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Are Incident Rates Reliable and Representative Measures of Safety Program Performance?


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Agenda


- ▶ Why do we need performance measures?
- ▶ Where did incidence rates come from?
- ▶ Breaking down the incidence rate equation
- ▶ Limitations of OSHA recordkeeping and BLS Annual SOII data
- ▶ OSHA ITA Data Study
- ▶ Looking forward to metrics that drive performance



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What measures do you use?

Organizations safety and incident management dashboard with key metrics



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Why do we need safety metrics?

Leading and Lagging

Leading Indicators:

- Risk Assessments
- Near Miss Reporting
- Safety C Score

Lagging Indicators:

- Incident Rates
- Last Time Incidents
- Safety Incidents

- Identify Relevant Metrics
- Collect Data
- Benchmarking
- Continuous Improvement
- Set Targets and Goals
- Analyze and Interpret Data
- Communicate and Engage

JPEGS found at <https://synergengog.com/process-safety-metrics/>

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Source for Incidence Rates

Case circumstances

- 2009 Subject 1: Reporting Fatality, Injury and Disease Information to the Department
- 2010 Subject 2: Reporting Fatality, Injury and Disease Information to the Department
- 2011 Subject 3: Reporting Fatality, Injury and Disease Information to the Department
- 2012 Subject 4: Reporting Fatality, Injury and Disease Information to the Department
- 2013 Subject 5: Reporting Fatality, Injury and Disease Information to the Department
- 2014 Subject 6: Reporting Fatality, Injury and Disease Information to the Department
- 2015 Subject 7: Reporting Fatality, Injury and Disease Information to the Department
- 2016 Subject 8: Reporting Fatality, Injury and Disease Information to the Department
- 2017 Subject 9: Reporting Fatality, Injury and Disease Information to the Department
- 2018 Subject 10: Reporting Fatality, Injury and Disease Information to the Department

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Incidence Rate Equations

Incidence Rate Calculator and Comparison Tool

STEP 1: Enter the number of cases actually reported by all employees at your establishment in the given year

STEP 2: Enter a value for at least one of the following data elements:

- Total number of hours worked by all employees
- Total number of man hours worked by all employees
- Number of cases involving lost time work
- Number of cases involving lost time or restricted work activity only

STEP 3: Select Year and then Area, Regulator and Industry

Incidence rate or person-time rate

Definition of incidence rate

Incidence rate or person-time rate is a measure of incidence that incorporates time directly into the denominator. A person-time rate is generally calculated from a long-term cohort follow-up study, wherein enrollees are followed over time and the occurrence of new cases of disease is documented. Typically, each person is observed from an established starting time unit (one of four "end points" is reached: onset of disease, death, migration out of the study ("lost to follow-up"), or the end of the study. Similar to the incidence proportion, the numerator of the incidence rate is the number of new cases identified during the period of observation. However, the denominator differs. The denominator is the sum of the time each person was observed, divided for all persons. This denominator represents the total time the population was at risk of and being watched for disease. Thus, the incidence rate is the ratio of the number of cases to the total time the population is at risk of disease.

(Number of reported accidents x 200,000)

Employee total hours worked

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Convert Triangles to Distribution Charts

HIENRICH'S ACCIDENT RATIOS

BIRD'S ACCIDENT RATIOS

MOSAIC ACCIDENT RATIOS

CONOCO PHILLIPS ACCIDENT RATIOS

▶ A distribution represents the ratio of outcomes, given a consistent or assumed occurrence of exposures. What's the probability of a severe outcome?

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Do you compare your rates to BLS peers?

Standard Normal Distribution "Bell Curve"

Incidence rate per 100 full-time workers

Standard Deviation: σ

Z-Score

Cumulative Percent

16 2017 2018

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Assumption of Normality

Calculating Standard Deviation

$$s_x = \sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{n - 1}}$$

n = The number of data points
 X_i = Each of the values of the data
 \bar{X} = The mean of X_i

Thought...

- ▶ When we calculate an "average" we naturally assume normality, or mean=mode
- ▶ If that assumption is violated, we need to be honest about each descriptive statistic and only perform analyses that are possible given a non-normal distribution
- ▶ If we attempt to calculate risk, the outliers will have major influence, and we need to compare the outliers to the more frequent data

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Does Osha's Injury Tracking Application Data Provide Reliable Representation of U.S. Company Injury And Illness Metrics?

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Abstract

The Occupational Safety and Health Administration (OSHA) requires employers to investigate and document injury and illness cases in recordkeeping forms and recommends annual calculation of incidence rates as a measure of their safety program performance. Recent research literature calls into question the reliability and validity of OSHA recordkeeping data and subsequent incidence rates (Fellows, 2022).

The objectives of this study are to investigate the consistency and reliability of OSHA Injury Tracking Application (ITA) datasets and their relationship to the U.S. Bureau of Labor Statistics (BLS) incidence rates (Bureau of Occupational Injury and Illness [BOII] reports, n.d.). Descriptive statistics tables and annual incidence rate charts for OSHA ITA datasets collected in 2016-2022 raised concerns about entry errors. Therefore, a three-step corrective redaction analysis was employed to reduce these errors. The average number of entries removed per year was 1216 (ranging from 604 to 1433). The corrective steps greatly improved the consistency and reliability of the dataset and reduced variable standard deviations. The most important reduced variables were total employees (76.3%), total hours worked (6.7%), total cases per employee (60.2%), and percent of zero injury reports (6.3%). The number of cases and days reported only reduced by an average of ~3.5%. These results are very different than the commonly proposed "under-reporting" issues for OSHA recordkeeping and BLS BOII reports. This study found that over-reporting of hours worked or number of employees caused most of the inconsistency in incidence rate representation.

Figure 1. Original OSHA ITA TRB and DART entries, 2016-2022

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Table 7: Numerical Reductions in Descriptive Statistics From Original Download to Final Correction

Amount Removed after Corrections	Average	2016	2017	2018	2019	2020	2021	2022
Total number of entries	36,991	28,977	33,337	36,227	30,880	39,893	39,791	45,449
Total number of employees	8,811,048	2,781,437	8,881,437	95,127	28,457	8,818,108	2,811,039	21,108
Total hours worked	2,381,110	2,381,110	3,381,110	2,881,110	1,781,113	4,811,110	5,811,110	5,811,110
Percent zero injuries reported	6.31%	6.86%	6.31%	6.26%	6.03%	6.87%	6.11%	6.30%
Total DART cases	12,664	6,361	10,663	11,663	9,661	16,249	14,778	18,508
Total OSHA cases	7,993	7,354	9,964	8,287	7,081	6,601	7,336	7,649
Total Other cases	14,893	16,474	12,803	12,872	13,368	9,614	10,800	14,868
Total DART days	407,803	287,837	481,878	395,961	332,884	435,400	431,434	495,824
Total OSHA days	418,788	300,338	412,390	348,234	283,646	301,482	333,663	402,127
Total injuries	27,930	28,467	30,432	30,143	28,340	33,932	28,482	32,721
Total illnesses	4,250	1,719	1,888	2,340	1,679	7,562	6,352	8,006

Table 8: Percent Descriptive Statistics Changes from Original Download to Final Correction

Percent Reduction after Corrections	Average	2016	2017	2018	2019	2020	2021	2022
Total number of entries	12.99%	13.48%	12.76%	12.62%	10.62%	13.60%	12.92%	14.26%
Total number of employees	76.32%	71.00%	74.12%	70.47%	43.23%	94.96%	98.66%	42.87%
Total hours worked	26.72%	26.46%	36.06%	20.85%	19.67%	38.45%	45.45%	43.20%
Percent zero injuries reported	12.64%	20.26%	18.59%	18.39%	10.31%	17.08%	15.99%	18.00%
Total DART cases	47.87%	5.66%	2.98%	2.72%	2.27%	2.38%	2.47%	2.39%
Total OSHA cases	8.07%	2.38%	2.50%	2.66%	2.44%	2.24%	2.34%	2.34%
Total Other cases	2.47%	2.47%	2.52%	3.14%	1.90%	1.86%	1.86%	1.86%
Total DART days	2.83%	2.83%	2.83%	2.83%	2.83%	2.83%	2.83%	2.83%
Total OSHA days	1.90%	1.90%	1.90%	1.90%	1.90%	1.90%	1.90%	1.90%
Total injuries	2.83%	2.83%	2.83%	2.83%	2.83%	2.83%	2.83%	2.83%
Total illnesses	2.44%	2.44%	2.44%	2.44%	2.44%	2.44%	2.44%	2.44%

Table 9: Changes in Calculated Hours Worked per Employee, Both Overall and Individual Entry, Changes in Calculated Hours Worked per Employee, Both Overall and Individual Entry, Changes in Calculated Hours Worked per Employee, Both Overall and Individual Entry

Hours Worked per EE, by Correction Step	2016	2017	2018	2019	2020	2021	2022
Average hours worked per EE, original, overall	724	700	728	2,381,035	140	41	523
Average hours worked per EE, rem DVO, overall	726	698	731	2,381,035	140	41	523
Average hours worked per EE, rem DVO, by entry	3,481	2,798	2,471	8,381,036	2,681	3,098	4,278
Median hours worked per EE, rem DVO, by entry	1,838	1,826	1,830	1,811	1,801	1,804	1,807
Average hours worked per EE, rem low, overall	2,509	2,663	2,445	3,246	2,744	2,841	2,935
Average hours worked per EE, rem low, by entry	2,446	2,713	2,489	7,704	2,736	2,977	3,417
Median hours worked per EE, rem low, by entry	1,802	1,832	1,821	1,801	1,795	1,782	1,805
Average hours worked per EE, rem high, overall	1,722	1,730	1,731	1,708	1,684	1,690	1,689
Average hours worked per EE, rem high, by entry	1,943	1,740	1,731	1,703	1,700	1,664	1,701
Median hours worked per EE, rem high, by entry	1,816	1,824	1,813	1,811	1,788	1,783	1,801

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Final Results - No relationship to BLS Rates different Avg by overall, entry, median

Table 11: TRB and DART at Each Step of Correction, Overall vs. Individual Entry and BLS

Annual Incidence Rates	2016	2017	2018	2019	2020	2021	2022
TRB-original, overall	0.75	1.60	1.66	0.69	2.79	2.44	2.66
DART-original, overall	1.60	1.60	1.79	0.01	1.94	1.65	1.68
TRB-rem DVO, overall	0.75	1.60	1.66	0.69	2.79	2.44	2.66
DART-rem DVO, overall	1.60	1.60	1.79	0.01	1.94	1.65	1.68
TRB-rem DVO, median by entry	0.75	0.60	0.60	0.60	0.60	0.60	0.60
DART-rem DVO, median by entry	2.78	2.80	2.80	2.80	2.80	2.80	2.80
TRB-rem low, overall	0.68	0.63	0.68	0.68	0.63	0.68	0.68
DART-rem low, overall	0.71	0.69	0.69	0.71	0.67	0.63	0.67
TRB-rem low, median by entry	1.61	1.61	1.79	0.81	1.93	1.72	1.86
DART-rem low, median by entry	4.93	3.19	3.19	4.93	3.28	3.42	3.48
TRB-rem high, overall	2.33	2.46	2.50	2.50	2.33	2.37	2.32
DART-rem high, overall	4.93	3.19	3.19	4.93	3.28	3.42	3.48
TRB-rem high, median by entry	3.20	3.44	3.43	3.29	2.97	3.03	3.02
DART-rem high, median by entry	1.97	3.31	3.31	3.31	2.91	2.91	2.91
TRB-rem high, by entry	1.47	1.52	1.52	1.51	1.35	1.35	1.38
DART-rem high, by entry	3.2	3.1	3.1	3.2	2.9	2.9	2.9
BLS TRB	1.7	1.6	1.7	1.6	1.8	1.8	1.8
BLS DART	1.7	1.6	1.7	1.6	1.8	1.8	1.8

Figure 5: Final Corrected TRB and DART, OSHA ITA Overall and Median, Calculated vs. BLS

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Group Activity

Efforts and Attributes to Improve

Reduce Vehicle Crash Risk

- ▶ What behaviors or conditions lead to vehicle crashes?
- ▶ How can you reduce or eliminate those behaviors and conditions that lead to vehicle crashes?

Improve Driver Safety & Enjoyment

- ▶ What behaviors or conditions lead to safer driving experience?
- ▶ What behaviors or conditions lead to more enjoyable driving experience?
- ▶ How can you promote/acknowledge behaviors/conditions that lead to safety and more enjoyable driving experience?

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Group Activity

Efforts and Attributes to Improve

Lose Weight

- ▶ Eat less or Diet foods
- ▶ Exercise more
- ▶ Track weight
- ▶ Track caloric intake

Improve Healthy Behaviors

- ▶ Assess current health status for medical determinations
- ▶ Identify support system for lifestyle changes
- ▶ Create realistic (SMART) goals
- ▶ Make incremental changes to meal-planning/prep
- ▶ Engage in activities you enjoy that get you moving (get heart rate up)

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Looking Forward - Safety Metrics

- ▶ Customized and specific to the company's current safety program and threats to effectiveness
- ▶ Compare data only to self and track change performance
- ▶ Measure positive observations and efforts to improve behaviors and conditions
- ▶ Acknowledge success, and learn from failures
- ▶ Safety is an attribute of work

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