

Supplemental Data

Crude Incidence Rates based on Injury and Employment Data Reported to MSHA

Methods

Because of changes in technology, employment, and commodity prices, we restricted our calculations of injury rates and rate ratios to employment and injury data from 2000–2015. To estimate the denominator for the rate calculations, we used the following methodology:

Step 1: Identify the number of all employees across all mines. We used data from the annual address and employment files which are cleaned and made publicly available by National Institute of Occupational Safety and Health (NIOSH).[1] The employment variable was “AVENEMP”.

Step 2: Identify the number of full-time and part-time employees. We used the annual Current Population Survey (CPS) data to determine the proportion of workers working part-time and full-time in the mining industry.[2] Based on CPS data, employment patterns in terms of hours worked were relatively stable between 2002–2015 (data was unavailable for 2000–2001). Average hours worked per week ranged between 47.7 and 49.4, and the proportion of the mining labor force working full-time ranged between 91.0% to 92.8% (average between 2002-2015 was 91.3%). The proportion of full and part-time employees as estimated by CPS was multiplied by the total number of employees at a mine to estimate the number of full and part-time employees. For the calculation we used the average proportion of full and part-time employees in the mining industry as reported by CPS.

Number of Full Time Employees=AVENEMP*.913;

Number of Part Time Employees =AVENEMP*.087;

Step 3: Estimate the total hours worked based on a 40-hour work week for part and full-time employees. The number of full-time employees was multiplied by 2000 hours (8 hour shift) to estimate the number of full time hours worked at the mine. The number of part-time employees was multiplied by 22 hours per week over 50 weeks per year to estimate the number of part time hours worked at the mine.

Total Estimated Hours Full Time Employees= Number of Full Time Employees *40*50;

Total Estimated Hours Part Time Employees = Number of Part Time Employees *40*50;

Step 4: Estimate the combined total for hours worked based on a 40-hour week and the total hours worked in excess of 40 hours per week. The total number of long work hours was then calculated by subtracting the total estimated full and part-time hours from the total hours worked at a mine as reported to MSHA. The variable for total work hours for all workers combined was “TOTHR”. These totals become the denominator for the crude incidence rates.

Total Hours Worked based on a 40-Hour Week = Total Estimated Hours Full Time Employees + Part Time Employees;

Total Hours Worked in Excess of 40-hours/week =TOTHR - Total Hours Worked based on 40 Hour Week;

Step 5: Calculate the crude incidence rates per 100 FTE (Full-Time Employees)

Crude Incidence Rate per 100 FTE for Long Working Hours= (Cumulative Number of Injuries During Long Work Hours / Total Hours Worked in Excess of 40 hours/week) * 200,000

Crude Incidence Rate per 100 FTE for First Eight Hours = (Cumulative Number of Injuries During Regular Shift / Total Hours Worked in 40 hours/week) * 200,000

Results

The rate ratio of long working hour injuries compared to injuries occurring during the first eight hours of work remained consistently elevated above 1.0 during the last 15 years (Online Only Table 1). Furthermore, the long working hour injury rate per 100 FTE was highest among miners working in metal/non-metal extraction (RR=1.83), in particular, work involving activities such as brine pumping (RR=3.39). The injury rate increased 3.5-fold among office workers when they worked long working hour (0.29 vs 1.01 injuries per 100 FTE).

References

1. U.S. Department of Labor. Mine Safety and Health Administration. Mining Industry Accident, Injuries, Employment, and Production Data. Available at <https://www.cdc.gov/niosh/mining/data/default.html>. Last Accessed December 19, 2017.
2. US Department of Labor. Bureau of Labor Statistics. Table 21: Persons at work in nonagricultural industries by class of worker and usual full- or part-time status. Downloaded data for years 2000-2015. Available at: <https://www.bls.gov/cps/tables.htm>. Last accessed May 31, 2018.

(See Table Below)

Supplemental Table 1: Estimated Reported Injury Rates Among Miners for Injuries Occurring During the First Eight Hours into a Shift vs Injuries Occurring Nine or More Hours into a Shift, U.S. MSHA Part 50 Program: 2000–2015.

Year	First Eight Hours of Shift Rate per 100 FTE	Nine or More Hours into Shift Rate per 100 FTE	Rate Ratio	Total Estimated Hours Worked by Full-Time and Part-Time Employees (w/o Long Work Hours)	Total Estimated Long Work Hours Worked	Cumulative Number of Injuries During Regular Shift	Cumulative Number of Injuries During Long Work Hours
2000	7.51	9.03	1.20	380,850,000	40,283,212	14,301	1,819
2001	7.13	8.25	1.16	372,480,000	40,665,755	13,271	1,677
2002	6.85	8.42	1.23	351,758,000	35,070,817	12,053	1,477
2003	6.45	7.26	1.13	336,700,000	36,021,106	10,859	1,308
2004	6.31	6.55	1.04	345,100,000	41,853,834	10,885	1,370
2005	6.15	6.36	1.03	361,752,000	46,153,794	11,132	1,467
2006	5.84	6.15	1.05	369,678,000	46,802,023	10,791	1,438
2007	5.57	6.72	1.21	368,636,000	43,764,722	10,262	1,471
2008	5.33	6.14	1.15	371,450,000	43,319,003	9,902	1,329
2009	4.84	6.13	1.27	333,374,000	31,137,968	8,071	954
2010	4.61	5.28	1.14	333,582,000	38,120,142	7,696	1,006
2011	4.51	5.04	1.12	354,836,000	43,244,522	7,997	1,089
2012	4.27	5.94	1.39	351,414,000	35,025,727	7,497	1,040
2013	4.10	5.71	1.39	341,580,000	34,944,606	6,996	997
2014	3.99	5.66	1.42	336,736,000	36,235,063	6,722	1,026
2015	3.83	5.94	1.55	308,986,000	30,730,650	5,924	913

Commodity							
Coal	6.23	4.25	0.68	2,234,692,000	331,374,619	69,625	7,035
Metal / Non-Metal	5.01	9.14	1.83	3,384,220,000	291,998,325	84,734	13,346
Mining Type							
Underground operations: All underground operations below surface of ground. Excavations beneath roof. Hoisting to surface.	7.78	4.11	0.53	1,414,100,000	195,834,513	54,979	4,027
Surface at Underground: Includes surface shops and yards, tippie physically located at the mine site	7.90	10.80	1.37	130,218,000	17,854,685	5,145	964
Surface: Strip or open pit mines including associated shops and yards	5.26	7.51	1.43	1,816,822,000	230,245,476	47,746	8,640
Auger: Auger mining operations for coal mines only	6.86	10.15	1.48	7,760,000	1,201,675	266	61
Culm Banks: Reworking of mine dumps or refuse pile. For coal mines only	10.71	13.56	1.27	2,446,000	294,886	131	20
Dredge: Mining operations conducted from a platform floating on water	11.04	12.23	1.11	45,788,000	7,589,189	2,527	464
Other Surface: Brine pumping, etc. For metal/nonmetal only	4.71	15.96	3.39	4,922,000	288,222	116	23
Independent shops and yards: Shops and yards not associated with one specific mine.	6.48	7.86	1.21	18,068,000	1,653,335	585	65
Mill or preparation plant: Mill prep plant or breaker operations assoc. with one specific mine. Includes associated shops & yards.	5.16	7.09	1.37	1,628,714,000	166,837,205	42,061	5,913
Office: Professional or clerical workers at the plant or mine	0.29	1.01	3.45	550,074,000	40,463,382	803	204