Severe Under-reporting of Work Injuries in Many Countries of the Baltic Sea Region:

An exploratory semi-quantitative study

“What goes unreported goes unfixed”

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Literature
Executive summary

The Baltic Sea Network on Occupational Health and Safety (BSN) (Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Northwest Russia, Norway, Poland, Sweden) has paid attention to an apparent problem related to monitoring systems that provide statistical indicators of work injuries.

In Estonia, Latvia, Lithuania, Poland, and the Russian Federation, the rates of fatal work injuries have been much higher than the EU-15 average. Yet, the incidence rates of non-fatal work injuries have been very low at the same time. A high rate of fatal work injuries in combination with a low rate of non-fatal work injuries suggests that much of the non-fatal work injuries have remained unregistered.

Under-reporting of work injuries is known to be widespread in many countries. However, the actual size of under-reporting has largely remained unquantified. The reason for this is that it is a challenging and expensive task to measure the true level of occurrence of work injuries in a country by using strict epidemiological methods.

The aim of the present exploration was to provide estimates of the order of magnitude about the size of occurrence and levels of reporting and under-reporting of non-fatal work injuries in the BSN countries. The study conducted semi-quantitative data analyses of monitoring statistics that had been submitted by national authorities to the International Labour Organization during a 5-year period between 2003 and 2007.

Eurostat has earlier noted that the reporting of non-fatal work injuries is nearly complete in Finland and Germany, where the compensation schemes encourage reporting by positive incentives. Statistical indicators from Finland, Germany, and the EU-15 average were used as benchmarks against which the indicator data of work injuries of other countries were compared.

Two separate schemes were used for making big-picture estimations on the reporting levels of non-fatal work injuries.

In the first scheme, incidence rates of work injuries of benchmark countries were applied to the workforce of a country. Then the calculated numbers of work injuries were compared with the registered numbers in the official statistics.

In the second scheme, the expected numbers of non-fatal work injuries were calculated by multiplying the registered number of fatal work injuries in a country by an external coefficient (ratio between fatal and non-fatal injuries) of a benchmark country.
The empirical external coefficients (ratio between fatal and non-fatal injuries) were calculated by dividing the number of non-fatal work injuries in a benchmark country by the number of fatal work injuries. In the EU-15, 4,011 fatal and 4,048,491 registered non-fatal work injuries occurred in 2005. Thus, for each fatality there were 1,009 registered non-fatal work injuries. In Finland the corresponding coefficient was 1,290 and in Germany 1,148.

The results of the order-of-magnitude analyses indicate that in several BSN countries the level of reporting of non-fatal work injuries (>3 days absence from work) was less than 10 to 20% of the estimated true level. The results are based on using two separate schemes of estimation in parallel and three different benchmark countries or regions. The results are in concordance with earlier estimates that had also covered some of the BSN countries.

As a consequence of severe under-reporting of work injuries, the decision makers of many BSN countries may have at their disposal seriously deceptive statistical information when setting policy objectives, estimating economic loss, or defining priorities on the national agenda.
1 Introduction

A basic principle for preventing and minimizing injuries and diseases is to have a system that provides correct information on both the occurrence and settings associated with those conditions.

Indicators of work injuries provide the most commonly used outcome measures of performance of occupational health and safety management. They also play a central role in identifying appropriate targets for prevention. Reliable statistical information is vital for setting policy objectives, adopting suitable policy measures, monitoring for trends, and making performance evaluation.

Reasonable estimates of the magnitude of work injuries are needed to provide a quantitative base for calculating the economic costs of work injuries to employees, employers, industries, and the government. A prerequisite is that the statistical information is reasonably reliable. Serious under-reporting of work injuries could result in mistaken policy measures and heavily flawed economic estimations.

The Baltic Sea Network on Occupational Health and Safety (BSN) (Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Northwest Russia, Norway, Poland, Sweden) has discussed the apparent problems in the region related to monitoring and surveillance systems that are the sources for statistical summaries on work injuries.

The indicators of work injuries particularly in the Formerly Socialist Economies have shown an improbable pattern. In such countries, the rates of fatal work injuries have been much higher than the EU-15 average. Yet, the incidence rates of non-fatal work injuries have been very low at the same time. A high rate of fatal work injuries in combination with a low rate of non-fatal work injuries suggests that much of the non-fatal work injuries remain unregistered.

The BSN Network considered it important to carry out a simple descriptive comparison of statistical indicators of work injuries in the member countries and an exploratory attempt for estimation of order-of-magnitude levels of reporting and under-reporting of non-fatal work injuries.

2 Background about work injury epidemiology

To provide context to the present BSN study, some features about work injury epidemiology are included below.
Recent publications on the estimates of the scope of occurrence rates of work injuries offer international overviews to the social and economic importance of work injuries (see Takala 1999; Leigh et al. 1999; Driscoll et al. 2005; Hämäläinen et al. 2006; Takala 2009; Hämäläinen et al. 2009; Eurostat 2010; Takala et al. 2014; Nenonen et al. 2014).

2.1 Occurrence and reporting of fatal work injuries

A fatal work injury hardly remains unnoticed at workplaces. Hence macro-level indicators based on work fatalities are often considered the most reliable outcome measures of overall OH&S performance. However, studies in industrialized countries suggest that under-reporting of fatal work injuries might actually be substantial in some circumstances.

An enlightening case comes from the United States. In 1987, the National Academy of Sciences issued a report, “Counting Injuries and Illnesses in the Workplace: Proposals for a Better System.” As a consequence of deficiencies noted in the system, changes were made. The most pronounced change was how fatal work injuries were counted. As a consequence of the changes made in the monitoring system, the number of fatal work injuries doubled in the first year of the new system. This 100% increase in the number of deaths was due to the implementation of a new and accurate system to count the fatal work injuries (see Rosenman 2008).

In Australia, in a period between 1989 and 1992, a comparison of the coroners’ records with official statistics (the Ministry of Labor, compensation data, death certificates, etc.) showed that 34% of fatal work injuries were not listed by any of these institutions. Only 35% of deaths were found in the statistics of the Ministry of Labor. The compensation data covered 57% of these deaths (Driscoll et al. 2003; see Brière et al. 2012). Substantial variations were observed according to economic sector, worker status and the type of accident.

**Nordic countries**

A comparison of fatal work injuries from 1980 to 1989, showed that the incidence rate was highest in Finland (4.2 deaths per 100,000 workers), lower in Norway (3.9), and 31% lower in Denmark (3.0) and Sweden (2.9) (Matthiasen et al. 1993). This indicates that in the 1980s the safety level in Danish and Swedish workplaces was better than in Finnish workplaces (Matthiasen et al., 1993; see Salminen et al. 2000).

The rate of fatal work injuries in the Nordic countries has been among the lowest in the world.

In Norway, Wergeland et al. (2009) estimated that during 2000-2003 the real number of fatal work injuries was 44% higher than the number of deaths registered by the Labour Inspection Authority.
2.2 Occurrence of non-fatal work injuries

In the United States about 4.4 work injuries for every 100 full-time equivalent workers are reported each year (Bureau of Labor Statistics, 2007).

The European Statistics on Accidents at Work (ESAW) in 2007 indicated that 2.9% of the workers suffered a work injury requiring at least 4 days of absence from work. In line with that, according to the Labour Force Survey ad hoc module 2007, 3.2% of the workers had a work injury in the past 12 months in the EU27 (Eurostat 2010). In the United States, about 4.2% of the workers reported a work injury in 2007 (Bureau of Labor Statistics 2007).

In contrast to the occurrence rates of about 3% per year of work injuries (at least 4 days of absence from work) in many Western European countries, many countries of Eastern Europe show work injury rates that are much below 1% per year. It is not likely that the reported low incidence rates in Eastern Europe were due to safer working conditions, because the incidence rates of fatal work injuries in those countries typically are several times higher than in the Western Europe.

2.3 Under-reporting of non-fatal work injuries

Under-reporting of work injuries is not a new issue to the research community. There is no disagreement in the empirical literature that an under-reporting exists and that this under-reporting is significant.

In some countries, the level of under-reporting may be much larger than even most experts would anticipate. For instance, estimations in Latvia indicated that the rate of registered work injuries may be 15–20 times lower than expected (Vanadzins and Martinsone 2012).

A body of research (Leigh et al. 2004; Lowery et al. 1998; Probst and Estrada 2010; Rosenman et al. 2006) suggests that the reported numbers of work injuries in the USA significantly underestimate the true numbers of non-fatal work injuries. Much of this is due to employee under-reporting, i.e., failing to notify a work injury to company officials.

Between 60–80% of all work injuries apparently were not captured in the national database in the USA (Lowery et al. 1998; Probst et al. 2008; Probst and Estrada 2010; Rosenman et al. 2006). Some 40%–50% of work-related injuries in Canada may go unreported (Thompson 2007).

In the Norwegian maritime industry, the number of unreported injuries made up roughly 50% of all work injuries (Hassle et al. 2011).
2.4 Critical points for monitoring work injuries

For any surveillance system to be accurate, employees must first inform their employers when they are injured at work. If this does not occur, employers are not able to accurately record this injury. Second, organizations must accurately report documented injuries experienced and reported by their workers to the appropriate regulatory authority. Failure at either stage will result in flawed surveillance data.

Thus, flawed surveillance data of work injuries arises when (see Probst and Estrada 2010):

a) organizations fail to record work injuries to the statutory authorities (organizational-level under-reporting) or
b) employees fail to report work injuries to the appropriate company officials (individual-level under-reporting).

Organizational-level under-reporting has been linked to multiple factors including organizational size, industry branch, perceived lack of management responsiveness and organizational safety climate, while individual-level under-reporting has been linked with variables such as fear of reprisals or loss of benefits, and with a general acceptance that injuries are a fact of life in certain lines of work (see Probst and Estrada 2010).

2.5 Terminology

The concepts “work accident” and “work injury” are often used almost interchangeably, although they are separate entities.

According to the ILO definition, an occupational injury is defined as any personal injury, disease or death resulting from an occupational accident. A case of occupational injury is the case of one worker incurring an occupational injury as a result of one occupational accident. An occupational accident is an unexpected and unplanned occurrence, including acts of violence, arising out of or in connection with work that results in one or more workers incurring a personal injury, disease or death.

If the event that results in an injury is intentional in its nature, then it is no longer an accident (e.g., injuries caused by acts of violence in the workplace). Moreover, although an accident may result in an injury, it can also lead to environmental or material damage without causing any injuries or casualties to personnel. (see Samant 2014)
2.6 Comparing the incomparable

A group of Nordic experts have prepared a report about the register data of 1,243 fatal work injuries that occurred in 2003 to 2008 in the Nordic countries (Tomasson et al. 2011). A key objective was to find out how feasible it is to combine the information from the work injury statistics in the Nordic countries.

The comparison between the Nordic countries showed relatively minor differences concerning the systems. However, there were small differences in nearly all aspects of the process, even though the same ESAW classification system was used. The expert group concluded that a more analytical study was not possible as the Nordic registries are not similar enough to facilitate a solid scientific comparison in an acceptable manner.

It is easy to agree that there are important aspects about work injury epidemiology that must be investigated with scientific rigor. Such studies require strict comparability between specific variables. Yet, such a scientific degree of accuracy is hardly needed when evaluating the performance of a routine monitoring system of work injuries and the comparison of the findings to those of the neighbouring countries.

So, resource-intensive scientific research is needed for specific purposes. However, “research” also means gathering of information for immediate practical needs, for policy formulation, evaluation of something, etc.

Comparability is a relative concept. There cannot be absolute comparability, only degrees of comparability.

Everything can be evaluated

It is not easy to measure the national level of reporting of work injuries. However, one cannot exclude from the scope of performance evaluation an important indicator for the reason that it is difficult to measure. Everything can be evaluated at least in qualitative terms.

Appropriate imprecision acceptable

Quantitative comparisons between different countries can be problematic for several reasons. It does not mean that comparisons between countries are not possible.

Comparability is a relative concept. There cannot be absolute comparability, only degrees of comparability.

Countries can be compared, within reason, even when precise quantitative analyses are not possible. Semi-quantitative and qualitative methods, profes-
sional expertise and experience, and common sense can be applied. Appropriate imprecision can well be tolerated in such comparisons.

The fact that some extent of error is inevitable but can still be an improvement on prior knowledge is central to how experiments, surveys, and other scientific measurements are performed (see Hubbard 2007).

3 Research questions

Regarding the BSN countries, even relatively elementary statistics on work injuries have not been available in an easily comparable manner.

The aims of the present descriptive and exploratory report were to provide a reasonably informative comparative big picture description about the main indicators of work injuries in ten BSN countries, and to estimate the order of magnitude of levels of reporting and under-reporting of non-fatal work injuries.

Main research questions addressed

- Checking the availability of data in the ILO Yearbook of Labour Statistics for comparisons across branch of economic activity and gender in the BSN countries
- Compiling comparative big picture summaries about indicators of work injuries in the BSN countries.
- Approximating the level of reporting and under-reporting of non-fatal work injuries in the BSN countries.

4 Objectives of the study

The study had the following main objectives:

- To prepare reasonably informative comparative summaries of statistical outcome indicators of work injuries in the BSN countries
- To provide big-picture comparisons between BSN countries by main economic activities and by gender, where possible
- To provide rough estimations of levels of reporting and under-reporting of work injuries in the BSN countries by using exploratory methods.

The main objective was to make more clearly visible to the decision makers that great differences exist between the BSN countries with regard to the
incidence rates of work injuries, and to estimate the approximate levels of under-reporting of non-fatal work injuries.

Another wide objective was to explore the landscape of work injuries in the BSN countries in order to provide the basis of more conclusive further research should that be considered worthwhile.

5 Methods

5.1 Exploratory semi-quantitative analysis of secondary data

The undertaking was an exploratory study to provide a rough measure about the occurrence of non-fatal work injuries in the BSN countries, and the level of reporting of work injuries.

The study conducted semi-quantitative data analyses of administrative statistics about work injuries submitted by the national authorities to the ILO Yearbook of Labour Statistics 2008.

It has to be noted that a semi-quantitative analysis is not precision driven. It provides approximations about issues under study. The results are given in the form of point approximations or as a range of approximations.

Two strategies to estimate the reporting level

Finland, Germany, and the EU-15 were used as benchmarks against which the indicator data of work injuries of other countries was compared.

Two separate schemes were used for making big-picture estimations on the reporting levels of non-fatal work injuries.

One strategy was to identify benchmark countries whose OH&S performance has been exemplary. After that, to make a simulation, a thought experiment was conducted, as if the whole workforce of a country would had been working for one year in a benchmark country. The incidence rate of non-fatal work injuries of the benchmark country would be applied to the workforce of the country that is to be estimated. The numbers of cases of injuries when working in the benchmark country would be compared to the reported numbers in the official statistics.

In a second strategy the expected “true” numbers of non-fatal work injuries were calculated by multiplying the annual number of fatal work injuries (5-year average) in a country by external coefficients (ratio between fatal and
non-fatal work injuries) that were calculated from data of the benchmark countries.

5.2 Countries included

The study addressed the countries of the Baltic Sea Network on Occupational Health and Safety. The BSN network covers 10 countries or regions: Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Northwest Russia, Norway, Poland, and Sweden.

5.3 Period of observation

For this report data covering the period 2003 to 2007 have been used. This period was chosen due to the availability of consistent data.

Using only one year for analysis would not offer robust indicators for relatively rare events, such as fatal work injury, in the small BSN countries, particularly when considering separate branches of economic activity and gender. Therefore statistical data of five years were combined in order to increase the robustness of the indicators.

5.4 Data sources

The main source of information was the ILO Yearbook of Labour Statistics 2008 which is an international reference on statistics of labour questions, bringing together in systematic form data from national authorities. The Yearbook contains fatal and non-fatal work injury data and supplementary data describing the scope of the data included in each country’s statistics.

The second source of data was the report “Causes and circumstances of accidents at work in the EU” by the European Commission which provides the incidence rates of injuries at work with at least 4 days’ absence from work in the EU-15 countries for 1995-2005 (European Commission 2009).

The International Labour Office (ILO) and Eurostat use secondary data that are provided by national data collectors.

5.4.1 ILO Yearbook of Labour Statistics 2008

The ILO Yearbook of Labour Statistics 2008 is the last printed collection published in this series. Since 2008 the online ILO databases have been upgraded from the LABORSTA (data up to 2008) to the ILOSTAT database (data from 2009 onwards). Official ILO data were not available beyond 2010 at the time of this analysis. There is a significant amount of missing data in the ILOSTAT database for the most recent years.
The national agencies are requested to provide the data to the ILO in conformity with the most up-to-date international statistical guidelines in this field, currently the Resolution concerning statistics of occupational injuries (Resolution ... 1998).

Despite of requests to deliver data in conformity with international guidelines, separate countries often provide data that are not exactly in line with recommendations.

The type of statistics for a particular country depends on the source used. Data on work injuries are most frequently obtained from work accident reporting systems or work injury compensation schemes, sometimes from surveys of establishments and of households.

Absolute numbers of work injuries and non-standardized incidence rates:

The ILO Yearbook 2008 provides the absolute numbers of registered work injuries and the non-standardized incidence rates per 100,000 employees by country, branch of economic activity, and gender. However, incidence rates by branch of economic activity or by gender are not available for all countries.

Separate incidence rates are available for fatal injuries and non-fatal injuries leading to absence from work.

**5.4.2 International Standard Industrial Classification of all Economic Activities (ISIC)**

In the ILO Yearbook of Labour Statistics 2008, the data are published according to the International Standard Industrial Classification of all Economic Activities (ISIC), Revision 3. ISIC is a United Nations system for classifying economic data. In 2008, the classification framework for branch of economic activity changed from ISIC-3 to ISIC-4, so that direct comparison of specific rates by branch of economic activity was not possible across this period.

Eurostat uses the NACE (Revision 2) classification of economic activities, which is derived from ISIC. ISIC and NACE have exactly the same items at the highest levels of classification.
5.5 Economically active population vs. source population for work injuries

Economically active population:

The economically active population comprises all persons of either sex who furnish the supply of labour for the production of goods and services during a specified time-reference period. (laborsta.ilo.org/appv8/data/c1e.html)

Source population:

A source population constitutes from employees who have been under monitoring and the base from which the reported injuries have arisen. It is often different from the size of the economically active populations. The size of the source population was back-calculated from the data included in the ILO Yearbook 2008. The numbers of reported and expected work injuries were used to count the level of reporting within the monitoring system.

Comparison between the size of the economically active populations and the source populations of the occurrence of the work injuries in the BSN countries is shown below. The size of the source population has been back-calculated using the indicators printed in the ILO Yearbook of Labour Statistics 2008.

<table>
<thead>
<tr>
<th></th>
<th>Economically active population 1)</th>
<th>Source population for the fatal work injuries 2) year 2005 A</th>
<th>Source population for the non-fatal work injuries 2) year 2005 B</th>
<th>Obs?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>2,862,000</td>
<td>2,759,520</td>
<td>2,772,808</td>
<td></td>
</tr>
<tr>
<td>Estonia</td>
<td>659,600</td>
<td>659,609</td>
<td>655,872</td>
<td></td>
</tr>
<tr>
<td>Finland</td>
<td>2,640,000</td>
<td>2,047,619</td>
<td>2,180,000</td>
<td>Obs</td>
</tr>
<tr>
<td>Germany</td>
<td>41,150,000</td>
<td>36,760,000</td>
<td>37,637,673</td>
<td>Obs</td>
</tr>
<tr>
<td>Latvia</td>
<td>1,135,000</td>
<td>1,045,251</td>
<td>1,045,251</td>
<td>Obs</td>
</tr>
<tr>
<td>Lithuania</td>
<td>1,606,800</td>
<td>1,165,146</td>
<td>1,165,147</td>
<td>Obs</td>
</tr>
<tr>
<td>Norway</td>
<td>2,400,000</td>
<td>2,443,150</td>
<td>2,443,150</td>
<td></td>
</tr>
<tr>
<td>Poland</td>
<td>17,162,000</td>
<td>10,630,434</td>
<td>-</td>
<td>Obs</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>73,432,000</td>
<td>25,288,000</td>
<td>25,211,832</td>
<td>Obs</td>
</tr>
<tr>
<td>Sweden</td>
<td>4,533,000</td>
<td>4,402,819</td>
<td>4,402,819</td>
<td></td>
</tr>
</tbody>
</table>

1) Denmark: year 2001; 2) backcalculated from data in the ILO Yearbook 2008; 3) LABORSTA Internet 1A Total and economically active population; A: backcalculated from indicators of fatal work injuries; B: backcalculated from indicators of non-fatal work injuries

Remarkable differences are evident between the size of the economically active population and the source population from which the work injuries have
been reported, particularly in the Russian Federation, Poland and Lithuania, and also in Finland, Germany, and Latvia.

The present analysis focused to estimate the level of reporting of non-fatal work injuries in the source populations. We have not expanded the calculations to comprise the whole economically active workforce (see Takala 1999, Hämäläinen et al. 2006, Takala et al. 2014).

Addressing the whole economically active workforce will be necessary when estimating the total economic loss caused by work injuries.

5.6 Comparability problems of work injury statistics across countries

The sources, methods of data collection, coverage and classifications used in the ILO Yearbook of Labour Statistics may differ between countries. The coverage may be limited to certain types of workers (employees, insured persons, full-time workers, etc.), certain economic activities, establishments employing more than a given number of workers, cases of injury losing more than a certain number of days of work, etc. (ILO Yearbook 2008).

Care must be taken when using the data for making international comparisons of work injuries. A number of previous studies have summarized limitations to international comparisons of rates of work injury (see Lilley et al. 2013). These include differences in case ascertainment, inconsistent case definitions, denominator data, inclusion criteria, etc.

To compare reliably work injury data of the BSN countries would require the availability of reasonably similar information on work injuries. However, great differences exist between BSN countries in this respect.

Given the diverse systems of occupational accident and disease recording and notification in member States, it is impossible to say with any degree of certainty whether the available information accurately reflects the actual situation. In addition to procedural divergences, the types and definitions of data elements differ widely from country to country. (see: International Labour Conference 2002)

A synoptic table of selected input variables related to work injury statistics shows differences in the BSN countries. The table does not include all sources for differences between countries.

[As was mentioned earlier in Section 2.6, a Nordic group of experts has evaluated the monitoring systems of work injuries in the Nordic countries. The evaluation came to a conclusion according to which arduous scientific studies could not be undertaken by combining the Nordic monitoring data because of problems with overall comparability of the details.]
Table 1. Synoptic table of selected input variables for the Baltic Sea Network countries.

<table>
<thead>
<tr>
<th>BSN Country</th>
<th>&quot;Coverage&quot;</th>
<th>Type of data and source</th>
<th>Minimum period of lost work days</th>
<th>Type of workers</th>
<th>Economic activities</th>
<th>Occupational diseases</th>
<th>Commuting accidents</th>
<th>Abbreviations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark⁴¹</td>
<td>workers employed</td>
<td>C/Ins</td>
<td>1 day</td>
<td>I</td>
<td>All</td>
<td>Included</td>
<td>Included</td>
<td>C = compensated injuries; C/Ins = compensated injuries/Insurance scheme</td>
</tr>
<tr>
<td>Estonia</td>
<td>workers insured</td>
<td>R/Not</td>
<td>1 day</td>
<td>E</td>
<td>All</td>
<td>Included</td>
<td>Included</td>
<td>R = reported injuries; R/Ins = reported injuries/Insurance scheme; R/Not = reported injuries/Notification system</td>
</tr>
<tr>
<td>Finland</td>
<td>employees</td>
<td>C/Ins</td>
<td>4 days</td>
<td>E, SE</td>
<td>All</td>
<td>Included</td>
<td>Included</td>
<td>R/Survey = reported injuries/survey of establishments or establishment reporting</td>
</tr>
<tr>
<td>Germany</td>
<td>full-time equivalent workers</td>
<td>C/Ins</td>
<td>3 days²</td>
<td>E, SE</td>
<td>All</td>
<td>Included</td>
<td>Included</td>
<td></td>
</tr>
<tr>
<td>Latvia</td>
<td>employees</td>
<td>R/Survey</td>
<td>1 day</td>
<td>E</td>
<td>All</td>
<td>Excluded</td>
<td>Excluded</td>
<td>E = employees; I = insured persons; SE = self-employed persons</td>
</tr>
<tr>
<td>Lithuania</td>
<td>employees</td>
<td>R/Not</td>
<td>1 day</td>
<td>E, SE</td>
<td>All</td>
<td>Included</td>
<td>Included</td>
<td>All = all economic activities; x = excluding; AF = armed forces; Agr = agriculture; Lowrates = activities with low rates of injuries; Pol = police</td>
</tr>
<tr>
<td>Norway</td>
<td>workers employed</td>
<td>R/Not</td>
<td>none</td>
<td>E</td>
<td>All</td>
<td>Excluded</td>
<td>Excluded</td>
<td></td>
</tr>
<tr>
<td>Poland</td>
<td>workers employed</td>
<td>R/Not</td>
<td>none</td>
<td>E, SE</td>
<td>All</td>
<td>Excluded</td>
<td>Excluded</td>
<td></td>
</tr>
<tr>
<td>Russian Federation</td>
<td>employees</td>
<td>R/Not</td>
<td>1 day</td>
<td>E</td>
<td>All</td>
<td>Excluded</td>
<td>Included</td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>workers employed</td>
<td>R/Ins</td>
<td>1 day</td>
<td>E, SE</td>
<td>All</td>
<td>Excluded</td>
<td>Excluded</td>
<td></td>
</tr>
</tbody>
</table>

¹) Denmark: no data is available for the ILO Yearbook after 2001
²) Finland: 3 days as reported to the ILO Yearbook until 2007, in parallel 4 days reported to Eurostat from 2005 onwards
Inclusion criterion for non-fatal work injuries

Source: (http://laborsta.ilo.org/default.html)

An example of a significant difference between quantitative data from separate countries can be seen in the inclusion criterion for non-fatal work injuries.

In Germany, a case to be included in the ILO Yearbook has had to fulfil an inclusion criterion of at least 4 days absence from work, which is the criterion also used by Eurostat.

In Finland, a minimum of 3 days absence from work was applied until 2007 for the data provided to the ILO Yearbook, although a Eurostat criterion of a minimum of 4 days absence from work has also been reported since 2005.

In Estonia, Latvia, Lithuania, Russia and Sweden, the inclusion criterion has been at least 1 day absence from work.

In Norway and Poland, there has not been a requirement for a minimum of lost work days to be included in the statistical summaries.

Commuting accidents

Another example of a source of incomparability is the inclusion or exclusion of commuting accidents in the statistics. According to the ILO Yearbook 2008, five BSN countries excluded (Finland, Latvia, Norway, Poland, Sweden) and four countries included (Estonia, Germany, Lithuania, Russian Federation) commuting accidents in their work injury statistics.

5.7 Organizations responsible for the statistics


Denmark:
http://laborsta.ilo.org/applv8/data/SSM8/E/DK.html

Estonia:

Finland:

Germany:
Latvia:  

Lithuania:  

Norway:  
https://www.google.fi/?gws_rd=ssl#q=Norway+%22Organization+responsible+for+the+statistics%22

Poland:  

Russian Federation:  

Sweden:  
http://laborsta.ilo.org/applv8/data/SSM8/E/SE.html

5.8 Stratification of the BSN countries by assumed reporting level

Reporting level

A reporting level of injuries at work is the relation between the number of notifiable injuries covered by the statistics and the number of injuries actually notified. A reporting level of 100% for one industry branch corresponds to the fact that all injuries at work that happened in that branch are reported. If this is not the case, the reporting level is below 100%. (ESAW 2012)

According to the study “Accidents at work in the European Union in 1994” the average reporting level for occupational injuries causing more than 3 days’ absence from work in 8 common branches of economic activity of the EU-15 was 91%. Eight countries reported a 100% level, while 3 reported levels in the range of 41 to 56% (see International Labour Conference 2002).

Reporting systems

Two types of reporting systems are in use in the EU-15 countries for work injuries, insurance-based system (Austria, Finland, France, Germany, Greece, Italy, Portugal, Spain, and Switzerland) and non-insurance based system (Denmark, Ireland, the Netherlands, Norway, Sweden and the UK), where there is a legal obligation on employers to report the work injuries to the relevant national authorities, which is often the National Labour Inspectorate.

Data collection in insurance and compensation schemes are thought not to suffer from under-reporting because the schemes are economically linked. In rela-
tion to work injuries, reporting under insurance schemes is considered to be very close to 100%, while reporting by a legal obligation on employers range from 30 to 50%. Table 2 shows the BSN countries for which the reporting levels have been estimated in the 1990s (ESAW 2001).

Table 2. Earlier estimates of national reporting levels of work injuries (>3 days absence from work) (see ESAW 2001)

<table>
<thead>
<tr>
<th>Insurance-based reporting system</th>
<th>ESAW 2001 Reporting levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td>100%</td>
</tr>
<tr>
<td>Germany</td>
<td>100%</td>
</tr>
<tr>
<td>Non-insurance-based reporting system</td>
<td></td>
</tr>
<tr>
<td>Denmark</td>
<td>46%</td>
</tr>
<tr>
<td>Norway</td>
<td>25 to 100%</td>
</tr>
<tr>
<td>Sweden</td>
<td>52%</td>
</tr>
</tbody>
</table>

In the formerly socialist economies of Europe (incl. Estonia, Latvia, Lithuania, Poland and the Russian Federation) it is an obligation on employers to report work injuries to the national authorities.

For some scrutinies, the BSN countries were grouped into three groups according to the reporting level:

- Finland, Germany: countries where work injuries are compensated by Insurance based system – reporting level expected to be nearly 100%
- Denmark, Norway, Sweden: countries where work injuries are dealt with universal social security – reporting level considered to be 30–50%
- Estonia, Latvia, Lithuania, Poland, Russian Federation: formerly socialist economies where work injuries are reported to national authorities – reporting level is considered to be low.

5.9 Benchmarks (Finland, Germany, EU-15)

The idea of benchmarking is to identify an actor whose performance regarding the issue of interest is exemplary, better than that of other actors of similar interests. Benchmarking is used in management of an actor to evaluate performance results or processes in relation to performance or processes of the actor that has been selected as a benchmark.

An ideal benchmark country for work injury indicators should show an excellent OH&S performance with trustworthy low incidence rates of work injuries. The indicators need to be based on nearly complete level of reporting.
The lowest registered rates of fatal work injuries among the BSN countries are presented by Sweden (1.5 per 100,000 per year during 2003–2007) and Norway (1.8 per 100,000). However, in these countries, the level of reporting of non-fatal work injuries has been found to be incomplete, 52% in Sweden and 25–100% in Norway (see ESAW 2001), or 55% in Sweden (Arbetsmiljöverket 2005), or 50% in Norway (Hassle et al. 2011).

The present BSN analysis selected as benchmarks the statistical indicators of work injuries of Finland, Germany, and the EU-15 average.

**Finland**

In Finland, work injuries are compensated by an insurance-based system which includes incentives both to employers and employees to report work injuries. The registered annual incidence rate of fatal work injuries was 2.1 per 100,000 during 2003–2007. The reporting level is considered to be nearly 100% (see ESAW in 2001).

Finland applied until 2007 an inclusion criterion of a minimum of 3 days absence from work for work injury data submitted to the ILO Yearbook of Labour Statistics.

Statistical work injury indicators from Finland are disaggregated by branches of economic activity (ISIC Rev.3).

The Finnish Register of Occupational Injuries contains information on all injuries that have been compensated on the basis of statutory workers’ compensation. All insurance companies practising statutory accident insurance in Finland are under an obligation by law to deliver these data.

A detailed review of ten surveillance systems in different countries has been conducted by Kendall (2005). The review used a five-point scale to rate a key criterion “How well does the surveillance system capture the important information?” The conclusion was that only a few of the systems can demonstrate even reasonable capture rates. The Finnish surveillance system was rated with a grade 4/5 (High). The Finnish model of occupational injury surveillance was considered to provide a template for developing a system for the surveillance of occupational injury in New Zealand.

**Germany**

In Germany, work injuries are compensated by an insurance-based system. The registered annual incidence rate of fatal work injuries was 2.5 per 100,000 during 2003–2007. The reporting level is considered to be nearly 100% (ESAW in 2001). The German work injury statistics uses an inclusion criterion of at least 4 days absence from work.
Statistics by branches of economic activity have not been provided to the ILO Yearbook.

**The EU-15 average**

The EU-15 averages of work injury indicators by branches of economic activity provided a third set of benchmarks for several comparisons. (European Communities 2009)

The data on non-fatal accidents for countries that entered the EU in 2004 (incl. Estonia, Latvia, Lithuania, Poland) have not been disseminated by ESAW because of under-reporting problems till 2007 (ESAW, 2008 onwards).

Statistics by branches of economic activity are provided.

### 6 Data availability by branch of economic activity and gender

After examining the obtainable information in the ILO Yearbook of Labour Statistics 2008 or the ILO LABORSTA database, it appeared that all relevant information of interest with regard to work injuries was not available to all ten BSN countries.

**Incidence rates provided separately by branch of economic activity**

Denmark, Estonia, Finland, Latvia, Lithuania, Norway, and Sweden reported the fatal and non-fatal work injury rates separately by branch of economic activity (ISIC-3).

Germany and the Russian Federation did not report the rates of fatal work injuries by branch of economic activity.

Germany, Poland and the Russian Federation did not report the rates of non-fatal work injuries by branch of economic activity.

**Incidence rates provided separately by gender**

The total fatal and non-fatal work injury rates were reported separately by gender in Denmark, Estonia, Finland, Lithuania, Sweden and the Russian Federation.

Germany, Latvia, Norway and Poland reported both fatal and non-fatal work injury rates as aggregates of men and women only.

<table>
<thead>
<tr>
<th>Country</th>
<th>Rates by branch of economic activity</th>
<th>Rates by gender</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fatal injury</td>
<td>Non-fatal</td>
</tr>
<tr>
<td>Denmark</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Estonia</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Finland</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Germany</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Latvia</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Lithuania</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Norway</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Poland</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Russia</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

For Denmark, data were available for the years 1999–2001.

7 Indicators of work injuries in the BSN countries

7.1 Fatal work injuries

Table 4 shows the average rates of fatal work injuries per year in the BSN countries for the years 2003–2007, by branch of economic activity, per 100,000 workers employed. The average annual numbers of fatal cases are given in brackets. The rates were not calculated for instances where the cell count is less than four fatalities.

Incidence rates of fatal work injuries

The non-standardized incidence rates of fatal work injuries were calculated as a 5-year average of years 2003–2007. The fatality rates in Finland and Germany, the only BSN countries with special work accident insurance coverage, was 2.1 per 100,000 for Finland and 2.5 for Germany. The average EU-15 rate in 2005 was 3.4 per 100,000. Those Nordic countries that do not have a special work accident insurance system showed work injury fatality rates that were similar (2.3 Denmark) or lower (1.8 Norway, 1.5 Sweden) than in Finland or Germany.

In the formerly socialist economies, the rates of fatal work injuries were more than twice as high as in other BSN countries (4.5 per 100,000 in Estonia, 5.8 Latvia, 9.9 Lithuania, 4.6 Poland, 12.5 Russian Federation).
Incidence rates by gender

The fatality rates were reported separately by gender in Denmark, Estonia, Finland, Lithuania, Sweden and the Russian Federation. In these countries, an overwhelming majority of fatalities (about 90%) occurred among men – among women, fatal work injuries were rare. Germany, Latvia, Norway and Poland reported fatality rates as aggregates of men and women only.

Incidence rates by branch of economic activity

Fatal work injuries are rare events. The Nordic and the Baltic countries are relatively small as regards the size of economically active population. A perusal of the accrued statistics in Table 4 shows that in small countries it is difficult to calculate reasonably stable annual rates of fatal work injuries for many branches of economic activity even when aggregating five years of experience.

Germany and the Russian Federation had reported to the ILO the fatal work injury rate as an aggregate, but not separately by branch of economic activity.

In Agriculture, the Nordic countries (excluding Finland as an outlier) showed by far the highest rates of fatal work injuries (11.3 per 100,000 Denmark, 15.3 Norway, 14.3 Sweden) as compared to other branches of economic activity. In the formerly socialist economies, too, Agriculture was among the most dangerous branches of economy (19.5 Latvia, 38.6 Lithuania, 14.7 Poland). The rate for fatal work injury in Agriculture was 10.1 per 100,000 in 2005 in the EU-15.

In Manufacturing, the Nordic countries showed rates of fatal work injuries that were close to the average and lower than the 2.6 per 100,000 rate of the EU-15. In the formerly socialist economies the rates were close to the national average, but clearly higher than in the EU-15.

In Construction, the Finnish rate of 8.8 per 100,000 was equal to the rate in the EU-15 whereas the rate was much lower in other Nordic countries (6.3 Denmark, 4.3 Norway, 4.2 Sweden). In the formerly socialist economies Construction was the most dangerous or the second most dangerous branch of economic activity showing 3–5 times higher fatality rates in comparison to the Nordic countries or the EU-15 (21.4 Latvia, 33.7 Lithuania, 15.2 Poland).

In Transport, Storage and Communications branch the rates of fatal work injuries in the Nordic countries were 2–3 times above the national average, yet lower than the EU-15 rate of 7.6 per 100,000. All formerly socialist economies showed higher rates of fatal work injuries than the EU-15 average.

<table>
<thead>
<tr>
<th>Economic activity (ISIC Rev.3)</th>
<th>Compensated injuries Work-injury insurance</th>
<th>Reported injuries Three Nordic countries</th>
<th>Reported injuries Formerly socialist countries</th>
<th>EU-152005 rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (men and women)</td>
<td>2.1 (43) 2.5 (919)</td>
<td>2.3 (62) 1.8 (41)</td>
<td>1.5 (65)</td>
<td>4.5 (28)</td>
</tr>
<tr>
<td>- men</td>
<td>3.9 (40) -</td>
<td>3.7 (58) -</td>
<td>2.7 (59)</td>
<td>7.6 (24)</td>
</tr>
<tr>
<td>- women</td>
<td>.. (3) -</td>
<td>.. (2) -</td>
<td>0.3 (5)</td>
<td>1.2 (4)</td>
</tr>
<tr>
<td>A Agriculture, Hunting and Forestry</td>
<td>.. (&lt;1) - (219)</td>
<td>11.3 (12)</td>
<td>15.3 (10)</td>
<td>14.3 (11)</td>
</tr>
<tr>
<td>B Fishing</td>
<td>.. (&lt;1) (2) -</td>
<td>8.9 (&lt;1) -</td>
<td>.. (1)</td>
<td>.. (0)</td>
</tr>
<tr>
<td>C Mining and Quarrying</td>
<td>.. (&lt;1) (10) -</td>
<td>5.3 (2) -</td>
<td>.. (1)</td>
<td>.. (1)</td>
</tr>
<tr>
<td>D Manufacturing</td>
<td>1.9 (8) - (134)</td>
<td>2.3 (9) -</td>
<td>2.0 (5)</td>
<td>1.5 (9)</td>
</tr>
<tr>
<td>E Electricity, Gas and Water Supply</td>
<td>.. (&lt;1) -</td>
<td>2.5 (&lt;1) -</td>
<td>.. (1)</td>
<td>.. (1)</td>
</tr>
<tr>
<td>F Construction</td>
<td>8.8 (11) - (152)</td>
<td>6.3 (11) -</td>
<td>4.3 (7)</td>
<td>4.2 (11)</td>
</tr>
<tr>
<td>I Transport, Storage and Communic.</td>
<td>7.3 (11) -</td>
<td>4.7 (8) -</td>
<td>4.7 (7)</td>
<td>4.3 (11)</td>
</tr>
</tbody>
</table>

1Denmark: years 1999-2001; 2European Communities 2009; 3) Germany: average rate calculated from LABORSTA data; 4) includes only employment accidents; self-employed farmers are not included
7.2 Non-fatal work injuries

Table 5 shows the rates of non-fatal work injuries in the BSN countries in 2007, by economic activity (ISIC Rev.3), per 100,000 workers employed. The registered numbers of cases are given in brackets.

Incidence rates of non-fatal injuries

The total rate of non-fatal work injuries in Finland and Germany, the two BSN countries with work accident insurance coverage, was about 2,800 per 100,000 workers employed for both countries, close to the average EU-15 rate of 3,098 per 100,000.

Those Nordic countries that do not have a special work injury insurance system showed non-fatal work injury rates, in aggregate, that were much lower (1,574 Denmark) or conspicuously lower (781 Norway, 674 Sweden) than in Finland, Germany, or the EU-15.

In the formerly socialist economies, the rates of non-fatal work injuries, in aggregate, were very low in comparison to Finland, Germany, or the EU-15 (562 per 100,000 Estonia, 179 Latvia, 307 Lithuania, 262 Russian Federation).

Incidence rates by gender

The incidence rates of non-fatal work injuries were reported separately by gender in Denmark, Estonia, Finland, Lithuania, Sweden and Russian Federation. In these countries, the majority of injuries (about 60–75%) occurred among men.

Germany, Latvia, Norway and Poland reported rates of non-fatal injuries as aggregates of men and women only.

Incidence rates by economic activity

Germany, Poland and the Russian Federation had reported the non-fatal work injury rate as an aggregate, but not separately by branch of economic activity.

Agriculture

In Agriculture branch, the Finnish rate of 4,187 per 100,000 for non-fatal work injuries was above the national average (2,845) and close to the EU-15 average rate of 4,560. The other Nordic countries showed rates that were clearly below national averages or the EU-15 rate (704 per 100,000 Denmark, 336 Norway, 512 Sweden).
In the formerly socialist economies, too, the rates of non-fatal work injuries for Agriculture were low in comparison to the EU-15 average (639 Estonia, 324 Latvia, 375 Lithuania).

**Manufacturing**

In Manufacturing branch, the Finnish rate of 3,789 per 100,000 for non-fatal work injuries was above the national average (2,845) and close to the EU-15 average rate of 3,505. The Danish rate of 3,219 per 100,000 was also close to the Finnish rate and the EU-15 average.

In Norway and Sweden, the rates were clearly higher than the respective national averages, but much lower than the EU-15 average rate (1,451 Norway, 1,209 Sweden).

In the formerly socialist economies, the rates were higher than the respective national average, but much lower than the EU-15 average (1,106 Estonia, 368 Latvia, 559 Lithuania).

**Construction**

In Construction, the Finnish rate of 7,685 per 100,000 for non-fatal work injuries was much above the national average (2,845) and higher than the rate of 6,069 in the EU-15.

In other Nordic countries, the rate was much less than in Finland or the EU-15 average (2,319 Denmark, 1,263 Norway, 1,126 Sweden).

In the formerly socialist economies, Construction branch showed very low rates for non-fatal work injuries in comparison to other countries (515 Estonia, 270 Latvia, 652 Lithuania).

**Transport, Storage and Communications**

In Transport, Storage and Communications branch the Finnish rate of 4,034 per 100,000 for non-fatal work injuries was close to the rate of 3,696 in the EU-15.

In other Nordic countries, the rate was above the national average (1,955 Denmark, 983 Norway, 1,034 Sweden), yet much lower than the rate in Finland or in EU-15.

The formerly socialist economies showed very low rates of non-fatal work injuries in comparison to other countries (485 Estonia, 307 Latvia, 499 Lithuania).
Table 5. Incidence rates of non-fatal work injuries with lost workdays\(^1\), by economic activity, per 100,000 workers employed (sources: ILO Yearbook of Labour Statistics 2008. Time series. International Labour Office, Geneva 2008; the ILO Database on International Labor Statistics (LABORSTA)).

<table>
<thead>
<tr>
<th>Economic activity (ISIC Rev.3)</th>
<th>Compensated injuries</th>
<th>Reported injuries</th>
<th>Reported injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Work-injury insurance</td>
<td>Three Nordic countries</td>
<td>Formerly socialist countries</td>
</tr>
<tr>
<td></td>
<td>Finland 2007 rate #cases</td>
<td>Germany 2005 rate #cases</td>
<td>Denmark 2001(^2) rate #cases</td>
</tr>
<tr>
<td>Total (men and women)</td>
<td>2845 (62021) 2803 (105494)</td>
<td>1574 (45444) 781 (19081)</td>
<td>674 (29675) 562 (3686) 179 (1871) 307 (5577)</td>
</tr>
<tr>
<td>- men</td>
<td>4189 (45114) (39307)</td>
<td>1876 (27865)</td>
<td>-</td>
</tr>
<tr>
<td>- women</td>
<td>1535 (16914) - (241159)</td>
<td>1226 (15781)</td>
<td>-</td>
</tr>
<tr>
<td>A Agriculture, Hunting and Forestry</td>
<td>4187 (1329) (96013)</td>
<td>704 (681)</td>
<td>336 (188)</td>
</tr>
<tr>
<td>B Fishing</td>
<td>3000 (30) (262)</td>
<td>239 (13)</td>
<td>1273 (61)</td>
</tr>
<tr>
<td>C Mining and Quarrying</td>
<td>3800 (153) (3256)</td>
<td>929 (61)</td>
<td>418 (163)</td>
</tr>
<tr>
<td>D Manufacturing</td>
<td>3789 (15690) (257849)</td>
<td>3219 (14940)</td>
<td>1451 (4020)</td>
</tr>
<tr>
<td>E Electricity, Gas and Water Supply</td>
<td>1849 (305) (4459)</td>
<td>1641 (243)</td>
<td>1059 (180)</td>
</tr>
<tr>
<td>F Construction</td>
<td>7685 (998) (135670)</td>
<td>2319 (4041)</td>
<td>1263 (2273)</td>
</tr>
<tr>
<td>G Wholesale and Retail Trade; Repair of Motor Vehicles, etc.</td>
<td>2177 (5836) (94944)</td>
<td>775 (3256)</td>
<td>313 (1122)</td>
</tr>
<tr>
<td>H Hotels and Restaurants</td>
<td>2275 (1645) (4144)</td>
<td>855 (676)</td>
<td>427 (286)</td>
</tr>
<tr>
<td>I Transport, Storage and Communic.</td>
<td>4034 (7154) (66822)</td>
<td>1955 (3553)</td>
<td>983 (1553)</td>
</tr>
<tr>
<td>J Financial Intermediation</td>
<td>304 (128) (4628)</td>
<td>237 (181)</td>
<td>66 (36)</td>
</tr>
<tr>
<td>K Real Estate, Renting and Business</td>
<td>2494 (5508) (84130)</td>
<td>609 (737)</td>
<td>299 (805)</td>
</tr>
<tr>
<td>L Public Administration and Defence; Compulsory Social Security</td>
<td>7644 (9296) (73983)</td>
<td>1727 (2668)</td>
<td>949 (1461)</td>
</tr>
<tr>
<td>M Education</td>
<td>368 (511) (37039)</td>
<td>878 (1744)</td>
<td>1063 (2286)</td>
</tr>
<tr>
<td>N Health and Social Work</td>
<td>515 (1783) (63303)</td>
<td>1674 (7830)</td>
<td>865 (4118)</td>
</tr>
<tr>
<td>O Other Community,Social and Personal Service Activities</td>
<td>1311 (1470) (41756)</td>
<td>1055 (1451)</td>
<td>351 (369)</td>
</tr>
<tr>
<td>P Households with Employed Persons</td>
<td>4111 (301) (1198)</td>
<td>2519 (23)</td>
<td>133 (4)</td>
</tr>
<tr>
<td>Q Extra-Territorial Organizations ...</td>
<td>- (3) (211)</td>
<td>- (0)</td>
<td>- (0)</td>
</tr>
<tr>
<td>X Not classifiable by economic activity</td>
<td>- (44280)</td>
<td>4406 (546)</td>
<td>-</td>
</tr>
</tbody>
</table>

\(^1\) Minimum period of lost workdays: 1 workday (Estonia, Latvia, Lithuania, Russia, Sweden), 3 workdays (Finland), 4 workdays (Germany, EU-15);
\(^2\)Denmark: years 1999-2001, \(^3\)European Communities 2009;
7.3 Relative rates of work injuries by branch of economic activity within each BSN country

The relative rates of fatal and non-fatal work injuries are presented in Table 6 using the national rates for total injuries as reference for internal comparison within countries. Estonia, Finland, Latvia, Lithuania, Norway and Sweden had provided data that made the calculations possible.

Table 6. Relative rates of fatal and non-fatal work injuries using the national rates for total injuries as reference for internal comparison within countries.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (average within a country)</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>A Agriculture, Hunting and Forestry</td>
<td>3.0</td>
<td>1.5</td>
<td>-</td>
<td>1.5</td>
<td>8.5</td>
<td>0.4</td>
<td>9.5</td>
</tr>
<tr>
<td>D Manufacturing</td>
<td>0.8</td>
<td>1.1</td>
<td>0.9</td>
<td>1.3</td>
<td>1.1</td>
<td>1.9</td>
<td>1.0</td>
</tr>
<tr>
<td>F Construction</td>
<td>2.6</td>
<td>2.0</td>
<td>4.2</td>
<td>2.7</td>
<td>2.4</td>
<td>1.6</td>
<td>2.8</td>
</tr>
<tr>
<td>I Transport, Storage and Commun.</td>
<td>2.2</td>
<td>1.2</td>
<td>3.5</td>
<td>1.4</td>
<td>2.6</td>
<td>1.3</td>
<td>2.9</td>
</tr>
</tbody>
</table>

For the most part the relative rates show patterns that are in accord to expectations both for fatal and non-fatal work injuries in most of the countries.

The rates of fatal and non-fatal work injuries are above national average in agriculture, construction and transport branches in almost all BSN countries for which comparative information is available in the ILO Yearbook.

However, Estonia shows an aberration in this pattern.

According to the statistical data sent to the ILO from Estonia, the rates of non-fatal work injuries in construction industry and in transport are below the national average. The finding is against the experience gained from other BSN countries or the EU-15. The most probable explanation is that in Estonia non-fatal work injuries are severely under-reported in construction industry, as well as in transport and communication.
8 Appraising the level of reporting non-fatal work injuries - external incidence rates (benchmarks: Finland, Germany, EU-15)

The present appraisal used two approaches for estimating the level of reporting of non-fatal work injuries in a country with at least 4 days absence from work.

The first approach was a thought experiment to calculate the hypothetical number of work injuries that would be expected to occur if the whole labour force of a country were employed in a benchmark country.

In the second approach the number of fatal work injuries in a country was multiplied by a coefficient (ratio between fatal and non-fatal work injuries) from a benchmark country.

A hypothetical ‘if-then’ thought experiment was used to examine what the work injury statistics would look like if the whole labour force of a specific country were employed for one year in a benchmark country whose level of reporting of work injuries is thought to be nearly complete.

Amongst the BSN countries, Finland and Germany are the ones that have an insurance-based reporting system of work injuries for which the level of reporting non-fatal work injuries with lost work days is close to 100% (see ESAW 2001). Both countries showed nearly identical overall rates of non-fatal work injuries during 2003–2007.

The incidence rates of non-fatal work injuries with lost work days per 100,000 employees in Finland and Germany were used as benchmarks against which the overall work injury rates of other countries were compared.

Finnish data were also used as benchmarks for incidence rates of work injury by branch of economic activity. German rates by branch of economic activity were not obtainable in the ILO Yearbook 2008.

In parallel with the Finnish incidence rates, the average work injury rates of EU-15 (European Communities 2009) were used as benchmarks for estimating the level of reporting by the branch of economic activity.

Thought experiments were conducted on countries that had provided the relevant data to the ILO Yearbook. These countries were Denmark, Estonia, Latvia, Lithuania, Norway, and Sweden.
Calculation of the size of the source population of work injuries

The total number of economically active population (total, by branch of economic activity and by status in employment) is given by the ILO Yearbook. This population, however, for various reasons, usually is not the same as the source population that is actually monitored for the occurrence of work injuries. The ILO Yearbook neither reports the overall size of the workforce that is monitored nor the size of the branches of economic activity.

In the present BSN analysis the numbers of the source population by branch of economic activity have been back-calculated from the numbers of cases and accident rates printed in the ILO Yearbook of Labour Statistics 2008.

The size of the source population among which the work injuries take place, is smaller than the total economically active population in most countries. In some countries the difference is quite remarkable.

8.2 Estonian workforce working in Finland or in the EU-15

The rate of fatal work injuries in Estonia was 4.5 per 100,000 per year as an average for the years 2003–2007, with an average of 28 cases of fatal injuries per year. In 2007, the overall rate of non-fatal work injuries with lost work days (minimum 1 lost work day required) was a low 562 per 100,000. (In comparison, in 2007 in Finland, the rate of fatal work injuries was 2.1 per 100,000, the rate on non-fatal work injuries 2,845 per 100,000).

Applying the Finnish rate of fatal work injuries of 2.1 per 100,000 in 2007 to a population of 659,609, the size of Estonian workforce, would predict 14 fatal work injuries occurring in 2007 in Estonia. This is one half of the actual number that was registered per year in Estonia in 2003–2007 (average 28 cases of fatal work injuries per year).

The implication is that working conditions in Estonia, in 2007, were more hazardous than in Finland or the EU-15. Hence one could expect that also the rates of non-fatal work injuries were higher in Estonia than in Finland or the EU-15. However, the incidence rates of reported work injuries were very much lower than those in Finland, Germany (data not shown) or the EU-15. This was so both for the total incidence of non-fatal work injuries and for injuries stratified by branch of economic activity (Table 7).
Table 7. Numbers of cases and non-standardised incidence rates of non-fatal work injuries with lost work days in Estonia, by economic activity, per 100,000 employees, and expected numbers of work injuries when using the incidence rates of Finland or the EU-15 average, and the estimated levels of reporting of work injuries in Estonia.

<table>
<thead>
<tr>
<th>Economic activity</th>
<th>Estonian statistics in 2007</th>
<th>If Estonian workforce of 659,609 were working in Finland</th>
<th>If Estonian workforce of 659,609 were working in EU-15</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Source population¹</td>
<td>Reported work injuries rate</td>
<td>Expected # cases</td>
</tr>
<tr>
<td>Total</td>
<td>659,609</td>
<td>562</td>
<td>3,707</td>
</tr>
<tr>
<td>- men</td>
<td>332,893</td>
<td>757</td>
<td>2,520</td>
</tr>
<tr>
<td>- women</td>
<td>325,205</td>
<td>365</td>
<td>1,187</td>
</tr>
<tr>
<td>A Agriculture, Hunting and Forestry</td>
<td>28,794</td>
<td>639</td>
<td>184</td>
</tr>
<tr>
<td>D Manufacturing</td>
<td>134,810</td>
<td>1106</td>
<td>1,491</td>
</tr>
<tr>
<td>F Construction</td>
<td>80,971</td>
<td>515</td>
<td>417</td>
</tr>
<tr>
<td>I Transport, Storage and Communications</td>
<td>58,351</td>
<td>485</td>
<td>283</td>
</tr>
</tbody>
</table>

¹) Using as reference the rates from Finland (at least 3 lost work days), b) using as reference the rates from the EU-15 (at least 4 lost work days).

The expected numbers of work injuries, if the Estonian labour force were working in Finland or in the EU-15, are shown in Table 7. The application of the Finnish or the EU-15 injury rates suggests that 18,000–20,000 non-fatal work injuries (at least 3 or 4 lost work days) should have been reported in Estonia in 2007. According to this estimation, some 14,000–16,000 work injuries may have remained unreported.

The 3,707 officially registered work injuries seemed to cover only some 18–20% of the expected number of work injuries in Estonia, i.e., the overall proportion of under-reporting might have been about 80%.

In the high-risk branches of economic activity, the problem of under-reporting appeared even more conspicuous. In the construction industry, only some 7–9% of work injuries (at least 3 or 4 lost work days) apparently were reported, 15% in agriculture, 29–32% in manufacturing, and 12% in transport, storage and communications.

Estimated reporting levels shown in Table 7 are reasonably well in line with some earlier calculations from Estonia. Statistics Estonia have used data collected with surveys to predict the actual frequency of work accidents. The results indicated that only 37% of work injuries in manufacturing industries were reported, and 20% of work injuries in construction industry. (see Rünkla 2012)
8.3 Latvian workforce working in Finland or in the EU-15

Table 8 shows that 1,871 non-fatal work injuries with lost work days (minimum 1 lost work day required) were reported in Latvia in 2007 which corresponds to a very low rate of 562 per 100,000 in comparison to a similar rate of 2,845 in Finland, 2,835 in Germany, or 3,098 in the EU-15.

The magnitude of expected numbers of work injuries in Latvia was calculated by applying the Finnish and EU-15 work injury rates to a population of the size of the Latvian workforce. According to these calculations 29,000–32,000 non-fatal work injuries with at least 3 or 4 lost work days should have been reported in Latvia in 2007. This estimation suggests that some 27,000–30,000 work injuries may have remained unreported.

Thus, the 1,871 officially registered work injuries may have covered some 6% of the expected number of work injuries in Latvia in 2007, i.e., the overall proportion of under-reporting may have been around 94%.

In high-risk branches of economic activity, the problem of under-reporting appeared even more prominent. In the construction industry some 2–3% of work injuries (at least 3 or 4 lost work days) may have been reported, 1–2% in agriculture, 10% in manufacturing, and 6–7% in transport, storage and communications.

Table 8. Numbers of cases and non-standardised incidence rates of non-fatal work injuries with lost work days in Latvia, by branch of economic activity, per 100,000 employees, and numbers of expected work injuries when using the incidence rates of Finland or the EU-15 average, and the estimated levels of reporting of work injuries in Latvia.

<table>
<thead>
<tr>
<th>Economic activity</th>
<th>Latvian statistics in 2007</th>
<th>If Latvian workforce of 1,045,251 were working in Finland</th>
<th>If Latvian workforce of 1,045,251 were working in the EU15</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Source population¹</td>
<td>Reported work injuries rate # cases</td>
<td>Estimated level of reporting work injuries in Latvia a)</td>
</tr>
<tr>
<td></td>
<td>1,045,251</td>
<td>179 1,871</td>
<td>2,845 29,737</td>
</tr>
<tr>
<td>A Agriculture, Hunting and Forestry</td>
<td>21,296</td>
<td>324 69</td>
<td>4,187 4,515</td>
</tr>
<tr>
<td>D Manufacturing</td>
<td>158,696</td>
<td>368 584</td>
<td>3,789 6,202</td>
</tr>
<tr>
<td>F Construction</td>
<td>85,185</td>
<td>270 230</td>
<td>7,685 9,671</td>
</tr>
<tr>
<td>I Transport, Storage and Communications</td>
<td>85,016</td>
<td>307 261</td>
<td>4,034 4,160</td>
</tr>
</tbody>
</table>

¹Using as reference the rates from Finland (at least 3 lost work days), ²Using as reference the rates from the EU15 (at least 4 lost work days)
³The numbers of the source population by branch of economic activity have been back-calculated from the numbers of cases and accident rates printed in the ILO Yearbook of Labour Statistics 2008.
³Average EU15 incidence rates in 2005 (European Communities 2009)
8.4 Lithuanian workforce working in Finland or in the EU-15

Table 9 shows that 3,577 non-fatal work injuries with lost work days (minimum 1 lost work day required) were reported in Lithuania which corresponds to a very low rate of 307 per 100,000 in comparison to a rate of 2,845 in Finland, 2,835 in Germany, or 3,098 in the EU-15.

The application of the Finnish or the EU-15 injury rates suggests that 33,000–36,000 non-fatal work injuries (at least 3 or 4 lost work days) should have been reported in Lithuania in 2007. This estimation suggests that some 29,000–32,000 work injuries may not have been reported.

According to calculations, the 3,577 injuries that were reported in Lithuania covered some 10% of the expected number of cases of work injuries, i.e., the overall proportion of under-reporting might be 90%. In high-risk branches of economy the problem of under-reporting seemed even more conspicuous. In construction industry, only some 8–11% of work injuries apparently were reported, 8% in agriculture, 16% in manufacturing, and 14% in transport, storage and communications.

Table 9. Numbers of cases and non-standardised incidence rates of non-fatal work injuries with lost work days in Lithuania, by branch of economic activity, per 100,000 employees, and numbers of expected work injuries when using the incidence rates of Finland or the EU-15 average, and the estimated levels of reporting of work injuries in Lithuania.

<table>
<thead>
<tr>
<th>Economic activity ISIC-Rev.3</th>
<th>Source population(^a)</th>
<th>Reported work injuries rate</th>
<th>Finnish # cases</th>
<th>Expected # cases in Lithuania</th>
<th>Estimated level of reporting work injuries in Lithuania (^a)</th>
<th>Expected EU15(^b) rate</th>
<th>Expected # cases in Lithuania</th>
<th>Estimated level of reporting work injuries in Lithuania (^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1,165,146</td>
<td>307</td>
<td>3,577</td>
<td>2,845</td>
<td>33,148</td>
<td>11%</td>
<td>3,098</td>
<td>36,096</td>
</tr>
<tr>
<td>A Agriculture, Hunting and Forestry</td>
<td>29,223</td>
<td>375</td>
<td>109</td>
<td>4,187</td>
<td>1,220</td>
<td>9%</td>
<td>4,560</td>
<td>1,333</td>
</tr>
<tr>
<td>D Manufacturing</td>
<td>218,425</td>
<td>559</td>
<td>1,221</td>
<td>3,789</td>
<td>8,300</td>
<td>15%</td>
<td>3,505</td>
<td>7,656</td>
</tr>
<tr>
<td>F Construction</td>
<td>104,141</td>
<td>652</td>
<td>679</td>
<td>7,685</td>
<td>8,019</td>
<td>8%</td>
<td>6,069</td>
<td>6,320</td>
</tr>
<tr>
<td>I Transport, Storage and Communications</td>
<td>91,382</td>
<td>499</td>
<td>456</td>
<td>4,034</td>
<td>3,655</td>
<td>12%</td>
<td>3,696</td>
<td>3,377</td>
</tr>
</tbody>
</table>

\(^a\)using as reference the rates from Finland (at least 3 lost work days), \(^b\)using as reference the rates from the EU15 (at least 4 lost work days)

\(^c\)The numbers of the source population by branch of economic activity have been back-calculated from the numbers of cases and accident rates printed in the ILO Yearbook of Labour Statistics 2008.

\(^d\)Average EU15 incidence rates in 2005 (European Communities 2009)
8.5 Danish workforce working in Finland or in the EU-15

Denmark’s reporting scheme of work injuries is based on universal social security system. There is no special economic incentive for the employer or the employee to notify a work injury to the authorities. According to former evaluations the reporting level of occupational accidents in Denmark is 46% (see ESAW 2001).

Table 10. Numbers of cases and non-standardized incidence rates of non-fatal work injuries with lost work days in Denmark, by economic activity, per 100,000 employees. In addition, expected numbers of work injuries when using the incidence rates of Finland or the EU-15 average, and the estimated levels of reporting of work injuries in Denmark.

<table>
<thead>
<tr>
<th>Economic activity ISIC-Rev.3</th>
<th>Size of workforce that is monitored</th>
<th>Reported work injuries rate</th>
<th>Finnish rate # cases</th>
<th>Expected # cases in Denmark</th>
<th>Estimated level of reporting of work injuries in Denmark</th>
<th>EU15 rate</th>
<th>Expected # cases in Denmark</th>
<th>Estimated level of reporting of work injuries in Denmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>2,759,520</td>
<td>1,707</td>
<td>47,105</td>
<td>2,845</td>
<td>78,510</td>
<td>60%</td>
<td>3,098</td>
<td>85,490</td>
</tr>
<tr>
<td>A Agriculture, Hunting and Forestry</td>
<td>100,339</td>
<td>884</td>
<td>88</td>
<td>4,187</td>
<td>4,201</td>
<td>21%</td>
<td>4,560</td>
<td>4,575</td>
</tr>
<tr>
<td>D Manufacturing</td>
<td>469,442</td>
<td>3,351</td>
<td>15,731</td>
<td>3,789</td>
<td>17,787</td>
<td>88%</td>
<td>3,505</td>
<td>16,454</td>
</tr>
<tr>
<td>F Construction</td>
<td>168,699</td>
<td>2,706</td>
<td>4,565</td>
<td>7,685</td>
<td>12,965</td>
<td>35%</td>
<td>6,069</td>
<td>10,238</td>
</tr>
<tr>
<td>I Transport, Storage and Communications</td>
<td>181,986</td>
<td>2,226</td>
<td>4,051</td>
<td>4,034</td>
<td>7,341</td>
<td>55%</td>
<td>3,696</td>
<td>6,726</td>
</tr>
</tbody>
</table>

a) using as reference the rates from Finland (at least 3 lost work days), b) using as reference the rates from the EU-15 (at least 4 lost work days)

The numbers of the source population by branch of economic activity have been back-calculated from the numbers of cases and accident rates printed in the ILO Yearbook of Labour Statistics 2008.

Average EU15 incidence rates in 2005 (European Communities 2009)

Average of the years 1999-2001

A total of 47,105 non-fatal work injuries was registered per year in Denmark in 1999–2001 which corresponds to an incidence rate of 1,707 per 100,000 in comparison to a similar rate of 2,845 in Finland, 2,835 in Germany, or 3,098 in the EU-15 (Table 10).

The magnitude of expected numbers of work injuries in Denmark was calculated by applying the Finnish and EU-15 average rates to a population of the size of the Danish workforce. According to these calculations 78,000–85,000 non-fatal work injuries per year should have been expected to occur in Denmark in 1999–2001. This estimation suggests that some 31,000–38,000 work injuries (at least 3 or 4 days absence from work) may not have been reported in Denmark.

The total of 47,105 registered injuries would indicate that the reporting level of work injuries in Denmark had been about 55–60% of the expected.
8.6 Other BSN countries: Poland, Russian Federation

Poland and the Russian Federation have provided total numbers and total incidence rates of fatal work injuries. In addition, Poland has submitted the total number of non-fatal work injuries, and the Russian Federation the total number and incidence rate of non-fatal work injuries. Numbers or rates by branch of economic activity have been submitted neither by Poland nor the Russian Federation.

The size of the source population for the work injury statistics from Poland or the Russian Federation is not available in the ILO Yearbook of Labour Statistics. However, the size of the source population could be backcalculated from the absolute numbers and incidence rates that were known.

Russian Federation:

The size of the source population for the absolute numbers and incidence rates submitted to the ILO Yearbook by the Russian authorities is 25,288,000. (Obs: In 2007, the size of the economically active population in the Russian Federation was 70,570,000.)

Thus, according to the statistical indicators submitted to the ILO Yearbook the source population under monitoring for work injuries was 25,288,000 in Russia in 2007. If the Finnish, German, or EU-15 incidence rates (at least 4 d absence from work) are applied to such a population, the results would show a total number of 640,000-783,400 non-fatal work injuries (at least 4 d absence from work) having occurred in Russia in 2007.

In 2007, a total of 66,055 non-fatal work injuries were reported to the ILO Yearbook from Russia. This would suggest that 8-10% of the expected number of non-fatal work injuries actually have been registered.

8.7 Norway and Sweden: overestimation by external incidence rate method

Among the BSN countries, Sweden and Norway showed the lowest rates of fatal work injuries in 2003-2007 (1.8 per 100,000 in Norway, 1.5 in Sweden) in comparison to the benchmark countries (2.1 in Finland, 2.5 in Germany, 3.4 in EU-15). According to these indicators work is less hazardous in Norway and Sweden than in the benchmark countries.

For this reason, it would not be wise to use external incidence rates of the benchmark countries (Finland, Germany, EU-15) to the Swedish or Norwegian workforce in order to estimate the “true” numbers of non-fatal work injuries. If such external incidence rates were used, the results would be expected to show numbers of non-fatal work injuries that would be overestimates for Sweden and Norway.
9 Approximating the level of reporting non-fatal work injuries - external coefficients (benchmarks: Finland, Germany, EU-15)

9.1 Ratio between fatal and non-fatal work injuries as a coefficient

Earlier reports

Indicators on fatal work injuries have been the starting point for estimating the number of less severe injuries in some earlier studies (Hämäläinen et al. 2006, Takala et al. 2014).

The ratio between fatal occupational accidents and accidents causing 3 days' or more absence from work has been observed varying with a wide range between regions and countries (Takala 1999).

In 1999, Takala described examples of ratios between fatal and non-fatal work injuries: 1 per 10 in Africa (ILO Yearbook of Labour Statistics 1996); 1 per 933 ratio of fatal accidents to all disabling accidents in the USA in 1992 (Leigh et al. 1993); 1 per 1,019 in Finland in 1994 and 1 per 975 in 1993 (3 days' or more absence from work); and 1 per 2,029 ratio of fatal to all non-fatal injuries in the USA in 1992.

A low ratio was considered to indicate underreporting of minor accidents. A reasonably conservative ratio, 1 per 750, between the fatal and non-fatal work injuries was considered a suitable basis for a new ILO estimate of non-fatal work injuries.

Present analyses

Finland, Germany and the EU-15 average were used as benchmarks for an estimation of expected numbers of non-fatal work injuries of other BSN countries. External coefficients (ratio between fatal and non-fatal injuries, at least 4 d absence from work) were calculated using data from these benchmark countries.

An elementary equation shows an empirical relation between fatal and non-fatal work injuries (at least 4 d absence from work) based on coefficients (ratio between fatal and non-fatal) from Finland, Germany and the EU-15:
coefficient \times \text{[registered \# \ of \ fatal \ work \ injuries]} = \text{expected \# \ of \ non-fatal \ work \ injuries}

\begin{align*}
\text{coefficient:} & \\
& 1,290 \text{ Finland (2003-2007)} \\
& 1,148 \text{ Germany (2003-2007)} \\
& 1,009 \text{ EU-15 (2005)}
\end{align*}

Expected numbers of non-fatal work injuries (at least 4 days absence from work) were calculated by multiplying the registered number of fatal work injuries in a country by an external coefficient (ratio between fatal and non-fatal injuries) of a benchmark country.

\section*{9.2 Ratios between fatal and non-fatal work injuries in the EU-15 countries}

In the 1990s, the ratio between fatal and non-fatal work injuries in the EU-15 countries with \textit{insurance-based system} was 1 to 1,200–1,300 (Austria 1,006, Finland 1,315, France 1,313, Germany 1,191, Italy 439, Portugal 458, Spain 1,530, Switzerland 1,678) (calculated from ESAW 2001).

In the EU-15 countries and Norway with \textit{non-insurance-based system} the ratio was much lower, 1 to 500–900 (Denmark 787, Norway 488, Sweden 469, the UK 937). This is less than one half of the ratio between fatal and non-fatal injuries of insurance-based countries in line with a view that non-fatal work injuries are more often left unreported in countries with non-insurance-based reporting systems.

\section*{9.3 Ratios between fatal and non-fatal work injuries in the BSN countries and the EU-15 average}

In the EU-15 countries, 4,011 fatal and 4,048,491 non-fatal work injuries (at least 4 d absence from work) occurred in 2005 (European Communities 2009). This means that for each fatality there were 1,009 non-fatal work injuries (at least 4 d absence from work) in the EU-15. In Finland the corresponding ratio was 1,290 and in Germany 1,148. (Table 11)
Table 11. Numbers, non-standardized incidence rates, and ratios between fatal and non-fatal work injuries among employees in the BSN countries as reported to the ILO Yearbook of Labour Statistics 2008. The numbers and rates of fatal injuries are averages of the years 2003–2007.

<table>
<thead>
<tr>
<th>Reporting systems in the countries</th>
<th>Average number of fatal injuries per year</th>
<th>Reported rate of fatal injuries per 100,000</th>
<th>Non-fatal injuries in 2007</th>
<th>Reported rate of non-fatal injuries per 100,000</th>
<th>Ratio between fatal and non-fatal work injuries</th>
<th>Approximate reporting level as assessed by ESAW 2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU-151)</td>
<td>4,011</td>
<td>3.4</td>
<td>4,048,491</td>
<td>3,098</td>
<td>1,009</td>
<td>..</td>
</tr>
<tr>
<td>Insurance-based reporting system</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ESAW 2001: reporting level nearly 100%</td>
</tr>
<tr>
<td>Finland</td>
<td>43</td>
<td>2.1</td>
<td>55,4712)</td>
<td>2,5302)</td>
<td>1,290</td>
<td>- the rate of registered non-fatal injuries is about 3,000 per 100,000 employees - the ratio fatal / non-fatal work injury is about 1 to 1,100-1,300</td>
</tr>
<tr>
<td>Germany</td>
<td>919</td>
<td>2.5</td>
<td>1,054,984</td>
<td>2,835</td>
<td>1,148</td>
<td></td>
</tr>
<tr>
<td>Reporting to national authorities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ESAW 2001: Reporting level low (25-50%)</td>
</tr>
<tr>
<td>Denmark2)</td>
<td>62</td>
<td>2.3</td>
<td>43,644</td>
<td>1,574</td>
<td>873</td>
<td>- the rate of registered non-fatal injuries is about 700-1,600 per 100,000 employees - the ratio fatal / non-fatal work injury is about 1 to 500-600</td>
</tr>
<tr>
<td>Norway</td>
<td>41</td>
<td>1.8</td>
<td>19,354</td>
<td>781</td>
<td>496</td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>65</td>
<td>1.5</td>
<td>29,675</td>
<td>751</td>
<td>446</td>
<td></td>
</tr>
<tr>
<td>Former socialist countries: Report-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No ESAW assessment.</td>
</tr>
<tr>
<td>ing to national authorities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Reporting level appears very low (&lt; 10 - 25%)</td>
</tr>
<tr>
<td>Estonia</td>
<td>28</td>
<td>4.5</td>
<td>3,686</td>
<td>555</td>
<td>149</td>
<td>- the rate of non-fatal injuries is very low, 150-600 per 100,000 employee - the ratio fatal / non-fatal work injury is very low, between 1 to 20 and 1 to 200</td>
</tr>
<tr>
<td>Latvia</td>
<td>54</td>
<td>5.8</td>
<td>1,812</td>
<td>151</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Lithuania</td>
<td>108</td>
<td>9.9</td>
<td>3,577</td>
<td>295</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Poland</td>
<td>479</td>
<td>4.6</td>
<td>92,824</td>
<td>8344)</td>
<td>194</td>
<td></td>
</tr>
<tr>
<td>Russian Federation</td>
<td>3,161</td>
<td>12.5</td>
<td>68,510</td>
<td>280</td>
<td>23</td>
<td></td>
</tr>
</tbody>
</table>

1) Year 2005, see European Communities 2009; 2) European Statistics on Accidents at Work (ESAW); 3) Denmark: year 2001; 4) Poland: a tentative rate, based on calculations made by the present analysis; 5) at least 4 lost work days is used for Finland in this table

Table 11 shows three clusters of BSN countries as regards indicators of work injuries. One cluster consists of countries with insurance based reporting system (Finland, Germany), the second cluster of Nordic countries with a system of reporting to national authorities (Denmark, Norway, Sweden), and the third cluster of formerly socialist economies with a system of reporting to national authorities (Estonia, Latvia, Lithuania, Poland, Russian Federation).

These clusters differ with regard to systems of reporting work injuries, levels of rate of fatal work injuries, levels of rate of non-fatal work injuries, and ratio between fatal and non-fatal injuries.
The ratio between fatal and non-fatal injuries shows large differences between the three clusters of BSN countries – the differences are of an order of magnitude (Table 11). The extremes in this respect are Finland (1:1,290) and Russian Federation (1:23). It is, of course, inconceivable that there were only 23 non-fatal work injuries per one fatal injury in Russia, or only 34 non-fatal injuries in Latvia or Lithuania, only 149 in Estonia and 194 non-fatal injuries per one fatal injury in Poland. These results suggest considerable under-reporting of non-fatal work injuries.

9.4 Numbers of non-fatal work injuries as expected by using external benchmark coefficients (ratio between fatal and non-fatal)

Table 12. Non-fatal work injuries as expected by using coefficients (ratio between fatal and non-fatal work injuries) calculated from the statistics of the EU-15, Finland, and Germany (from data in the ILO Yearbook 2008) in 2003-2007.

<table>
<thead>
<tr>
<th></th>
<th>Average number of reported cases of fatal work injuries per year (2003-2007)</th>
<th>Reported cases of non-fatal work injuries per year</th>
<th>Expected cases of non-fatal work injuries, coefficient from EU-15 1:1,009</th>
<th>Expected cases of non-fatal work injuries, coefficient from Finland 1:1,290</th>
<th>Expected cases of non-fatal work injuries, coefficient from Germany 1:1,148</th>
<th>Estimated reporting level: Present analysis (%)</th>
<th>Expected cases Hämäläinen et al. 2006 3) Years 1997-1999</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark 1)</td>
<td>62</td>
<td>43,644</td>
<td>62,558</td>
<td>79,980</td>
<td>71,176</td>
<td>55-70</td>
<td>68,772</td>
</tr>
<tr>
<td>Estonia</td>
<td>28</td>
<td>3,686</td>
<td>28,000</td>
<td>36,120</td>
<td>32,144</td>
<td>10-13</td>
<td>45,130</td>
</tr>
<tr>
<td>Latvia</td>
<td>54</td>
<td>1,812</td>
<td>54,000</td>
<td>69,660</td>
<td>61,992</td>
<td>2-3</td>
<td>79,757</td>
</tr>
<tr>
<td>Lithuania</td>
<td>108</td>
<td>3,577</td>
<td>108,000</td>
<td>139,320</td>
<td>123,984</td>
<td>3</td>
<td>140,281</td>
</tr>
<tr>
<td>Norway</td>
<td>41</td>
<td>19,081</td>
<td>41,000</td>
<td>52,890</td>
<td>47,068</td>
<td>36-47</td>
<td>55,018</td>
</tr>
<tr>
<td>Poland</td>
<td>489</td>
<td>92,824</td>
<td>489,000</td>
<td>630,810</td>
<td>561,372</td>
<td>15-19</td>
<td>1,212,275</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>3,161</td>
<td>66,055</td>
<td>3,161,000</td>
<td>4,077,690</td>
<td>3,628,828</td>
<td>2</td>
<td>5,322,065</td>
</tr>
<tr>
<td>Sweden</td>
<td>65</td>
<td>29,675</td>
<td>65,000</td>
<td>83,850</td>
<td>74,620</td>
<td>35-46</td>
<td>58,456</td>
</tr>
</tbody>
</table>

1) Denmark: year 2001; 2) workforce under monitoring; 3) whole economically active workforce

For example, in Estonia an average of 28 fatal work injuries occurred per year in 2003–2007. Using the EU-15 coefficient 1,009 (ratio between fatal and non-fatal injuries), the 28 fatalities would predict a point-estimate of 28,000 non-fatal work injuries (at least 4 days absence from work) in Estonia in 2007. Using corresponding coefficients calculated from the statistics of Finland or Germany suggests somewhat higher point estimates for non-fatal work injuries. (Table 12)

The differences between the numbers of non-fatal work injuries reported in a country and the expected ones, using external coefficients, were remarkable.
(Table 12). These calculations provide big-picture approximations about the magnitude of non-fatal work injuries and the level of reporting.

In the Baltic States, according to these calculations, the reporting levels of work injuries are remarkably low. In Estonia between 10 to 13% of the estimated true number of work injuries (>3 d absence from work) may have been reported, 2 to 3% in Latvia, and 3% in Lithuania.

In Poland, 489 fatal and 92,824 non-fatal work injuries were reported per year in 2003–2007. The calculations suggest that between 490,000 to 630,000 non-fatal work injuries (>3 d absence from work) may have occurred per year. The estimated level of reporting of work injuries in Poland may have been between 15 to 19% (Table 12).

In the Russian Federation, 3,161 fatal and 66,055 non-fatal work injuries were reported per year in 2003–2007 according to the ILO Yearbook of Labour Statistics 2008. Yet, the results of calculations shown in Table 12 suggest that at least 3 million non-fatal work injuries may have occurred per year among a Russian source population of 25,288,000 (backcalculated from data submitted to the ILO Yearbook 2008). It would mean that the reporting level of non-fatal work injuries in Russia may have been about 2%.

9.5 Ratio between fatal and non-fatal work injuries across branch of economic activity in Finland and the EU-15

We have not been able to identify earlier calculations on the ratio between fatal and non-fatal work injuries by branch of economic activity. Such information is important particularly if differences across economic activity are large. Data were at our disposal only from the EU-15 and Finland.
Table 13. Fatal and non-fatal work injuries and calculated coefficients (ratio between fatal and non-fatal work injuries) in the EU-15 and Finland.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of fatal work injuries per year</td>
<td>No. of non-fatal work injuries per year</td>
</tr>
<tr>
<td>Total</td>
<td>4,011</td>
<td>3,983,881</td>
</tr>
<tr>
<td>A Agriculture, Hunting and Forestry</td>
<td>514</td>
<td>232 224</td>
</tr>
<tr>
<td>D Manufacturing</td>
<td>726</td>
<td>972 793</td>
</tr>
<tr>
<td>F Construction</td>
<td>1,054</td>
<td>727 820</td>
</tr>
<tr>
<td>I Transport, Storage and Communications</td>
<td>654</td>
<td>316 866</td>
</tr>
</tbody>
</table>

a) All NACE branches; b) at least 4 days absence from work; c) at least 3 days absence from work;

Table 13 shows the ratios between fatal and non-fatal work injuries as calculated for the EU-15 and Finland. The ratio is not uniform across branches of economic activity.

The overall ratio between fatal and non-fatal work injuries is an aggregate. Disaggregation of data by branch of economic activity indicates remarkable differences between industries. Yet, the pattern seems similar for Finland and the EU-15: Manufacturing shows a ratio clearly above the overall average whereas the high-risk industries (Construction, Transport and Communications) show ratios that are clearly below the overall average.

It is known that certain types of fatal injuries occur foremost in specific industries: capsised tractor accidents (Agriculture), falls from heights (Construction), car accidents (Transport). Consequently, variances in distribution of fatal risks in particular industries might have a strong influence on the level of the ratio between fatal and non-fatal work injuries in that industry. (In the Netherlands, Bellamy found that the accident triangles were different shapes for different hazards. For every death from being struck by a moving vehicle, she found only four permanent injuries and just 8 recoverable injuries. By contrast, for every death from “contact with handheld tool operated by self” there were 280 recoverable injuries (see Leathley 2014).)
It is also possible that in some branches of industry there is more under-reporting of work injuries than in other branches.

9.6 How stable is the ratio between fatal and non-fatal work injuries?

It is of particular interest to clarify: How does the ratio between fatal and non-fatal work injuries relate to changes in the occurrence rates of work injuries over time? How much does the ratio indicator vary between branches of economic activity? How much is the ratio indicator influenced by the level of the rate of fatal work injuries?

Statistics of fatal and non-fatal work injuries by branch of economic activity were available from Finland between 1980 and 2007 in the ILO Yearbook of Labour Statistics 2008. These data were analysed in order to have a view on the variability of the ratio indicator, and to survey on how the ratio indicator behaves over periods of years and by branch of economic activity.

Appendix 1 summarizes the findings from the analyses of the Finnish time series from 1980 till 2007, a span of 28 years.

9.6.1 Stability of the ratio between fatal and non-fatal work injuries by branch of economic activity

Different industries may show different patterns of work injuries because of industry-specific circumstances. This could influence also the ratio between fatal and non-fatal work injuries which may be inherently different across branches of economy.

The Manufacturing industry showed consistently higher scores of the ratio indicator than the total average. The Construction industry and the Transport and communications industry showed consistently lower scores than the total average. (see Appendix 1)

These differences between branches of economic activity mean that the comparability of the overall level of reporting between countries may depend to some extent of the structures of economic activity.

9.6.2 Stability of the ratio between fatal and non-fatal work injuries regarding the rate of fatal work injuries

From 1980 to 2007, the occurrence of both fatal and non-fatal work injuries has been approximately halved in Finland (Appendix 1).

During 1980–1984 the rate of fatal work injuries was 4.6 per 100,000 employees. During 2005–2007 the rate was 2.1 per 100,000 which shows over 50%
decline in the course of 28 years. Yet, the ratio between fatal and non-fatal work injuries remained unchanged at the level of 1,300 for all economic activities over the years. No trends were noticeable (see Appendix 1).

Thus, the ratio between fatal and non-fatal work injuries was insensitive to the rate of fatal work injuries.

9.6.3 Stability of the ratio between fatal and non-fatal work injuries over years

The ratio between fatal and non-fatal work injuries remained unchanged in the course of 28 years: during 1980–1984 the ratio was 1,307, and during 2005–2007 it was 1,271). No trends were noticeable (see Appendix 1).

The level of the ratio indicator remained unchanged for the branches of Manufacturing and Construction for 28 years. No trends were noticeable.

The ratio indicator for the Transport & Communications industry showed a 23% increase between 1980 and 2007– this translates to a change of less than 1% per year on average.

The ratio indicator showed some remarkable peaks and lows during the span of 28 years. The occasional unsteadiness of the indicator was caused by variability in the denominator (cases of fatal injuries). Such peakedness can be smoothened by using a time span of five years, for instance.

10 Comparison of estimations by using external incidence rates or external coefficients from benchmark countries

In the coefficient estimation strategy, the annual amount of fatal work injuries was multiplied by an external coefficient (ratio between fatal and non-fatal) from benchmark countries. This approach showed much higher numbers of expected non-fatal work injuries in comparison to an approach that applied external incidence rates directly to the workforce under monitoring. Comparison of the results between Tables 7–9 and Table 12 reveals large differences in the expected numbers of cases by these two approaches.

For instance, applying the external incidence rate of the EU-15 average to the Estonian workforce would predict an occurrence of 20,304 non-fatal work injuries (Table 7), whereas an estimation that uses the external coefficient of EU-15 would predict 28,000 to 36,000 non-fatal work injuries occurring in Estonia (Table 11). The application of external incidence rates of benchmark countries will yield underestimates of true occurrences, because the approach does not
consider the inherent level of hazardousness of work in a country that is estimated.

**External incidence rate method usually leads to underestimation**

The high incidence rates of fatal work injuries in many BSN countries between 2003 and 2007 indicate that work was more hazardous in these countries than in the benchmark countries (Finland, Germany, EU-15). Using external incidence rates from safer benchmark countries to calculate estimates of occurrence of non-fatal work injuries will suggest a minimum of expected injuries, "at least this many work injuries should be registered". Such calculations necessarily provide an underestimation of the true occurrence.

**Ratio between fatal and non-fatal work injuries (the “coefficient”) method**

Multiplication of the annual number of fatal work injuries by an external coefficient (ratio between fatal and non-fatal) provides, in principle, a more attractive prediction of the true number of non-fatal work injuries in a country. This approach, by exploiting data of fatal work injuries in a country that is estimated, pays attention also to the inherent level of hazardousness of work.

However, it appears that the “coefficient method” has not yet been thoroughly tested in various circumstances, and it is therefore better exercise caution, if using it for the time being.

Empirical results indicate that the ratio between fatal and non-fatal work injuries (the "coefficient") is not uniform across the branches of economic activity (see Table 13). This is the same as with the incidence of work injuries that also differs between industries.

The ratio is much higher for Manufacturing: about 1,350 in the EU-15, 2,100 in Finland. The ratio is much lower for high-risk fatality industries. In the EU-15. the empirical overall coefficient for all industries is about 1,000 (1 fatal to 1,000 non-fatal), but for Agriculture it is much lower, about 450, for Construction about 700, for Transport about 500. In Finland, the corresponding ratios are about 1,300 for all industries, 900 for Construction, 600 for Transport and Communications.

If the structure of economy in a country shows high proportions of workers employed in the high-risk industries (Agriculture, Construction, Transport and Communication), then the expected numbers of non-fatal work injuries, predicted by the "coefficient approach", might be somewhat overestimated.

**Estimated level of reporting non-fatal work injuries**

The levels of reporting of work injuries in the BSN countries by using the two separate explorative strategies of estimation are summarized in Table 14.
Table 14. Estimated reporting level of non-fatal work injuries as expected by using two separate strategies of estimation.

<table>
<thead>
<tr>
<th>Estimated level of reporting non-fatal work injuries</th>
<th>Using coefficients (ratio between fatal and non-fatal injuries) from benchmark countries (Finland, Germany, or the EU-15) (%)</th>
<th>Using external incidence rates from benchmark countries (Finland, Germany, or the EU-15) (%)</th>
<th>Previously estimated reporting levels ESAW 2001 ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>55–70</td>
<td>55–60</td>
<td>46</td>
</tr>
<tr>
<td>Norway</td>
<td>36–47</td>
<td>-</td>
<td>25–100</td>
</tr>
<tr>
<td>Sweden</td>
<td>35–46</td>
<td>-</td>
<td>52</td>
</tr>
<tr>
<td>Estonia</td>
<td>10–13</td>
<td>18–20</td>
<td>-</td>
</tr>
<tr>
<td>Latvia</td>
<td>2–3</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>Lithuania</td>
<td>3</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>Poland</td>
<td>15–19</td>
<td>28–31</td>
<td>-</td>
</tr>
<tr>
<td>Russia</td>
<td>2</td>
<td>8–10</td>
<td>-</td>
</tr>
</tbody>
</table>

¹ ESAW 1998 data (see: ESAW 2001)

Because the use of external incidence rates of benchmark countries results in underestimation of the true occurrence of non-fatal work injuries, the level of reporting work injuries will become artificially elevated. As is evident in Table 14, the approach of using external coefficients from benchmark countries will reveal levels of reporting which are lower than the results from the external incidence approach.

**Comparison with earlier estimates**

The calculations that applied external coefficients (ratio between fatal and non-fatal) and national totals of fatal work injuries in Denmark, Norway, and Sweden indicated levels of reporting of non-fatal work injuries that were of the same order of magnitude than earlier estimates made by ESAW (2001) (Table 14).

**10.1 Pluses and minuses of using external incidence rates to estimate the minimum occurrence of non-fatal injuries**

**Assumptions**

The benchmark countries have, by definition, better working conditions and lower incidence rates of work injuries than the countries whose performance is being evaluated.
The use of several benchmarks can sometimes increase the acceptance of the estimates.

**Pluses**

- the idea is intuitive
- the method is simple
- easy to explain
- understandable also to non-specialists

**Minuses**

- the estimates are necessarily underestimates, “at least this many injuries”
- the actual risk level (working conditions) in the country has no impact to the estimate

### 10.2 Pluses and minuses of using external coefficients to estimate the occurrence of non-fatal injuries

**Assumptions**

The benchmark countries have, by definition, better working conditions and lower incidence rates of work injuries than the countries whose performance is being evaluated.

The use of several benchmarks can sometimes increase the acceptance of the estimates.

**Pluses**

- the actual risk level (working conditions) has an impact to the estimate
- a simple rule of thumb 1:1,000, based on EU-15 experience
- easy to explain also to non-specialists

**Minuses**

- the empirical relationship between fatal and non-fatal work injuries needs further characterization as regards separate branches of economic activity
- sensitive to the completeness of reporting of fatal work injuries
11 General notes/Discussion points

All BSN countries have built surveillance systems to monitor the occurrence and trends of key outcome indicators of occupational health and safety. However, official statistics on work injuries of many countries are of limited quality. The reporting level of work injuries, the propensity to report, depends strongly on the system that governs the compensation of such events.

**Poor quality of data: Need to be pragmatic**

As regards monitoring or surveillance systems, problems of data quality and comparability affect most kinds of data of work injuries. In some areas, international guidelines stipulate how principal concepts are defined, such as branch of economic activity (ISIC Rev. 3), and hence are largely comparable across most countries. Nonetheless, even for highly standardized variables some differences in definition exist between countries. Even in cases where international organizations have spent decades to coordinate how data should be defined and collected, problems of comparability remain (see [http://www.nsd.uib.no/](http://www.nsd.uib.no/)).

It is useful to make crude comparisons even when it is well known that there are differences and methodological uncertainties between the data sources of different countries. International comparisons have the potential of being eye-openers and promoters for change.

At this phase of development, it would not be practical to demand strict comparability for monitoring statistics across countries in all situations. The level of maturity of the monitoring system determines what level of quality of data can be reasonably expected. One should not set impractical expectations for comparability demands.

Reasonable degree of imprecision in comparability between countries can well be tolerated. If there is a problem that requires an exact unbiased result as an answer, then one must conduct proper epidemiological studies.

**Interpretation problems from failing surveillance**

Under-reporting of work injuries is known to be widespread, but the number of injuries that go unreported is difficult to quantify.

Because of many uncertainties, it has been sometimes suggested, that data quality issues being prominent, it may be more relevant to analyse indicator trends rather than levels.

Yet, if only 10–20 % of the actual number of work injuries are registered in some countries, how much can be trusted on the results that are presented as trend calculations? How to interpret a result that shows that more cases of
work injuries were registered during the past year than during earlier years? Does it mean that the number of injuries has increased, or does it mean that injuries have been registered more effectively than before? How useful can such statistics be for planning of interventions and monitoring of the results, if the reporting level is known to be very low?

If only a small proportion of work injuries is reported and registered, it may be impossible to say with any degree of certainty what the actual situation is or is the situation developing for better or for worse.

**Consequences of under-reporting**

The data on non-fatal injuries for countries that entered the EU in 2004 have not been disseminated by Eurostat because of under-reporting problems till 2007. Since 2008 the data are published, but the under-reporting phenomenon is acknowledged to exist. (ESAW, 2008 onwards)

Statistical indicators are fundamental components in creating and implementing policies.

The negative influence that under-reporting has on preventive safety measures at enterprise level is quite substantial. Employers are guided by injury statistics in designing and implementing workplace safety programmes. If employers are not fully aware of the size of the work injury events that occur in their workplaces, preventive efforts may remain less of a priority.

A similar problem exists at the national level. Decision makers who control resources and expenditures tend to rely in official statistics and do not expect that an extensive proportion, perhaps 80% or more in some countries, of work injuries may not have been included in the national statistics.

If decision makers are not aware about the true size and nature of the burden of work injuries, preventive efforts may not be considered, calculations of economic loss are distorted, etc.

**Need for linkage to economic parameters**

Work-related injuries and diseases contribute to the overall expenses of medical care and morbidity more than is generally assumed. Such expenses have been calculated in the USA to be at least as large as the cost of cancer (Leigh 2011).
12 Conclusions and recommendations

- The results of the analyses indicate that the level of reporting is less than 10 to 20% of the estimated level of non-fatal work injuries (>3 days absence from work) in several BSN countries.

- As a consequence of severe under-reporting of work injuries, the decision makers of many countries have at their disposal seriously deceptive statistical information when setting policy objectives, or defining priorities on the national agenda.

- Monitoring for trends of non-fatal work injuries would be inappropriate and misleading in countries where the level of reporting is less than 10 or 20%.

- Reliable work injury indicators should be made available to the national decision makers, employers, trade unions, and other stakeholders so as to support them in planning, implementing, and monitoring the performance of workplace safety programmes.

- A thorough analysis is needed to estimate the size of the economic loss caused by hazardous working conditions by branch of economic activity in the countries of the Baltic Sea Region.
Notes on the ratio between fatal and non-fatal work injuries in Finland

A particular interest is to consider: How does the ratio between fatal and non-fatal work injuries relate to changes in the occurrence rates of work injuries over time? How much does the ratio indicator vary between branches of economic activity? How much is the ratio indicator influenced by the level of the rate of fatal work injuries?

Finnish statistical data was analysed in order to have a view on the variability of the ratio indicator, and to survey on how the ratio indicator behaves over periods of years and by branch of economic activity.

Components:

The components of the ratio between fatal and non-fatal work injuries are (a) fatal work injuries and (b) non-fatal work injuries (>3 days' absence from work).

\[
\text{ratio indicator} = \frac{\text{number of non-fatal injuries}}{\text{number of fatal injuries}}
\]

Descriptive statistics of fatal work injuries in Finland

The total incidence rates of fatal work injuries in Finland, and the rates by branch of economic activity, have declined substantially in a 28-year period between 1980 and 2007 (Table 1). The total rate of fatal injuries has declined at an average speed of 2 percentages per year. In 2005-2007 the overall fatality rate was less than 50% of the rate in 1980-1984. The most remarkable decline has taken place in the Manufacturing industry.

Table 1. Incidence rates and numbers of cases of fatal work injuries per 100,000 employees, 5-year averages. Includes injuries at actual work place and in work traffic. (Rates calculated from LABORSTA data: Occupational injuries - 8B Rates of occupational injuries, by economic activity.)

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rate</td>
<td>Rate</td>
<td>Rate</td>
<td>Rate</td>
<td>Rate</td>
<td>Rate</td>
</tr>
<tr>
<td>Total</td>
<td>4.6</td>
<td>3.9</td>
<td>3.5</td>
<td>2.7</td>
<td>2.1</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>81</td>
<td>66</td>
<td>51</td>
<td>42</td>
<td>44</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>8.2</td>
<td>4.2</td>
<td>3.3</td>
<td>3.1</td>
<td>2.7</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>22</td>
<td>14</td>
<td>13</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>Construction</td>
<td>12.1</td>
<td>9.3</td>
<td>11.2</td>
<td>10.1</td>
<td>8.4</td>
<td>7.7</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>15</td>
<td>14</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Transport</td>
<td>10.0</td>
<td>9.1</td>
<td>9.3</td>
<td>7.6</td>
<td>5.7</td>
<td>7.8</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>15</td>
<td>14</td>
<td>11</td>
<td>9</td>
<td>8</td>
</tr>
</tbody>
</table>

ⁱ⁾Three years
Incidence of fatal work injuries per 100,000 employees in Finland 1980 - 2007

**All industries: Incidence**

1980-1984 mean incidence: 4.6 per 100,000
2005-2007 mean incidence: 2.1 per 100,000

**Manufacturing: Incidence**

1980-1984 mean incidence: 4.8 per 100,000
2005-2007 mean incidence: 1.5 per 100,000
Incidence of fatal work injuries per 100,000 employees in Finland 1980 - 2007

Construction: Incidence

<table>
<thead>
<tr>
<th>r</th>
<th>r²</th>
<th>Slope</th>
<th>Y Intercept</th>
<th>Std. Err. of Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.4903</td>
<td>0.2406</td>
<td>-0.153941</td>
<td>316.829498</td>
<td>2.2920</td>
</tr>
<tr>
<td>t</td>
<td>df</td>
<td>p</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-2.87</td>
<td>26</td>
<td>0.004025</td>
<td>two-tailed</td>
<td>0.008050</td>
</tr>
</tbody>
</table>

N: 28
X: Mean 1993.5 9.9599
Variance 67.6697 6.6947
Std. Dev. 0.225 0.5613
Std. Err. 1.1516 0.4879

1980-1984 mean incidence: 12.1 per 100,000
2005-2007 mean incidence: 7.7 per 100,000

Incidence of fatal work injuries per 100,000 employees, Finland 1980 - 2007

Transport & communication: Incidence

<table>
<thead>
<tr>
<th>r</th>
<th>r²</th>
<th>Slope</th>
<th>Y Intercept</th>
<th>Std. Err. of Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.4311</td>
<td>0.1891</td>
<td>-0.135249</td>
<td>316.273333</td>
<td>4.00394</td>
</tr>
<tr>
<td>t</td>
<td>df</td>
<td>p</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-2.48</td>
<td>26</td>
<td>0.009940</td>
<td>two-tailed</td>
<td>0.018938</td>
</tr>
</tbody>
</table>

1980-1984 mean incidence: 10.0 per 100,000
2005-2007 mean incidence: 7.8 per 100,000
Descriptive statistics of non-fatal work injuries in Finland

Table 2. Numbers of cases of non-fatal work injuries by branch of economic activity in Finland, 5-year averages. More than 3 days’ absence from work. Includes injuries at actual work place and in work traffic.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>111,934</td>
<td>104,715</td>
<td>75,625</td>
<td>56,706</td>
<td>57,282</td>
<td>61,480</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>52,847</td>
<td>44,357</td>
<td>28,195</td>
<td>20,096</td>
<td>17,645</td>
<td>16,167</td>
</tr>
<tr>
<td>Construction</td>
<td>20,128</td>
<td>13,218</td>
<td>13,193</td>
<td>8,173</td>
<td>9,705</td>
<td>12,034</td>
</tr>
<tr>
<td>Transport</td>
<td>7,730</td>
<td>7,527</td>
<td>6,961</td>
<td>6,024</td>
<td>6,103</td>
<td>6,810</td>
</tr>
</tbody>
</table>

¹) Three year averages

Table 3. Occurrence of non-fatal work injuries per 100,000 employees by branch of economic activity, 5-year averages. More than 3 days’ absence from work. Includes injuries at actual work place and in work traffic.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>3,054</td>
<td>2,789</td>
<td>2,875</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>4,866</td>
<td>4,105</td>
<td>3,876</td>
</tr>
<tr>
<td>Construction</td>
<td>7,861</td>
<td>8,197</td>
<td>8,022</td>
</tr>
<tr>
<td>Transport</td>
<td>4,233</td>
<td>4,081</td>
<td>4,401</td>
</tr>
</tbody>
</table>

¹) Three year average

**Incidence of non-fatal work injuries (>3 d absence from work) per 100,000 employees in Finland 1995 - 2007**

1995-1999 mean incidence: 3,054 per 100,000
2005-2007 mean incidence: 2,875 per 100,000
For the Manufacturing industries, the data points of non-fatal work injuries do not deviate far from the linear regression line over the years. The correlation coefficient is very strong. This observation provides much credibility to the quality of the notification and registering systems of non-fatal work injuries (>3d absence from work) in the manufacturing industries. The difference is conspicuous in comparison to the much more pronounced spread of data points for the Construction or Transport industries.
In the Construction industries, the statistics of non-fatal work injuries show very large deviations from the linear regression line over the years. The correlation coefficient is low. This observation suggests that the quality and completeness of the notification and registering systems of non-fatal work injuries (>3d absence from work) in the construction industries would deserve to be improved. These statistics appear much less credible than those of the Manufacturing industries.

**Incidence of non-fatal work injuries (>3 d absence from work) per 100,000 employees in Finland 1995 - 2007**

- 1995-1999 incidence average: 4,233 per 100,000
- 2005-2007 incidence average: 4,401 per 100,000

The two figures below show the total numbers of registered fatal and non-fatal work injuries in Finland in a 28-year period between 1980 and 2007.
In Finland, the numbers of both fatal and non-fatal (>3 d absence from work) work injuries has declined more than 50% during the 28 years between 1980 and 2007.

The ratio between fatal and non-fatal work injuries in Finland

Table 4. The ratio between fatal and non-fatal work injuries by branch of economic activity in Finland, 5-year averages.

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1,307</td>
<td>1,302</td>
<td>1,138</td>
<td>1,138</td>
<td>1,359</td>
<td>1,452</td>
<td>1,271</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>1,693</td>
<td>2,065</td>
<td>2,126</td>
<td>2,045</td>
<td>1,167</td>
<td>2,742</td>
<td>1,918</td>
</tr>
<tr>
<td>Construction</td>
<td>1,080</td>
<td>1,460</td>
<td>896</td>
<td>805</td>
<td>1,113</td>
<td>1,087</td>
<td>1,073</td>
</tr>
<tr>
<td>Transport</td>
<td>521</td>
<td>533</td>
<td>594</td>
<td>697</td>
<td>713</td>
<td>874</td>
<td>640</td>
</tr>
</tbody>
</table>

The table presents rather consistent patterns of scores over the years. The Manufacturing industry shows consistently higher scores of the ratio indicator than the total average, with the exception for the years 2000-2004. The Construction industry and the Transport and communications industry show consistently lower scores than the total average.

The empirical ratio between fatal and non-fatal work injuries seems insensitive to the level of the rate of fatal work injuries (a presumed main measure of hazardourness of working conditions). From 1980 to 2007 the rate of fatal work injuries declined more than 50% from 4.6 to 2.1 per 100,000 employees, but the level of the ratio remained unchanged.

The trend line chart of the ratio between fatal and non-fatal work injuries is displayed in Figure A.
Figure A. Finland 1980 – 2007: The trend line chart of the ratio between fatal and non-fatal work injuries (at least 3 days’ absence from work).

A mere visual inspection of the graph indicates that the ratio between fatal and non-fatal work injuries for all industries has remained at the same level, on average, throughout the follow-up between 1980 and 2007. (A formal statistical assessment shows no statistically significant trend for the ratio during the 28 years of follow-up.)

[The ratio between fatal and non-fatal injuries over the span of 28 years occasionally shows remarkable peaks and lows. (The peak in 1984: due to exceptionally low number of fatal injuries; ibid. in 2002, ibid. in 2007. The lows in 1997 and 1998: due to exceptionally high numbers of fatal injuries.) The occasional unsteadiness of the ratio indicator is mostly caused by annual variability in the numbers of the denominator (cases of fatal injuries). Such yearly zigzagging of indicator values can be smoothened by using time spans of five years, for instance. ]

The ratio between fatal and non-fatal work injuries could be a tool for a specific purpose: it could be used in the assessment of the approximate number, or level of under-reporting, of non-fatal work injuries in a country whose economy reasonably resembles that of Finland.

N = 28
Mean 1270
SD 222
r = 0.17
r² = 0.03
p (one-tailed) 0.20
p (two-tailed) 0.40
Ratio between fatal and non-fatal work injuries in Finland 1980–2007

### All industries

<table>
<thead>
<tr>
<th>t</th>
<th>df</th>
<th>p</th>
<th>one-tailed</th>
<th>two-tailed</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.46</td>
<td>26</td>
<td></td>
<td>0.198825</td>
<td>0.307460</td>
</tr>
</tbody>
</table>

1980-1984 mean ratio: 1,307 : 1
2005-2007 mean ratio: 1,271 : 1

### Manufacturing

<table>
<thead>
<tr>
<th>t</th>
<th>df</th>
<th>p</th>
<th>one-tailed</th>
<th>two-tailed</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.04</td>
<td>26</td>
<td></td>
<td>0.4844006</td>
<td>0.908399</td>
</tr>
</tbody>
</table>

1980-1984 mean ratio: 1,695 : 1
2005-2007 mean ratio: 1,918 : 1
The ratio between fatal and non-fatal work injuries in Transport industries shows a statistically significant (two-tailed $p = 0.02$) increasing trend during the period from 1980 to 2007. The occurrence of non-fatal work injuries remained at the same level from 1980 to 2007, but the occurrence of fatal injuries has declined over time. (A 23% increase during a time span of 28 years of follow-up, although statistically significant, translates to a change of less than 1% per year.)
Findings and tentative conclusions concerning the ratio indicator

- During the period from 1980 to 2007 in Finland, the occurrence of both fatal and non-fatal work injuries has been approximately halved.

- From 1980 to 2007, the ratio between fatal and non-fatal work injuries for all economic activities in Finland remained at the level of about 1,300 non-fatal injuries (>3 days’ absence from work) per one fatal injury. No trend in the score of the ratio indicator was discernible.

- The level of the ratio indicator remained unchanged for the branches of Manufacturing and Construction for 28 years. No trends were noticeable.

- The ratio indicator was not fully stable over time in all branches of economic activity. Transport & communications industry showed a 23% increase in the ratio indicator from 1980 to 2007 (two-tailed p = 0.02) – this translates to a change of less than 1% per year on average.

- The Manufacturing industry showed rather consistently higher scores of the ratio indicator than the total average. The Construction industry and the Transport and communications industry showed consistently lower scores than the total average.

- The ratio indicator showed some remarkable peaks and lows during the span of 28 years. The occasional unsteadiness of the indicator was caused by variability in the denominator (cases of fatal injuries). Such peakedness could be smoothened by using a time span of five years, for instance.

- The ratio between fatal and non-fatal work injuries was insensitive to the rate of fatal work injuries.
Literature


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http://ssmon.chb.kth.se/index.php/volume-18/issue-1


Standardised Incidence rates in ESAW.  


Severe Under-reporting of Work Injuries in Many Countries of the Baltic Sea Region:

An exploratory semi-quantitative study

“What goes unreported goes unfixed”

Kari Kurppa, MD, PhD
Finnish Institute of Occupational Health
Helsinki 2015