: 10.18488/journal.1/2015.5.6/1.6.341.354

ISSN(e): 2224-4441/ISSN(p): 2226-5139

© 2015 AESS Publications. All Rights Reserved.

1.1. Long-Term Development of Occupational Injuries

Occupational injuries have been registered in Finland for over 100 years. The number of injuries generally increased until the 1970's except the period of the Second World War. The reason for this was partly industrialization and partly the increasing number of insured employees. After the founding of the Finnish Work Safety Board in 1973, the number of injuries decreased, but in the 1990's the numbers stabilized (Salminen, 2006).

In Italy, occupational accidents have been registered since 1890. They first increased until 1907, but then decreased by one third and stabilized at a lower level. After the Second World War, accident frequency increased slowly until 1965, after which it decreased until 1990. The annual decline was 4% from 1951 to 1998. In the long run, accident frequency corresponded to industrial production (Fabiano *et al.*, 1995;2001)

1.2. The Future of Occupational Safety

In the Delphi study, the participating Finnish safety experts determined the future trends of occupational safety in Finland up to 2015. The five most probable factors increasing injury risks were:

1. An increase in the number of foreign workers
2. An increase in the turn-over of personnel
3. Underestimation of traditional occupational safety work
4. Outsourcing
5. Changes in organizations (Mattila *et al.*, 2012).

Finland had 177 000 immigrant workers in 2010, which was 3.5% of the workforce at the end of 2009 (Reini, 2012). According to a review of 31 studies, foreign-born workers were over two times more often involved in occupational injuries than native workers (Salminen, 2011). However, one Finnish study showed that immigrant bus drivers did not have more occupational injuries than Finnish drivers (Salminen *et al.*, 2009).

Almost half of fatal injuries in the Finnish manufacturing industry occurred to external employees. Injuries occurred most commonly during installations or work preparations. Victims of fatalities were more often young workers from small companies (Nenonen, 2011). The risk of occupational injury has increased in temporary agency work. This might be due to the significant use of temporary agency work in traditionally injury-prone industries, such as manual work in production and construction (Hintikka, 2011).

In 2040, workers will change jobs with increasing frequency in order to stay employed (Cornish, 2005). Increasing turn-over in companies will lead to rise in the number of new employees. Several studies (Butani, 1988; Breslin *et al.*, 2008; Chau *et al.*, 2010) have shown that the risk of occupational injury decreases with length of service in the company. The risk of occupational injury during the first day in a company is up to 50 times higher than after working there for one year (Larsson, 1988)

Underestimation of traditional occupational safety work may lead to an increase of occupational accidents. In Germany, the significant success of effective noise control measures has reduced the number of new pensions over the 30 years (Liedtke and Jürgens, 2004), but this

success could be lost in 10 years, if work on these control measures is stopped (Toppila, 2012). On the other hand, a recent study from California (Levine *et al.*, 2012) showed that randomized government safety inspections decreased the injury rate in the participating establishments by 9.4%. Traditional occupational safety work is thus also still effective, when it is done well.

The British safety and health authority, the Health and Safety Executive (HSE), collected twenty-eight experts to assess the future of occupational health and safety in 2017. The result was four scenarios:

1. The Digital Rose Garden, in which Britain has harnessed the creativity of its diverse society. British businesses are flourishing and British employees are staying at home. People think differently about risks and safety through "a return to a more rational view".
2. Boom and Blame is a dog-eat-dog arena. People are worried about their future. Manufacturing has mostly been outsourced to other countries. The workplace is the office more often than the factory floor. Workplace safety is still as high a priority, but stress is the top health issue.
3. Tough Choices means future that seems nasty and brutish. The decline in the economy has kept unemployment high and the best of the young have been driven overseas. There is enough work for all but the health divide has grown wider. Safety at work is a priority for employees, because the media are referring to Britain's accident epidemic.
4. A Virtue of Necessity makes Britain one great seaside town consisting of older people. They take greater responsibility for their own well-being. Britain has fewer large industries but there is an increasing trend of small business. Personal responsibility is the key word in occupational safety and health (Schultz, 2007).

1.3. Trends of Occupational Injury in Different Countries

In the five selected European Union countries, fatal occupational injuries clearly declined in 25 years (1975-2000). The annual crude rate change percentage was the highest in Sweden (-6.7%), and the lowest in Spain (-3.7%) and in Finland (-3.8%). The researchers believed that the falling trend could be real (Benavides *et al.*, 2005).

Europe

In Finland, the fatality rate in the construction industry increased from 11.9 per 100 000 employees in 1977 to 12.5 in 1991 or 5%, and declined in the manufacturing industry from 5.9. per 100 000 employees to 3.5 or 41%. This contradictory development can be explained by pro-cyclic approximation in the construction industry and the normal positive result of safety work in manufacturing (Saloniemi and Oksanen, 1998).

A high technological level was associated with a low accident ratio in Sweden from 1960 to 1995. During the same time period, production increased by 71% and the accident rate declined from 2.2 per million working-hours to 1.3 or 69%. However, technological development has decreased the number of occupational accidents by 50% from the expected level (Lyttkens, 1982).

In Denmark, the number of occupational injuries decreased from 53 963 in 1984 to 38 970 in 2003. At the same time, the number of fatalities declined from 87 to 51. Thus occupational injuries decreased by 27.8% and fatalities by 41.4% over twenty years (Rasmussen *et al.*, 2004).

In Norway, the occupational injury rate increased by 127% from 41 per 100 000 working years in 1991 to 93 in 1996. The injury rate increased with increasing age (Bull *et al.*, 1999), and falls were the most frequent injury event among both men and women (Bull *et al.*, 2001).

The industrial revolution took place in the United Kingdom between 1760 and 1830 and led to rapid urbanization and the growth of the modern industrial society. The first law of labour protection was passed in 1802 and the latest strategy was implemented in 2004. Between 1974 and 2011 fatal injuries fell by 82% (from 2.9 per 100 000 employees to 0.5) and reported non-fatal injuries decreased by 76%. Half of the reduction in non-fatal injuries was explained by changes in patterns of employment and mixes of occupations (Harrison, 2012). Fatalities in the British Coal industry had steadily declined since nationalization in 1947 (Singleton, 1982). Minor workplace injuries in the UK were affected by the level of economic activity, whereas the rate of major injuries was not influenced by cyclical fluctuations (Davies *et al.*, 2009).

In Spain, the number of fatal injuries between 1992 and 2002 was 8 510. The incidence of fatal injuries decreased from a rate of 9.8 per 100 000 workers in 1992 to 6.1 in 2002, representing an overall reduction of 38%. The highest decline was among employment industries, women and permanent employment (Santamaria *et al.*, 2006).

Portugal is also a Member State of the European Union. Its number of occupational injuries decreased from 1992 to 1995 by 27%, but eventually stabilized until 2001. Increasing labour flexibility and overtime work led to a significant increase in fatal accidents during the first decade of the 2000's (Macedo and Silva, 2005).

In the Former Czechoslovakia, injury frequency decreased by 34.0% from 5.21 in 1969 to 3.26 in 1979. The fatality rate declined from 1.26 per 10 000 employees in 1969 to 0.83 in 1979, which is a fall of 34.1%. However, economic losses due to accidents increased during this decade (Bauer, 1982).

In Austria, the rate of fatal and non-fatal occupational injuries decreased from 8.59% in 1955 to 4.08% in 2004. This may have been caused by an increasing gross domestic product, which resulted in greater investments in safer technologies, and the falling of unemployment (Barth *et al.*, 2007). However, empirical evidence from Austria showed that higher dismissal rate also decreased the reporting of moderate accidents (Boone *et al.*, 2011), a factor that also led to a decreasing number of occupational injuries.

In the former Yugoslavia, the number of fatal accidents was 366 in the ten-year period from 1990 to 1999. The fatality rate dropped from 9.3 per 100 000 employees in 1990 to 3.8 in 1996, which means a 59% decline (Glavaski *et al.*, 2003). In Slovenia, the most of industrialized part of the area, both the fatal and the non-fatal occupational accident rate had dropped significantly since the early 1960s, but in the 1990s no obvious declining trend was seen (Pavlic *et al.*, 2011). In 2000, 25 940 work injuries and 26 fatalities were reported in Slovenia, which means that the fatality and non-fatality rates were at the European Union level (Bilban, 2005). In the Serbian rubber manufacturing industry and in the production of electrical goods and equipment, the occupational accident rate declined significantly after 1997, when the surveillance and prevention programme was implemented (Jovanovic *et al.*, 2005).

In Greece, the occupational injury rate decreased in the period from 1938 to 1945 but increased during from 1946 to 1955. The fatality rate increased across the period 1938-1945 and subsequently decreased after that. These changes were related to changes in the level of economic activity during the Second World War (Rachiotis *et al.*, 2004).

Asia

In Turkey, the occupational injury rate declined from 15.0 per 1 000 workers in 2000 to 10.9 in 2005. During the same time period, the fatality rate decreased from 23.4 per 100 000 employees to 15.5. This means that in five years the injury rate and fatality rate fell by 26.8% and 33.9%, respectively. Permanent disabilities also began to fall in 2002 (Unsar and Sut, 2009).

In Israel, occupational accident incidence decreased from 78.0 per 1000 employees in 1970 to 62.3 in 1980, which means a 20% decline in ten years. The decrease in the severity of accidents was smaller. The manufacturing industry accounted for most of the decrease (Pines *et al.*, 1992).

In Jordan, the fatality rate dropped from its highest at 77.87 per 100 000 actively insured employees in 1982 to 9.99 in 1993. This means nearly an eightfold decrease over 12 years. Rabi *et al.* (1998) explain this rapid change by general improvements in safety management and hazard control.

In Yazd City, Iran, the number of construction accidents increased from 31 to 86 over a period of 20 years. Based on this information, the researchers (Halvani and Ibrahemzadih, 2012) estimated that the number of construction accidents would exceed 300 by 2011, if the prevention of accidents is not successful.

India has the second largest population in the world, exceeding 1.2 billion. About 64% is working aged. The Director General of the Factory Advisory Services & Labour Institutes reported 1 509 fatal and 33 093 non-fatal injuries in 2009. However, these numbers are grossly underestimated (Pingle, 2012).

In Singapore, the national plan of action has reduced the workplace fatality rate from 4.9 per 100 000 workers in 2004 to 2.2 per 100 000 workers in 2010. This huge reduction has succeeded through the co-operation of all relevant parties, a new safety and health act with increased coverage of workplaces and stricter penalties for violations, the promotion of benefits, and the recognition of best practices. The Prime Minister of Singapore has now set a goal to reduce the fatality rate to 1.8 within a decade (Koh, 2012).

China has the largest population and the highest number of employed people in the world. The longest follow up of occupational fatalities started in 1953. At first the fatality rate decreased steadily, but the first peak (55 per 100 000 workers) appeared during 1957-1961. The rate then dropped to the level of 10 per 100 000 workers, which was 5.9 times lower than the highest value. The second peak reached the level of 45 in 1971, but after this the fatality rate declined steadily until 1992. After a low peak in 1992, occupational fatalities turned downwards (Song *et al.*, 2011). During the last years (2000-2008) the fatality rate has first increased slowly and then decreased by as much as 31% (Zhangtao, 2010; Tao *et al.*, 2011). The improved fatality rate is closely connected to the economic development of China (Song *et al.*, 2011).

In Taiwan the rate of occupational injuries causing permanent disability decreased from 1.63 per 10 000 workers in 1983 to the level of 0.59 in 1993, which means a 64% drop (Chang and Wang, 1997). The fatal occupational injury rate declined from 6.8 per 100 000 in 1994 to 0.8 in 2005. This was a drop of 89%, which means an annual decline of 7.4%. The annual decrease was faster for males than for females and for older workers than for younger ones (Ho *et al.*, 2010).

The fatality rate declined in Japan from 0.06 per million work hours in 1955 to 0.02 in 1975, which means a drop of 67% in twenty years. In 1975 the Japanese fatality rate was lower than that of the USA, the UK, West Germany and Italy. The injury rate was highest in small establishments (Reich and Frumkin, 1988).

In South Korea the injury rate at workplaces decreased from 5.00% in 1974 to 1.30% in 1994 (Jeong, 1997) and injury-related mortality declined by 32% between 1996 and 2006 (Hong *et al.*, 2011). Being caught in and between objects was the most common type of non-fatal accidents, whereas falls from a height most often caused fatalities (Jeong, 1999). The Korean economic crisis in 1998 caused a slow decrease in fatalities for several years after the crisis (Min *et al.*, 2010). However, it has been estimated that the real injury rate is two to three times higher than that officially reported (Won *et al.*, 2007). The Korean government has set a goal to decrease occupational deaths by 50% during the third five-year plan for prevention of industrial accidents (2010-2014). A survey of Korean companies showed that they saw the leadership of the company owner as the most critical factor in achieving this national goal (Kang *et al.*, 2012).

Australia and New Zealand

The overall rate of workplace fatalities declined steadily over the period 1982 to 1992 in Australia. The death rate was 3.6 per 100 000 persons in 1992, which was 32% lower than the rate of 5.3 deaths in 1982. The rates of work-road deaths also decreased over the period 1982 to 1992 but not as smoothly as workplace fatalities (Driscoll *et al.*, 2002). The decline continued, because the death rate was 1.9 per 100,000 workers in 2010 (Macdonald *et al.*, 2012).

In New Zealand the fatality rate of occupational accidents decreased from 8.1 per 100 000 workers in 1975 to 6.3 in 1984. This means a 22% decline over 10 years. The self-employed had a higher fatality rate than salaried workers (Cryer and Fleming, 1987). Between 1985 and 1994, the fatality rate dropped by 32% to the level of 5.0 per 100 000 workers (Feyer *et al.*, 2001).

Africa

In Nigerian factories, the fatality rate varied from 0.9% in 1990 to 5.4% in 1994. However, it had no linear up- or downward trend (Ezenwa, 2001). The underreporting of injuries may confuse these statistics. Managerial problems caused most of failures in the Nigerian restaurants (Oparanma and Gabriel, 2012).

In Ghana, occupational injury rate was four times higher in rural areas (44.9/1000 employees) than in urban areas (11.5). Motor vehicle incidents and lacerations were two leading injury mechanisms. Especially in rural areas children were injured rather often in occupational accidents (Mock *et al.*, 2005). In the Ghanaian gold mines the total injury rate has steadily decreased from 16.17 per 1000 workers in 1997 to 5.09 in 2002, while the fatality rate declined from 0.89 to 0.12

per 1000 over the same period (Sutherland, 2011). Organizational factors like Perceived Organizational Support, Organizational Citizenship Behaviour, and safety compliance explained occupational accidents among Ghanaian industrial workers more than individual factors like age, gender or education (Salminen *et al.*, 2013).

In the 89 enterprises operating in Khartoum State, Sudan, recorded 371 occupational accidents during the period from 2005 to 2007, of which 76% caused injury, 20% disability, and 4% fatality. Chemical industry had the highest the frequency-severity index and the metallurgic industry the lowest index. Employees who were male, older, divorced, and had lower levels of education had the lowest safety performance indicators (Zaki *et al.*, 2012).

North America

In Quebec, Canada, the fatality rate among men declined from 12.7 per 100 000 in 1981 to 8.2 in 1984, which means a 35% drop in three years. Among women, rates varied from 0.2 to 0.8 per 100 000, but women had excess mortality from violent acts (Rossignol and Pineault, 1993). The overall incidence of fatal accidents in Ontario declined to 2.5 per 100 000 in 1986-1989 (Shannon *et al.*, 1993). It is estimated that still 42% of lost time injuries in Ontario could be prevented (Shannon and Vidmar, 2004).

In the mining industry in the US, the fatality rate decreased from 300 per 100 000 miners in 1911 to around 30 in 1997 (Stout and Linn, 2002). The injury rate fell slightly between 1973 and 1991 and had a strong negative relationship with unemployment. From 1992 to 2007 the downward trend was strong and consistent, but had no correlation with unemployment (Bhushan and Leigh, 2011). The number of workers dying on the job decreased from approximately 7300 in 1980 to 5300 in 1995, with an accompanying reduction in the annual rate of fatal occupational injuries from 7.4 to 4.3 per 100 000 workers. This means that the fatality rate declined at an estimated 3.3% per year (Loomis *et al.*, 2003).

A state-based Fatality Assessment and Control Evaluation (FACE) programme in the US showed significantly reduced fatal falls in the period spanning 1990 to 1998, but not decrease in electrocutions (Menendez *et al.*, 2012). It is estimated that deindustrialization explained 10-15% of the decline of the fatal occupational injury rate from 1980 to 1996 (Loomis *et al.*, 2004).

1.4. Occupational Accidents and the Economic Cycle

It seems that economic development determines the rate of occupational injury. In California, injury rates in the manufacturing and construction industries were strongly influenced by general economic conditions - rising sharply with business upsurges and declining during the recessions between 1957 to 1982 (Robinson, 1988; Robinson and Shor, 1989). In the US, workplace injuries were positively related to the business cycle and negatively to unemployment from 1976 to 2007 (Asfaw *et al.*, 2011). Injury and employment rates from 1970 to 1999 in the US, Canada, France, Finland, and Sweden showed that economic expansion can result in increases in workplace injury rates. However, safety measures and declined employment had a counter effect and led to a net reduction in the occupational injury rate (Ussif, 2004).

Boone and Van Ours (2006) examined the role of the economic cycle from another perspective. Their theory is based on the idea that reporting an accident affects the reputation of a worker and raises the probability of losing one's job. If unemployment is high, a worker faces a great loss when dismissed, and fewer accidents are reported. The empirical data sets from 16 OECD countries show that cyclical fluctuations influence the reporting of moderate workplace accidents, but not of fatal accidents.

1.5. Consideration of Future Safety

A new concept and measure "Consideration of Future Safety Consequences (CFSC)" has been presented (Probst *et al.*, 2013). An empirical study with American pulp and paper workers showed that CFSC was a significant predictor of safety knowledge, safety motivation, safety behaviour, safety compliance, experienced accidents and workplace injuries. However, a later study with American copper mill workers showed that CFSC was no longer a significant predictor of experienced accidents, the proportion of unreported accidents, or workplace injuries. Because workplace are usually studied retrospectively, this new concept can open a new perspective to the accident research.

1.6. The Future of Occupational Injuries

In the future we can expect a slow decrease in the injury rate in Finland due to changes in the structure of industries. When service industries replace manufacturing industries, injury prevalence is likely to slow down. However, economic cycles determine the amount of injuries, at least in the short run (Salminen, 2009).

The decline of occupational injuries has raised discussion about the goal of zero vision. In the Swedish road safety policy, Vision zero states that in the long run, no person should be killed or seriously injured as a consequence of road traffic (Rosencrantz *et al.*, 2007). In Finland, Vision zero is interpreted more ideologically or as a way of thinking rather than a concrete goal. However, Finnish companies have voluntarily joined the Zero Accident Forum, in which they can exchange their best accident prevention practices.

1.7. Violence at the Workplace

In the United States, the estimated rate of homicide declined by 0.9% annually from 1980 to 1995, which was slower than the decline of unintentional fatal injuries (Loomis *et al.*, 2003). From 1993 to 2002 the decline of workplace homicides was 6% per year (Hendricks *et al.*, 2007). The decline was fastest in public administration (-5.3%) from 1983 to 1992, but the fatality rate increased (+2.6%) in wholesale trade (Bailer *et al.*, 1998). The retail industry had the highest number of homicides and total cost, at \$ 2.1 billion between 1992 and 2001 (Hartley *et al.*, 2005). A higher rate of fatal occupational injury was found within a state policy climate favouring business over labour, such as the South and Northeast States (Loomis *et al.*, 2009).

Based on five interview studies of injury and violence victims in Finland (Heiskanen, 2007) violence had steadily increased at Finnish workplaces from 2% in 1980 to 5.3% in 2009. Women encountered violence at their work twice more often (7%) than men (4%). In addition,

compensation claims to insurance companies showed that violence increased 35% from 2003 to 2006 and the proportion of female victims increased from 58% to 64% (Hintikka and Saarela, 2010).

2. CONCLUSIONS

Based on the previous literature, we draw the following conclusions:

1. The rate of occupational injuries and fatalities will slowly decrease in industrialized countries. The main reason for this is the change from an industrial society to a service society. Finding new, safer technology will help this development. However, the last injuries are more complex and caused by several different factors, and their prevention is more challenging.
2. Occupational injuries will increase in newly industrialized countries such as China and India. When Western companies move their production to these countries, they also bring occupational injuries with them. Prevention of occupational injuries comes later on the list of priorities.
3. Violence at work will increase in service societies. This is partly due to the lowering of respect for employees; customers now often vent their anger on service workers. It may be that companies and employees in the service sector have not taken the risk of violence seriously; this is shown by the low degree of training for dealing with violent clients.

REFERENCES

- Asfaw, A., R. Pana-Cryan and R. Rosa, 2011. The business cycle and the incidence of workplace injuries: Evidence from the U.S.A. *Journal of Safety Research*, 42(1): 1-8.
- Bailer, A.J., L.T. Stayner, N.A. Stout, L.D. Reed and S.J. Gilbert, 1998. Trends in rates of occupational fatal injuries in the United States (1983-92). *Occupational and Environmental Medicine*, 55(7): 485-489.
- Barth, A., R. Winker, E. Ponocny-Selinger and L. Sögner, 2007. Economic growth and the incidence of occupational injuries in Austria. *Wiener Klinische Wochenschrift*, 5-6(119): 158-163.
- Bauer, M., 1982. Work accidents and their effect on the Czechoslovakian economy. *Journal of Occupational Accidents*, 4(2-4): 205-223.
- Benavides, F.G., J. Benach, J.M. Martínez and S. González, 2005. Description of fatal occupational injury rates in five selected European union countries: Austria, Finland, France, Spain and Sweden. *Safety Science*, 8(43): 497-502.
- Bhushan, A. and J.P. Leigh, 2011. National trends in occupational injuries before and after 1992 and predictors of workers' compensation costs. *Public Health Reports*, 126(5): 625-663.
- Bilban, M., 2005. Occupational medicine in the Slovene area. *Journal of Occupational Health*, 3(47): 193-200.
- Boone, J. and J.C. Van Ours, 2006. Are recessions good for workplace safety? *Journal of Health Economics*, 6(25): 1069-1093.
- Boone, J., J.C. Van Ours, J.P. Wuellrich and J. Zweimüller, 2011. Recessions are bad for workplace safety. *Journal of Health Economics*, 30(4): 764-773.
- Breslin, F.C., E. Tompa, R. Zhao, J.D. Pole, B.C. Amick, P.M. Smith and S. Hogg-Johnson, 2008. The relationship between job tenure and work disability absence among adults: A prospective study. *Accident Analysis and Prevention*, 1(40): 368-375.

- Bull, N., T. Riise and B.E. Moen, 1999. Occupational injuries reported to insurance companies in Norway from 1991 to 1996. *Journal of Occupational and Environmental Medicine*, 9(41): 788-793.
- Bull, N., T. Riise and B.E. Moen, 2001. Mechanisms of occupational injuries reported to insurance companies in Norway from 1991 to 1996. *American Journal of Industrial Medicine*, 39(3): 312-319.
- Butani, S.J., 1988. Relative risk analysis of injuries in coal mining by age and experience at present company. *Journal of Occupational Accidents*, 10(3): 209-216.
- Chang, Y.C. and J.D. Wang, 1997. Trends in major occupational injuries in different industrial divisions in Taiwan during 1983-1993. *Journal of Occupational Health*, 39(4): 295-301.
- Chau, N., P. Wild, D. Dehaene, L. Benamghar, J.M. Mur and C. Touron, 2010. Roles of age, length of service and job in work-related injury: A prospective study of 446 120 person-years in railway workers. *Occupational and Environmental Medicine*, 67(3): 147-153.
- Cornish, E., 2005. *Futuring. The exploration of the future*. Bethesda, MD: World Future Society.
- Cryer, P.C. and C. Fleming, 1987. A review of work-related fatal injuries in New Zealand 1975-84 - numbers, rates and trends. *New Zealand Medical Journal*, 100(816): 1-6.
- Davies, R., P. Jones and I. Nunez, 2009. The impact of the business cycle on occupational injuries in the UK. *Social Science & Medicine*, 2(69): 178-182.
- Driscoll, T., R. Mitchell, J. Mandryk, S. Healey, L. Hendrie and B. Hull, 2002. Trends in work-related fatalities in Australia, 1982 to 1992. *Journal of Occupational Health and Safety - Australia and New Zealand*, 1(18): 21-33.
- Ezenwa, A.O., 2001. A study of fatal injuries in Nigerian factories. *Occupational Medicine*, 8(51): 485-489.
- Fabiano, B., I. Parentini, A. Ferraiolo and R. Pastorino, 1995. A century of accidents in the Italian industry: Relationship with the production cycle. *Safety Science*, 1(21): 65-74.
- Fabiano, B., F. Curró and R. Pastorino, 2001. Occupational injuries in Italy: Risk factors and long term trend (1951-98). *Occupational and Environmental Medicine*, 58(5): 330-338.
- Feyer, A.M., J. Langley, M. Howard, S. Horsburgh, C. Wright, J. Alsop and C. Cryer, 2001. The work-related fatal injury study: Numbers, rates and trends of work-related fatal injuries in New Zealand 1985-1994. *New Zealand Medical Journal*, 114(1124): 6-10.
- Glavaski, M., I. Mikov, M. Savic, M. Lugumerski and M. Arsic, 2003. Fatal occupational injuries in Yugoslavia: 1990 to 1999. *Journal of Occupational Health*, 45(2): 127-130.
- Halvani, G. and M. Ibrahimzadih, 2012. Epidemiological study and estimating of accidents distribution in construction industry workers in Yazd city by applying time series until 2011. *International Journal of Occupational Safety and Health*, 1(2): 26-30.
- Harrison, J., 2012. Occupational safety and health in the United Kingdom: Securing future workplace health and wellbeing. *Industrial Health*, 50(4): 261-266.
- Hartley, D., E.A. Biddle and E.L. Jenkins, 2005. Societal cost of workplace homicides in the United States, 1992-2001. *American Journal of Industrial Medicine*, 47(6): 518-527.
- Heiskanen, M., 2007. Violence at work in Finland; trends, contents, and prevention. *Journal of Scandinavian Studies in Criminology and Crime Prevention*, 8(1): 22-40.
- Hendricks, S.A., E.L. Jenkins and K.R. Anderson, 2007. Trends in workplace homicides in the U.S., 1993-2002: A decade of decline. *American Journal of Industrial Medicine*, 50(4): 316-325.

- Hintikka, N., 2011. Accidents at work during temporary agency work in Finland - Comparisons between certain major industries and other industries. *Safety Science*, 3(49): 473-483.
- Hintikka, N. and K.L. Saarela, 2010. Accidents at work related to violence - analysis of finnish national accident statistics database. *Safety Science*, 4(48): 517-525.
- Ho, S.C., L.Y. Wang, C.K. Ho and C.Y. Yang, 2010. Fatal occupational injuries in Taiwan: 1994-2005. *Occupational and Environmental Medicine*, 4(67): 251-255.
- Hong, J., W.K. Lee and H. Park, 2011. Change in causes of injury-related deaths in South Korea, 1996-2006. *Journal of Epidemiology*, 6(21): 500-506.
- Jeong, B.Y., 1997. Characteristics of occupational accidents in the manufacturing industry of South Korea. *International Journal of Industrial Ergonomics*, 20(4): 301-306.
- Jeong, B.Y., 1999. Comparisons of variables between fatal and nonfatal accidents in manufacturing industry. *International Journal of Industrial Ergonomics*, 23(5-6): 565-572.
- Jovanovic, J., M. Jovanovic, S. Lekovic, A. Arizanovic and S.S. Adamovic, 2005. Occupational accidents in Serbian industries in transition. *Central European Journal of Public Health*, 2(13): 66-73.
- Kang, Y.S., S.W. Yang, T.G. Kim and D.S. Kim, 2012. Systematic strategies for the third industrial accident prevention plan in Korea. *Industrial Health*, 6(50): 567-574.
- Koh, D.S.Q., 2012. Can we reduce workplace fatalities by half? *Safety and Health at Work*, 3(2): 104-109.
- Larsson, T., 1988. Risk and the inexperienced worker: Attitudes of a social anthropologist. *Journal of Occupational Health and Safety: Australia and New Zealand*, (4): 35-40.
- Levine, D.I., M.W. Toffel and M.S. Johnson, 2012. Randomized government safety inspections reduce worker injuries with no detectable job loss. *Science*, 336(6083): 907-911.
- Liedtke, M. and W.W. Jürgens, 2004. Thirty years of enforced noise control at German workplaces - effective prevention? Paper Presented at the 13th International Conference on Noise Control, Gdynia, Poland.
- Loomis, D., J.F. Bena and A.J. Bailer, 2003. Diversity of trends in occupational injury mortality in the United States, 1980-96. *Injury Prevention*, 9(1): 9-14.
- Loomis, D., D.B. Richardson, J.F. Bena and A.J. Bailer, 2004. Deindustrialisation and the long term decline in fatal occupational injuries. *Occupational and Environmental Medicine*, (61): 616-621.
- Loomis, D., M.D. Schulman, A.J. Bailer, K. Stainback, M. Wheeler, D.B. Richardson and S.W. Marshall, 2009. Political economy of US states and rates of fatal occupational injury. *American Journal of Public Health*, 8(99): 1400-1408.
- Lyttkens, C.H., 1982. The relation between accidents and output in Swedish industry. *Journal of Occupational Accidents*, 4(2-4): 233-242.
- Macdonald, W., T. Driscoll, R. Stuckey and J. Oakman, 2012. Occupational health and safety in Australia. *Industrial Health*, (50): 172-179.
- Macedo, A.C. and I.L. Silva, 2005. Analysis of occupational accidents in Portugal between 1992 and 2001. *Safety Science*, 5-6(43): 269-286.
- Mattila, S., J. Lappalainen and M. Aaltonen, 2012. Korkean riskin työpaikkojen tunnuspiirteiden määrittäminen. Delfoi-tutkimus (Characteristics of High Risk Workplaces. A Delphi Study). Helsinki: Työterveyslaitos.

- Menendez, C.C., D. Castillo, K. Rosenman, R. Harrison and S. Hendricks, 2012. Evaluation of a nationally funded state-based programme to reduce fatal occupational injuries. *Occupational and Environmental Medicine*, 11(69): 810-814.
- Min, K.B., J.Y. Min, J.B. Park, S.G. Park and K.J. Lee, 2010. Changes in occupational safety and health indices after the Korean economic crisis: Analysis of a national sample, 1991-2007. *American Journal of Public Health*, 11(100): 2165-2167.
- Mock, C., S. Adjei, F. Acheampong, L. Deroo and K. Simpson, 2005. Occupational injuries in Ghana. *International Journal of Occupational and Environmental Health*, (11): 238-245.
- Nononen, S., 2011. Fatal workplace accidents in outsourced operations in the manufacturing industry. *Safety Science*, 10(49): 1394-1403.
- Oparanma, A.O. and J.M.O. Gabriel, 2012. Causes of failures in hospitality industry in Port Harcourt, Nigeria. *International Journal of Asian Social Science*, 5(2): 583-586.
- Pavlic, M., B. Likar, A. Pavlic and M. Markic, 2011. Managing occupational injuries records in Slovenia from 1948 to 2008. *Safety Science*, 6(49): 834-842.
- Pines, A., C. Lemesch and O. Grafstein, 1992. Regression analysis of time trends in occupational accidents (Israel, 1970-1980). *Safety Science*, 2(15): 77-95.
- Pingle, S., 2012. Occupational safety and health in India: Now and the future. *Industrial Health*, 50(3): 167-171.
- Probst, T.M., M. Graso, A.X. Estrada and S. Greer, 2013. Consideration of future safety consequences: A new predictor of employee safety. *Accident Analysis and Prevention*, 55: 124-134. Doi: 10.1016/j.aap.2013.02.023. Epub 2013 Mar 4.
- Rabi, A.Z., L.W. Jamous, B.A. AbuDhaise and R.H. Alwash, 1998. Fatal occupational injuries in Jordan during the period 1980 through 1993. *Safety Science*, 3(28): 177-187.
- Rachiotis, G., T.C. Constantinidis, G. Dounias, S. Drivas and V. Makropoulos, 2004. Occupational injuries in Greece (1938-1955): History of medicine and descriptive epidemiology. *Epidemiologia e Prevenzione*, 6(28): 350-354.
- Rasmussen, K., O. Carstensen, D. Glasscock, K. Nielsen and O.N. Hansen, 2004. Arbejdsulykker i Danmark - forekomst og forebyggelse. *Ugeskr Laeger*, 49(166): 4464-4467.
- Reich, M.R. and H. Frumkin, 1988. An overview of Japanese occupational health. *American Journal of Public Health*, 7(78): 809-816.
- Reini, K., 2012. Maahanmuuton taloudelliset vaikutukset. Vieraskielisen työvoiman aluetaloudelliset vaikutukset pohjanmaalle (The Economic Effects of Immigration. The Regional Economic Effects of Immigrant Labour on Ostrobothnia). Report 12/2012. Helsinki: National Institute for Health and Welfare.
- Robinson, J.C., 1988. The rising long-term trend in occupational injury rates. *American Journal of Public Health*, 3(78): 276-281.
- Robinson, J.C. and G.M. Shor, 1989. Business-cycle influences on work-related disability in construction and manufacturing. *Millbank Quarterly*, 67 (Suppl 2 Pt 1): 92-113.
- Rosencrantz, H., K. Edvardsson and S.O. Hansson, 2007. Vision zero - is it irrational? *Transportation Research Part A*, 41(6): 559-567.

- Rossignol, M. and M. Pineault, 1993. Fatal occupational injury rates: Quebec, 1981 through 1988. *American Journal of Public Health*, 11(83): 1563-1566.
- Salminen, S., 2006. Työtapaturmien kehitys 1997-2003 Työ ja terveystutkimuksen valossa (Development of Occupational Injuries between 1997 and 2003 in the Light of the Work and Health Survey). *Työ ja Ihminen*, 3(20): 249-253.
- Salminen, S., 2009. Työtapaturmat (Occupational Injuries). In K. Tiirikainen (Ed.). *Tapaturmat Suomessa*. Helsinki: Edita. pp: 103-109.
- Salminen, S., 2011. Are immigrants at increased risk of occupational injury? A literature review. *Ergonomics Open Journal*, (4): 139-144.
- Salminen, S., S.A. Gyekye and A. Ojajärvi, 2013. Individual and organizational factors of safe behaviour among Ghanaian industrial workers. *Engineering Management Research*, 1(2): 98-110.
- Salminen, S., M. Vartia and T. Giorgiani, 2009. Occupational injuries of immigrant and Finnish bus drivers. *Journal of Safety Research*, 3(40): 203-205.
- Saloniemi, A. and H. Oksanen, 1998. Accidents and fatal accidents - some paradoxes. *Safety Science*, 1(29): 59-66.
- Santamaria, N., N. Catot and F.G. Benavides, 2006. Tendencias temporales de las lesiones mortales (Traumáticas) por accidente de trabajo en España (1992-2002). *Gaceta Sanitaria*, 4(20): 280-286.
- Schultz, W., 2007. HSE futures scenario building. The future of health and safety in 2017. Research Report RR600. Norwich: Health and Safety Executive.
- Shannon, H.S., L. Hope, L. Griffith and D. Stieb, 1993. Fatal occupational accidents in Ontario, 1986-1989. *American Journal of Industrial Medicine*, 23(2): 253-264.
- Shannon, H.S. and M. Vidmar, 2004. How low can they go? Potential for reduction in work injury rates. *Injury Prevention*, 10: 292-295.
- Singleton, W.T., 1982. Accidents and the progress of technology. *Journal of Occupational Accidents*, (4): 91-102.
- Song, L., X. He and C. Li, 2011. Longitudinal relationship between economic development and occupational accidents in China. *Accident Analysis and Prevention*, 1(43): 82-86.
- Stout, N.A. and H.I. Linn, 2002. Occupational injury prevention research: Progress and priorities. *Injury Prevention Suppl*, 4(8): iv9-iv14.
- Sutherland, D.K.B., 2011. Occupational injuries in a gold mining company in Ghana. *African Newsletter on Occupational Health and Safety*, 1(21): 8-10.
- Tao, Z., W. Ming-Xiao, X. Miao-Rong and J. Ming-Qiu, 2011. Analysis of traumatic occupational fatalities in China. *American Journal of Industrial Medicine*, 7(54): 560-564.
- Toppila, E., 2012. Työhyvinvoinnin huuma - työsuojelun tuho? (Ecstasy of Well-Being at Work - Destruction of Work Safety?). *Työ Terveysturvallisuus*, 4(42): 52.
- Unsar, S. and N. Sut, 2009. General assessment of the occupational accidents that occurred in Turkey between the years 2000 and 2005. *Safety Science*, 5(47): 614-619.
- Ussif, A.A., 2004. An international analysis of workplace injuries. *Monthly Labor Review*, March: 41-51.
- Won, J., Y. Ahn, J. Song, D. Koh and J. Roh, 2007. Occupational injuries in Korea: A comparison of blue-collar and white-collar workers' rates and underreporting. *Journal of Occupational Health*, 1(49): 53-60.

- Zaki, G.R., F.A. El-Marakby, Y.H. Deign El-Nor, F.H. Nofal and A.M. Zakaria, 2012. Occupational safety of different industrial sectors in Khartoum State, Sudan. Part 1: Safety performance evaluation. Journal of Egyptian Public Health Association, 87(5-6): 131-136.
- Zhangtao, 2010. Analysis on occupational-related safety fatal accident reports of China, 2001-2008. Safety Science, 5(48): 640-642.

Views and opinions expressed in this article are the views and opinions of the authors, International Journal of Asian Social Science shall not be responsible or answerable for any loss, damage or liability etc. caused in relation to/arising out of the use of the content.