

# Change to Hours-Based Fatality Rates in the Census of Fatal Occupational Injuries

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*In June of 2009, BLS introduced a new methodology for calculating fatality rates. This article describes the new methodology and its benefits and provides examples of the impact of the methodology change.*

The [Census of Fatal Occupational Injuries \(CFOI\)](#) produces fatality rates to measure the risk of incurring a fatal injury faced by groups of workers, such as workers in a certain age group or occupation. These rates also can be used to compare risk among different groups of workers of varying employment levels. Fatality rates are published each year by employee status, gender, age group, race, ethnicity, occupation, and industry.

Fatality counts from the CFOI are combined with data from the [Current Population Survey \(CPS\)](#) to produce these rates. The CPS is a monthly sample survey of about 60,000 households that collects demographic and labor force status information on the civilian population of the United States. Demographic information collected includes age, gender, race, and ethnicity. For the reference week of the survey, respondents also report whether they were employed, whether they were at work, and the number of hours worked.

CFOI fatality rates for years 1992 through 2007 are employment based--that is, they are measured in terms of the number of fatalities per a given number of workers. These rates measure the risk of fatal injury for those employed during a given year, but they do not take into account the amount of time workers are exposed to the risk. Fatality rates calculated in terms of injuries per number of employed workers alone do not fully capture the relative risk of incurring an occupational fatality.<sup>1</sup> This discrepancy is most noticeable among groups that do not typically work a 40-hour work week, such as older and younger workers and workers in retail trade and mining. A more ideal measurement would account for the time a worker is exposed to dangers associated with fatal injuries. As a result, BLS introduced hours-based rates in June of 2009.

## Employment-based Rates

Employment-based rates, available for years 1992 through 2007, represent the number of fatal occupational injuries per 100,000 employed workers. They are calculated as follows:

$(N \div W) \times 100,000$ , where

N = the number of fatal work injuries, and

W = the number of employed workers.

Because the CFOI does not collect employment data, rates are calculated using annual employment estimates from the CPS. The scope of the CPS differs from that of the CFOI. For example, because CPS data exclude the resident military, employment data in the CFOI are supplemented by resident military data from the U.S. Department of Defense. CPS tabulations are limited to the population aged 16 years and older, so fatalities among workers under age 16 are excluded from fatality counts in calculating the rates.

For example, the 2007 employment-based fatality rate is computed as follows:

N = 5,657 – 18 workers under the age of 16 = 5,639;

W = 147,215,000 (from the CPS, 2007 annual averages, plus the resident military figures obtained from the Department of Defense);

Fatality rate =  $(5,639 \div 147,215,000) \times 100,000 = 3.8$  fatalities per 100,000 workers.

**Hours-based Rates**

Hours-based rates use the average number of employees at work and the average hours worked to measure fatality risk per standardized length of exposure. The rates calculated by this method also represent the number of fatal occupational injuries per 100,000 full-time equivalent workers. These rates are calculated as follows:

$$(N \div EH) \times 200,000,000, \text{ where}$$

N = number of fatal injuries,  
 EH = total hours worked by all employees during the calendar year, and  
 200,000,000 = base for 100,000 equivalent full-time workers (working 40 hours per week, 50 weeks per year).

As with the data used for employment-based rates, the data for the average number of employees at work and the average hours worked are obtained from the CPS. Workers under the age of 16 are again excluded from the fatality count to maintain consistency with the CPS. Volunteer workers, also not included in the CPS, are now excluded. In addition, since the CFOI has not been able to obtain reliable hours-worked data for the resident military, military workers are also excluded from the fatality counts used to calculate hours-based rates.

For example, the 2007 hours-based fatality rates are calculated as follows:

$$N = 5,657 - 149 \text{ workers under the age of 16, volunteers, and resident military} = 5,508;$$

$$EH = 275,042,880,000 \text{ (from CPS, 2007 annual averages, } 140,328,000 \text{ employees at work}^2 \text{ times } 39.2 \text{ average hours per week times } 50 \text{ weeks);}$$

$$\text{Fatality rate} = (5,508 \div 275,042,880,000) \times 200,000,000 = 4.0 \text{ fatalities per } 100,000 \text{ workers.}$$

Employment- and hours-based rates will be similar for groups of workers who tend to work full time and year round. Rates will be higher for some worker groups, such as those with a large proportion of part-time workers. Examples are the youngest and oldest workers and workers in the retail trade industry. Rates will be lower for groups of workers who work more hours than average or who rarely take time off, such as workers in the mining industry or farmers and ranchers.

Table 1 shows both employment- and hours-based rates for selected worker demographic and major industry groups for 2007. Since not all workers work full time through the entire year, the hours-based methodology produces a rate for all workers of 4.0 and the employment-based methodology yields a rate of 3.8. For workers over age 65, who are more likely to work part-time, the hours-based rate is 13.5 and the employment-based rate is 10.2. Because workers in the 25- to 54-year age groups are more likely to work full time, the rates are about the same when computed using the hours-based methodology and the employment-based methodology. In industries such as private mining, where long work hours are the norm--an average of 49.0 hours per week, compared with 39.2 hours for all workers combined--the hours-based rate is lower than the employment-based rate.

**Table 1. Fatal occupational injuries, annual average hours worked per week, and rates of fatal occupational injuries by selected worker characteristics, 2007**

Characteristic	Total fatalities	Hours-based		Employment-based	
		Annual average hours worked (in millions)	Fatality Rate	Total Employment (in thousands)	Fatality rate
<b>Total</b>	5,657	275,043	4.0	147,215	3.8
Gender					

NOTE: Totals for major categories may include subcategories not shown separately. Workers under the age of 16 years, volunteer workers, and member of the resident military are not included in rate calculations to maintain consistency with CPS employment. The total fatalities column represents total published fatalities before the exclusions. Data for 2007 are revised and final.

Source: U.S. Department of Labor, Bureau of Labor Statistics, Census of Fatal Occupational Injuries, 2007.

Characteristic	Total fatalities	Hours-based		Employment-based	
		Annual average hours worked (in millions)	Fatality Rate	Total Employment (in thousands)	Fatality rate
<b>Men</b>	5,228	158,049	6.4	79,255	6.6
<b>Women</b>	429	116,468	0.7	67,958	0.6
Age					
<b>16 to 17</b>	20	2,001	1.9	2,287	0.9
<b>18 to 19</b>	97	4,897	3.5	3,704	2.6
<b>20 to 24</b>	424	24,137	3.4	14,353	3.0
<b>25 to 34</b>	991	61,451	3.1	32,020	3.1
<b>35 to 44</b>	1,168	67,703	3.4	34,527	3.4
<b>45 to 54</b>	1,425	68,373	4.1	34,601	4.1
<b>55 to 64</b>	934	37,824	4.9	20,110	4.6
<b>Over 65</b>	574	8,370	13.5	5,614	10.2
Industry					
<b>Private Industry</b>	5,112	236,433	4.3	124,994	4.1
<b>Agriculture, Forestry, Fishing, and Hunting</b>	585	4,229	27.0	2,045	27.9
<b>Mining</b>	183	1,710	21.4	730	25.1
<b>Utilities</b>	34	1,194	5.7	851	4.0
<b>Construction</b>	1,204	22,187	10.8	11,416	10.5
<b>Manufacturing</b>	400	33,371	2.4	16,204	2.5
<b>Wholesale Trade</b>	207	8,993	4.5	4,357	4.7
<b>Retail Trade</b>	348	29,571	2.4	16,478	2.1
<b>Transportation and Warehousing</b>	890	10,771	16.5	5,265	16.9
<b>Information</b>	79	6,642	2.3	3,372	2.3
<b>Financial activities</b>	119	19,856	1.2	10,249	1.2
<b>Professional and business services</b>	476	29,271	3.3	15,219	3.1
<b>Educational and Health Services</b>	149	35,545	0.8	19,904	0.7
<b>Leisure and hospitality</b>	260	20,121	2.5	11,972	2.2
<b>Other Services (Exc. Public Administration)</b>	175	12,374	2.7	6,934	2.5
<b>Government</b>	545	38,319	2.3	22,221	2.5

NOTE: Totals for major categories may include subcategories not shown separately. Workers under the age of 16 years, volunteer workers, and member of the resident military are not included in rate calculations to maintain consistency with CPS employment. The total fatalities column represents total published fatalities before the exclusions. Data for 2007 are revised and final.

Source: U.S. Department of Labor, Bureau of Labor Statistics, Census of Fatal Occupational Injuries, 2007.

Table 2 shows hours- and employment-based rates for selected occupations with high fatality rates. For some occupations, such as roofers, logging workers, and structural iron and steel workers, hours-based rates produce larger rates. Work in these occupations is constrained by weather conditions, and workers are unlikely to work year round. In contrast, hours-based rates are lower for farmers and ranchers and for fishers and related fishing workers. For both of these occupations, weekly hours are higher than average. In addition, many workers in these occupations are self-employed and are thus less likely to take time off.

**Table 2. Rates of fatal occupational injuries for selected occupations with high fatality rates, 2007**

Occupation	Fatalities	Hours-based	Employment-based
Fishers and related fishing workers	38	109.5	111.8
Logging workers	76	89.1	86.4
Aircraft pilots and flight engineers	87	70.6	70.7
Structural iron and steel workers	40	47.8	45.5
Farmers and ranchers	293	36.0	39.5
Roofers	79	33.4	29.4
Electrical power-line installers and repairers	30	27.6	29.1
Driver/sales workers and truck drivers	976	26.1	28.2
Refuse and recyclable material collectors	18	24.0	22.8
Police and sheriff's patrol officers	146	19.8	21.8

NOTE: Data for 2007 are revised and final.

Source: U.S. Department of Labor, Bureau of Labor Statistics, Census of Fatal Occupational Injuries, 2007.

Both employment- and hours-based rates are now available for 2006 and 2007, providing evidence on the differences between the two types of rates. The new rate methodology represents a break in series and therefore data for years that have employment-based rates should not be compared with data for years that have hours-based rates. Beginning with reference year 2008, only hours-based rates are calculated. (See the BLS Web site at <http://www.bls.gov/iif/> for all available rate tables).

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**NOTE:** Table 1 of this article was originally published with an incorrect value for womens annual average hours worked (in millions); the correct value is 116,468, which now appears in table 1.

**Notes**

<sup>1</sup> For further discussion, see John W. Ruser, "Denominator Choice in the Calculation of Workplace Fatality Rates," *American Journal of Industrial Medicine*, February 1998.

<sup>2</sup> This figure is the annual average number of people at work, which excludes employed persons absent from their jobs because of vacation, illness, or industrial dispute. For more information, see Current Population Survey, [Technical Paper 63RV](#), Design and Methodology, on the Internet at <http://www.census.gov/prod/2002pubs/tp63rv.pdf>.