Comparison of Fatal Occupational Injury Surveillance Systems Between the European Union and the United States

Fernando G. Benavides, MD, PhD,1 George L. Delclos, MD, MPH,2 Sharon P. Cooper, PhD,3 and Joan Benach, MD, PhD1

Background  Comparison of workplace injury statistics among countries is often problematic, mainly because work injury statistics are based on different national recording and notification systems.

Methods  Definitions of fatal work-related injuries, identification of the reference population, and rates of fatal work-related injuries, from 1995 to 1998, were compared between the European Statistics on Accidents at Work (ESAW) and the United States (U.S.) Census of Fatal Occupational Injuries (CFOI).

Results  Similar definitions for workplace fatalities were found, but CFOI is based on an active search, and ESAW on passive notification. Daily fatal occupational injury numbers were similar in both: about 17 workers die per day, but average annual work-related death rates were higher in the U.S.

Conclusions  There are enough differences to allow direct comparisons between both systems. CFOI is likely to be more comprehensive than ESAW. It is conceivable that the true number of fatal occupational injuries in the European Union (E.U.) could be higher, and thus the apparent difference in U.S. and E.U. fatal injury rates may be an artifact of the different surveillance systems.

KEY WORDS: fatal work injury; fatality rates; work environment; global economy

INTRODUCTION

The assessment and comparison of workplace injuries among countries is often problematic, mainly because work injury statistics are based on different national recording and notification systems [ILO, 1996]. However, given economic global trends and an increasing number of trade agreements, that may contain provisions addressing health and safety issues, there is a need for comparable information systems that can allow the development of regional and global policies to prevent occupational injuries. This is crucial so that countries with weaker safety rules do not gain an unfair advantage over those with stricter regulations.

The International Labor Organization (ILO) recently estimated that annual crude work fatality rates averaged around 14 per 100,000 workers per year (335,000 deaths worldwide in 1994), ranging from 5.37 in established market economies (the United States of America, European Union, etc.) to 23.12 in Other Asia and island countries (Indonesia, Pakistan, Korea, etc.) [Takala, 1999]. Although workplace fatalities are somewhat more reliably reported than nonfatal occupational injuries, underreporting of the work-relatedness of events, differences in economic activity structures,
and inaccurate employment figures used were some of the main shortcomings identified by the ILO that can limit even comparisons of fatality rates. However, the ILO advocates these kinds of comparisons because, in addition to their need as economies become more global, they can also lead to improvements of national surveillance and information systems.

Within two of the most developed economic regions of the world, the United States (U.S.) and the European Union (E.U.), where these limitations might be less of a factor, workplace deaths continue to be a major public health problem [Herbert and Landrigan, 2000]. An appropriate comparison between both regions could provide useful insight towards improving global cooperation in the occupational health and safety arena [Schulte, 2002]. To our knowledge, no studies so far have compared both regions. The objectives of this article were to describe fatal work injury surveillance system characteristics, and to compare basic statistics between the U.S. and the E.U.

METHODS

The U.S. has two primary surveillance systems for recording work-related fatalities: the National Traumatic Occupational Fatalities (NTOF) surveillance system and the Census of Fatal Occupational Injuries (CFOI). Although both programs are complementary, CFOI was used in this study. The main advantage of CFOI is that it is based on multiple data sources, in contrast to NTOF, which relies only on the use of death certificates [Biddle and Marsh, 2002]. Beginning in 1992, the CFOI surveillance system is considered to be more complete and reliable, since it includes all fatal occupational injuries confirmed by at least two separate sources that document the work relationship of the fatality, such as state agency administrative reports, death certificates, and/or workers’ compensation reports [Rosa et al., 2000]. In this study the number of fatal occupational injuries by sex, age, and industry was collected from the CFOI home page [Bureau of Labor Statistics, 2001].

Since 1994, the E.U. has produced the annual European Statistics on Accidents at Work (ESAW) report through EUROSTAT, a Directorate-General of the European Commission, to process and publish comparable statistical information at the European level, applying a harmonized methodology based on country sources [Eurostat, 2001c]. The data on fatal occupational injuries used in this study were obtained from the EUROSTAT databases [Eurostat, 2001a].

Fatality crude rates by sex and age from 1995 to 1998 were calculated as deaths per 100,000 workers. This 4-year period was chosen because, at the time of the analysis, it was the only period common to both reporting systems. The fatality rates published by CFOI, based on employment data from the Current Population Survey as a denominator, were used. For the ESAW, fatality rates were recalculated using employment data from the Labour Force Survey [Eurostat, 2001b], since typically only rates adjusted for industrial sector are provided, and crude rates are not available.

Definitions of fatal work-related injury, with specification of inclusion and exclusion criteria, identification of the reference population and other surveillance system characteristics, were compared and contrasted between CFOI and ESAW.

Comparison by industrial sector was limited to construction and manufacturing, because of differences in the industrial classification schemes between the Standard Industrial Classification of the U.S. [Office of Management and Budget, 1987], and the Statistical Classification of Economic Activities of the E.U. [NACE, 1990] for other industrial sectors. Differences within these two industrial sectors were not considered, although this could be very relevant, especially in manufacturing. Thus, construction is a very simple sector with relatively few subgroupings. Manufacturing, on the other hand, is a complex sector with many branches (from manufacture of food to chemicals and machinery).

RESULTS

Information Systems

The CFOI and ESAW reporting systems have a very similar case definition for workplace fatality (Table I). Both include deaths occurring off company premises during working hours and during work where the vehicle is considered the work environment (i.e., road traffic injuries of a truck driver), although for some European countries, such as the United Kingdom and Ireland, these are excluded. Deaths occurring while commuting to or from work are also excluded by both systems.

Both ESAW and CFOI systematically exclude workplace deaths due to non-external causes, such as heart attacks or strokes, unless these were clearly preceded by a traumatic event.

However, there are some differences between the two systems. For example, many European countries do not include fatal work injuries that affect the self-employed (totally for Belgium, France, Portugal, Greece, and the Netherlands, and partially for Spain, Germany, and Finland), or for some public services workers (Belgium, Greece, Spain, France, Netherlands, and Portugal). In contrast, work-related deaths are collected across all industrial sectors in the United States, including the public and self-employed sectors.

In part, system differences in event counting are a consequence of the sources used by each system. The CFOI surveillance system is based on a comprehensive, active search of different sources, such as death certificates, workers’ compensation, or state agency administrative
TABLE I. Definitions and Surveillance System Characteristics of Fatal Occupational Injuries in the United States (U.S.) and the European Union (E.U.)

<table>
<thead>
<tr>
<th>Fatal occupational injuries</th>
<th>U.S.</th>
<th>E.U.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agency</td>
<td>Bureau of Labor Statistics (BLS), Census of Fatal Occupational Injuries (CFOI)</td>
<td>EUROSTAT European Statistics on Accidents at Work (ESAW)</td>
</tr>
<tr>
<td>Established</td>
<td>1992</td>
<td>1994</td>
</tr>
<tr>
<td>Case definition</td>
<td>A death in which the decedent was working at the time of the event</td>
<td>A discrete occurrence in the course of work which leads to the death of the victim</td>
</tr>
<tr>
<td>Additional inclusion criteria</td>
<td>Occurring off the employer’s premises but was there to work</td>
<td>Occurring during work but off company premises</td>
</tr>
<tr>
<td></td>
<td>Engaged in work activity where the vehicle is considered the work environment (e.g., taxi, truck)</td>
<td>Road traffic fatalities (i.e., truck drivers) except for Ireland and the United Kingdom</td>
</tr>
<tr>
<td></td>
<td>Fatal heart attacks and strokes only if a traumatic work injury was a contributory cause of death</td>
<td></td>
</tr>
<tr>
<td>Exclusion criteria</td>
<td>Commuting deaths (to or from work)</td>
<td>Commuting deaths (to or from work)</td>
</tr>
<tr>
<td></td>
<td>Deaths having only a medical origin (i.e., heart attacks at work or strokes)</td>
<td>Deaths having only a medical origin (i.e., heart attacks at work or strokes)</td>
</tr>
<tr>
<td></td>
<td>Work accidents which affect specific groups of employees in some countriesa</td>
<td></td>
</tr>
<tr>
<td>Data sources</td>
<td>Active search for at least two reliable sources documenting the work relationship of the fatality: state agency administrative reports, death certificates, or workers’ compensation and claim reports</td>
<td>Passive reporting under insurance schemes in eleven member countries and on labor inspectorate report in the remaining four countries</td>
</tr>
<tr>
<td>Reference population</td>
<td>An estimation of all civilian employees age 16 years and older from the Current Population Survey plus resident military figures from the Bureau of the Census</td>
<td>Employed persons age 15 years and over estimated through the European Labour Force Survey was used in this studyb</td>
</tr>
</tbody>
</table>

aSelf-employed workers are totally excluded in Belgium, Greece, the Netherlands, and Portugal; they are partially excluded in Spain, Germany, and Finland. Also excluded are some public services workers in Belgium, Greece, Spain, France, the Netherlands, and Portugal.
bEurostat amended this figure to adjust numerator to denominator.

reports. On the other hand, ESAW is based mainly on passive notification linked to specific insurance schemes in 11 E.U. countries, and on labor inspection records for the 4 remaining member countries (Denmark, the Netherlands, United Kingdom, and Ireland).

The worker population used by CFOI, based on the Current Population Survey, includes all employed workers age 16 years and older, including government workers and military service workers residing in the U.S., which allows comprehensive estimates of rates. In this study, all employees age 16 years and over were used to estimate global rates, although when comparisons among European members are made by EUROSTAT, all self-employed workers in Belgium, Greece, the Netherlands, and Portugal are excluded, and partially excluded in Spain, Germany, and Finland. Workers from some public services in Belgium, Greece, Spain, France, the Netherlands, and Portugal are excluded.

Comparison of Statistics

The daily fatal occupational injury figures in the U.S. and the E.U. during the 1995–1998 period were similar: around 17 workers (14 men and 3 women) die every day as a consequence of their jobs. In terms of rates, a slightly decreasing trend was observed in both the U.S. and E.U., although rates were consistently higher in the U.S. than in the E.U. (Table II). The average annual work-related death rate for the study period was 4.7 per 100,000 workers in the U.S., and 3.8 in the E.U., or 24% higher in the former. With respect to differences by sex, fatality rates were 10-fold higher for men than women in the U.S., and 11-fold higher in the E.U. Rates among women during the study period were between 60 and 100% higher in the U.S. than in the E.U.

Age-related fatal injury rates were also similar in both regions (Fig. 1) in 1998, work-related fatality rates per 100,000 were lowest for workers under 25 years of age (3.1 in the U.S. and 2.9 in the E.U.) and highest for workers 65 years of age and over (14.3 and 9.5, respectively). Importantly, though, differences between the U.S. and E.U., by age group, progressively widened with increasing age, from approximately 7% for workers under 25 years of age to over 50% in those 65 years of age and over.

Specific fatality rates for the manufacturing sector were higher in the E.U. (varying from 4.2 in 1995 to 3.5 per 100,000 in 1998), than in the U.S. (from 3 to 3.3, respectively) (Fig. 2). However, during the same time period,
there was a steady decline in the E.U. rates, of approximately
20%, whereas rates in the U.S. remained relatively un-
changed. Conversely, specific rates for the construction
industry were consistently lower in the E.U. than in the U.S.,
with a progressively widening difference over the 4-year-
period, since construction fatality rates decreased by 21% in
the E.U. (from 13.8 to 11.4 per 100,000 workers), but varied
little in the U.S. (from 15 to 14.5 per 100,000). Differences in
fatal work-related injury rates between the manufacturing
and construction sectors were greater in the U.S. The fatality

<table>
<thead>
<tr>
<th>Year by sex</th>
<th>U.S.</th>
<th>E.U.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Deaths</td>
<td>Employed&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>1995</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6,210</td>
<td>126,248</td>
</tr>
<tr>
<td>Male</td>
<td>5,676</td>
<td>68,556</td>
</tr>
<tr>
<td>Female</td>
<td>534</td>
<td>57,692</td>
</tr>
<tr>
<td>1996</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6,112</td>
<td>127,997</td>
</tr>
<tr>
<td>Male</td>
<td>5,605</td>
<td>69,329</td>
</tr>
<tr>
<td>Female</td>
<td>507</td>
<td>58,668</td>
</tr>
<tr>
<td>1997</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6,218</td>
<td>130,810</td>
</tr>
<tr>
<td>Male</td>
<td>5,743</td>
<td>70,769</td>
</tr>
<tr>
<td>Female</td>
<td>475</td>
<td>60,041</td>
</tr>
<tr>
<td>1998</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6,026</td>
<td>132,684</td>
</tr>
<tr>
<td>Male</td>
<td>5,544</td>
<td>71,744</td>
</tr>
<tr>
<td>Female</td>
<td>482</td>
<td>60,940</td>
</tr>
</tbody>
</table>

<sup>a</sup>In thousands.
<sup>b</sup>Fatality rate per 100,000 workers.
<sup>c</sup>Differences are due to cases where sex was not specified.

rate in the construction industry was approximately five times that in the manufacturing industry in the U.S., as compared to a 3-fold difference between the two sectors in the E.U.

**DISCUSSION**

This initial evaluation of data from two large fatal occupational injury surveillance systems in the U.S. and the E.U. revealed that there are important differences to be considered when conclusions from these kinds of comparisons are drawn. The most significant disparity may reside in the fact that CFOI is based on an active search of work-related injury deaths, where death certificates play an important role as a source of cases. This allows CFOI to identify work-related deaths in all workers, including self-employed and government workers. The ESAW system, on the other hand, is based on passive reporting from only one source, either social security claims or labor inspectorate reports, depending on the member state. This may signify that ESAW excludes all fatal occupational injuries occurring in workers not covered by social security health insurance schemes related to work injury, including many self-employed workers and civil servants (permanent government workers providing public services) in some European countries. Self-employment represents around 12% of the total employment in the E.U. [Eurostat, 2001b].

However, a clear, and critical, similarity between the CFOI and ESAW systems is the case definition of a fatal occupational injury that includes on-the-job traffic fatalities, with the exception of Ireland and the United Kingdom, and excludes deaths while commuting to and from work, as well as those resulting from non-traumatic events. The exclusion of motor vehicle occupational fatalities (which represent around 37.5% of all work-related fatalities in the entire E.U.) in Ireland and the United Kingdom may be another important source of underreporting [Dupré 2001].

Previous studies conducted in the U.S. have indicated that any single source is unlikely to capture all fatal occupational accidents. In a review that assessed effectiveness of source documents for identifying fatal occupational injuries, one of the weakest sources were state agency administrative reports, which showed a capture rate of only 32% [Stout and Bell, 1991]. The sensitivity of death certificates in identifying work-related fatal injuries has been reported as 77.6%, with a specificity of over 99% [Kraus et al., 1995]. We are unaware of any similar studies in the E.U., except for a recent study that detected an underreporting of nearly 10% for fatal occupational injuries in Spain, probably because they occurred days after injury date [Benavides et al., 2003]. These comparisons suggest that the CFOI system is likely to be more comprehensive than ESAW. Although a specific study to assess ESAW completeness for fatal work-related injuries is needed, our hypothesis is compatible with a recent study by the ILO, which estimated that in the E.U., about 3,000 occupational fatalities are missed each year. This estimate was applied to the totality of the employed population, including self-employed workers and civil servants [Takala, 1999].

Differences in completeness of reporting between the two systems could, in part, explain the high rates found in the U.S. in comparison with the E.U., although absolute numbers are quite similar, and the employed workforce in the E.U. is slightly larger than in the U.S. It is conceivable that the true number of fatal occupational injuries in the E.U. could be higher than that reported by ESAW. If, for example, the U.S. workplace fatality rate for 1998 (4.5 per 100,000) were applied to the E.U. employed workforce of the same year (n = 152,494,000), the number missed would be...
approximately 1,386 fatal occupational accidents. Based on the aforementioned observations, a substantial portion of these missed occupational injury cases could have occurred among self-employed workers, civil servants not covered by social security systems, and uncounted motor vehicle occupational fatalities in Ireland and the United Kingdom.

An alternative argument could be that the working conditions in the U.S. are more dangerous than in the E.U., but the percentages of people working in construction and manufacturing (the only two common specific sectors in both) were higher in the E.U. (7.7 and 20.7%, respectively) than in the U.S. (6.5 and 15.6%, respectively) in 1998. A study of rates, adjusted for industrial sectors, is needed to explain these differences.

Age distribution differences are not likely to explain overall rate differences because the age distributions were very similar between the U.S. and the E.U. workforce: those under 25 years comprised 15.1 and 11.4% of workers, respectively, while those 65 years and over were 1.3 and 2.8%, respectively.

Despite these differences, both surveillance systems showed a slightly decreasing trend in rates over the study period. Previous studies have reported similar trends. In the U.S., with NTOF data which is based only on death certificates, occupational injury mortality rates decreased annually by approximately 3.7% from 1980 to 1989 [Stout et al., 1996]; after adjusting for race, sex, and age and using a regression model, the annual decrease was 3.1% between 1983 and 1992 [Bailer et al., 1998]. Based on CFOI data, the rate declined overall by 7% between 1992 and 1997 [Rosa et al., 2000]. In the E.U., an overall decrease of more than 21% was reported between 1994 and 1999 [Eurostat, 2002].

In terms of demographic characteristics of workers, both surveillance systems show a similar pattern. The high-risk in men and in workers aged 65 years and older, as expected [Veazie et al., 1994], showed that both high-risk groups share a similar death rate distribution in the U.S. and in the E.U., although the higher work-related fatality rate among women in the U.S. should be further explored. A possible explanation could be homicide work fatality in the U.S. For several years, homicide has been the leading cause of workplace fatalities among women in the U.S. [Jenkins, 1996]. However, the higher fatality rate in the elderly in the U.S., in comparison with the E.U. could be due to a reporting bias, since in Europe there is a high percentage of self-employed workers 50 years of age or older (representing 27% of all self-employed workers).

The disparities in rates by age groups, which persist when examined further by sex, occupation, and economic activity, have been explained in terms of a decreased ability to survive injury, less dexterity, and also because older workers may be undercounted in the workforce [NIOSH, 1993]. The current ageing of the workforce in both the U.S. and the E.U. makes it urgent to further clarify the causes of the higher risk in older workers. It should also be noted that neither system includes rates for young adolescent workers, whose participation in the workforce has been increasing, at least in the U.S., and who may have higher fatality rates than adult workers [National Research Council, 1998]. More than 70 teenage workers are estimated to die from work-related injuries each year [Runyan and Zakocs, 2000].

Unfortunately, differences between economic activity classifications used in CFOI and ESAW only allowed a meaningful comparison for manufacturing and construction activities. Construction is well established as one of the highest risk activities in the U.S., together with agriculture/forestry/fishing, mining, and transportation. A similar situation exists in the E.U. On the other hand, manufacturing has had low fatality rates in both the U.S. and the E.U. However, fatal occupational injury rates were quite similar for manufacturing, but different for construction. The great similarity found in workplace fatality rates for manufacturing between both systems may be explained in terms of minor underreporting in this economic sector, possibly due to a smaller number of self-employed workers in these industries. This point, however, should be confirmed because the European Labor Force Survey does not provide a distribution of self-employed workers by economic sector [Eurostat, 1999]. Conversely, differences in the construction sector could be due to higher underreporting in this sector, as a consequence, at least in part, of the high number of self-employed workers. If so, the decrease in construction fatalities in the E.U. could be a reflection of the increasing number of self-employed workers in the sector. However, although shifts in the self-employed could partly explain the result, there could also be important differences in construction worker demographics or type of construction activities between the two regions that are not taken into account. Construction was the industry division with the greatest proportion of fatalities (18%) in the U.S. between 1980 and 1995 [Marsh and Layne, 2001].

In summary, direct comparisons of work-related fatality rates are complicated, but they can help to enhance data collection for fatal occupational injuries, a priority for both CFOI and for ESAW. Attempting these comparisons may, in and of themselves, stimulate greater interest in making the definitions and various criteria for data collection more similar. The extensive experience accumulated by CFOI, that builds on the previous experience with the NTOF [Division of Safety Research, 1998; MMWR, 1999] could be useful for ESAW, which could consider incorporating other sources, such as death certificates, to enhance collection of all fatal occupational injuries occurring in the E.U. Both systems might also consider formally addressing the comparability of the two reporting schemes, including harmonization of industrial classifications and occupational titles, which would allow a better understanding of differences in rates and
trends and, subsequently, improve targeting for intervention strategies. It is recognized that fatalities are only a starting point in improving occupational injury surveillance. Future comparisons should be expanded to include non-fatal work-related injuries that are more frequent, and have a different pattern by industrial sector. The move towards a new global society requires that attention be devoted not only to economic needs, but also to health and safety issues.

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