# Best Practices in Workplace Surveillance:

## Maximizing the Use of BLS Methods & Data for On-Going Work Injury & Illness Surveillance

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# Benchmark

- "A standard of measurement or evaluation" - Webster

# "Statistical" Benchmark

- Injury/Illness experience of worker population

# Risk Assessment

- Relative differences in injury/illness experiences of comparison populations

# Reasons for Benchmarking

- Examine injury & illness experience of company workforce with respect to industry as a whole (or in comparison with other industries or with other companies/facilities)
- Identify associations and possible causes
- Target corrective programs (e.g. training, surveillance, PPE, exposure monitoring etc.) on most important areas
- Measure corrective program effectiveness

# Sources for Statistical Benchmarking

- Required governmental reports (OSHA Log)
- Annual BLS Survey results
- Company Health records, accident reports
- Proactive case data coding

# Benchmarking Sources for Semiconductor Industry

- US Government Annual Survey (BLS) (including Supplemental Data)
- OHS Annual Survey (US)
- OHS International Survey

# U.S. Government Surveys (U.S. Data)

(US Bureau of Labor Statistics)

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# BLS Program - “Pros”

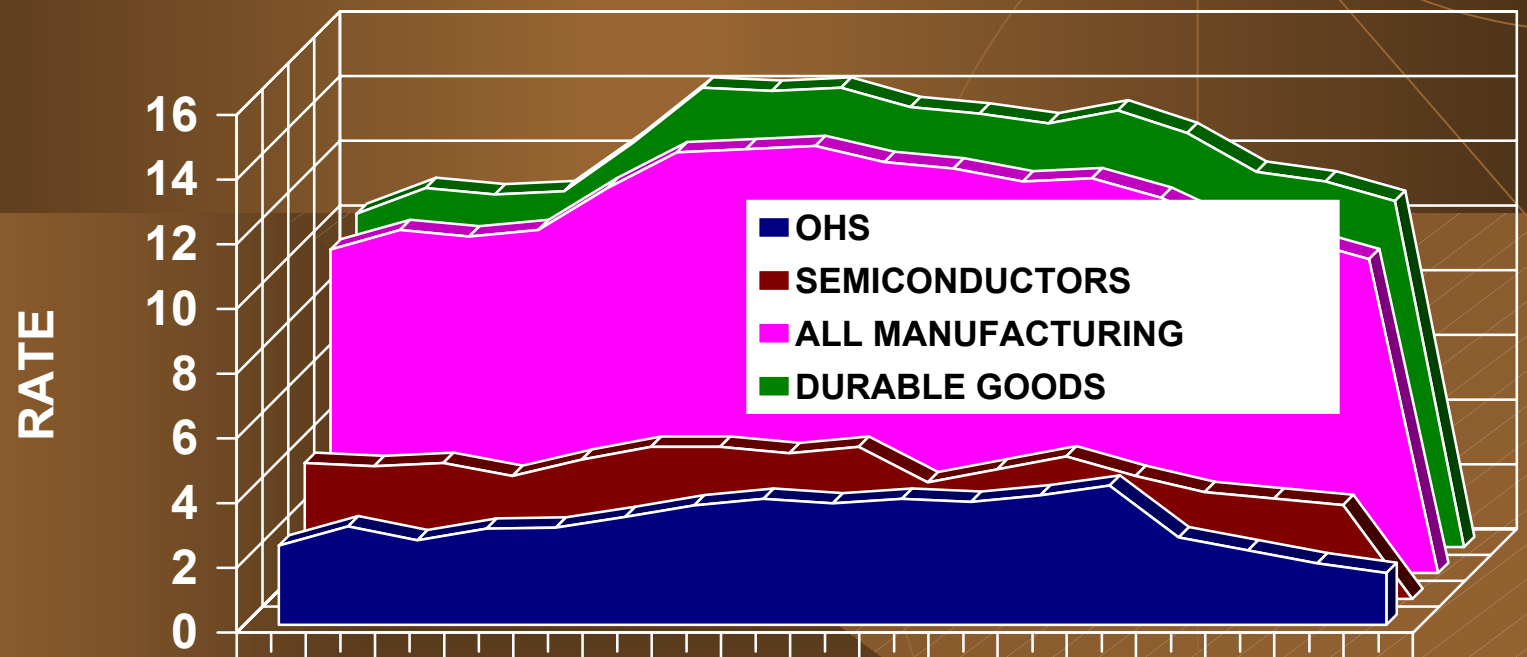
- National, industry-wide benchmarks
- Case & Lost time incidence rates
- Historical value: 1972-1999
- Common case identification & recording
- Rates understood by employees & managers

# BLS Program - “Cons”

- Annual rate of limited, practical value
- Annual rate misused as “benchmark”
- Absence of detail to identify cause(s)
- Recordkeeping often “sloppy” & inaccurate
- Work related illnesses difficult to identify

# Comparative Annual Incidence Rates for Selected Industry Sectors (1983-99)

## Figure 1




| | '83 | '84 | '85 | '86 | '87 | '88 | '89 | '90 | '91 | '92 | '93 | '94 | '95 | '96 | '97 | '98 | '99 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DURABLE GOODS | 10.3 | 11.1 | 10.9 | 11 | 12.5 | 14.2 | 14.1 | 14.2 | 13.6 | 13.4 | 13.1 | 13.5 | 12.8 | 11.6 | 11.3 | 10.7 | |
| ALL MANUFACTURING | 10 | 10.6 | 10.4 | 10.6 | 11.9 | 13 | 13.1 | 13.2 | 12.7 | 12.5 | 12.1 | 12.2 | 11.6 | 10.6 | 10.3 | 9.7 | |
| SEMICONDUCTORS | 4.2 | 4.1 | 4.2 | 3.8 | 4.3 | 4.7 | 4.7 | 4.5 | 4.7 | 3.6 | 4 | 4.4 | 3.8 | 3.3 | 3.1 | 2.9 | |
| OHS | 2.5 | 3 | 2.6 | 3 | 3 | 3.3 | 3.7 | 3.9 | 3.8 | 3.9 | 3.8 | 4 | 4.3 | 2.7 | 2.3 | 1.9 | 1.6 |

**ANNUAL INCIDENCE RATES**

(Cases per 100 Workers per Year)

SOURCE: Annual Surveys, US BLS, US DOL & OHS Annual Surveys

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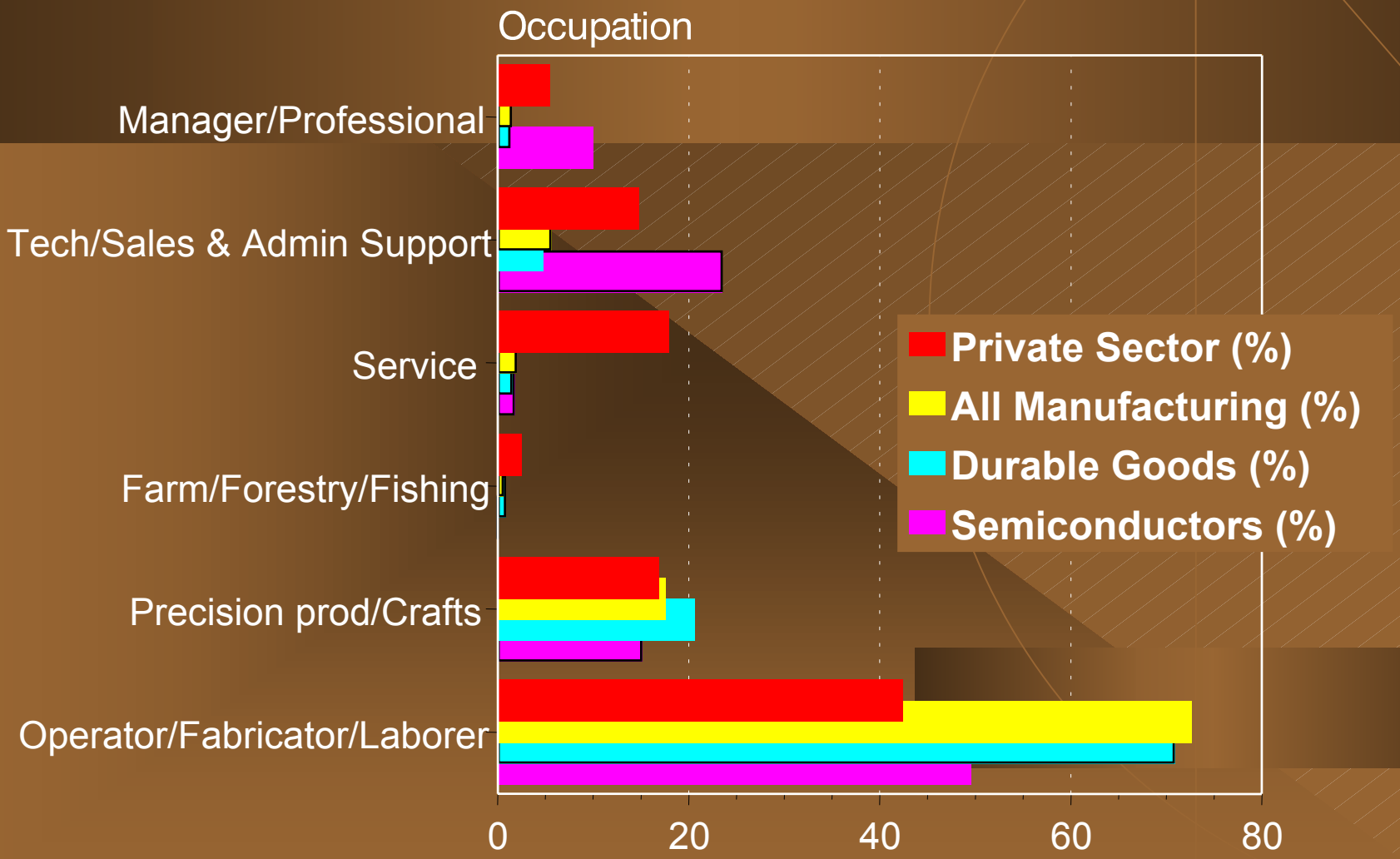
# BLS Supplemental Data Program

- 1975-87 (SDS); 1992 - Present (1999)
- Disabling cases (days away from work)
- Detailed coding by “case characteristics”
- Major Fault - Useful data collected - not available to affected industries in useful format (details not published)

# COMPARATIVE DISTRIBUTION of LOST WORKDAY CASES[1] by Employee Occupation - 1998

*Figure 2*

**Selected Industry Sectors**




SOURCE: Annual Survey, US BLS, US DOL, 1998

[1] Cases with days away from work

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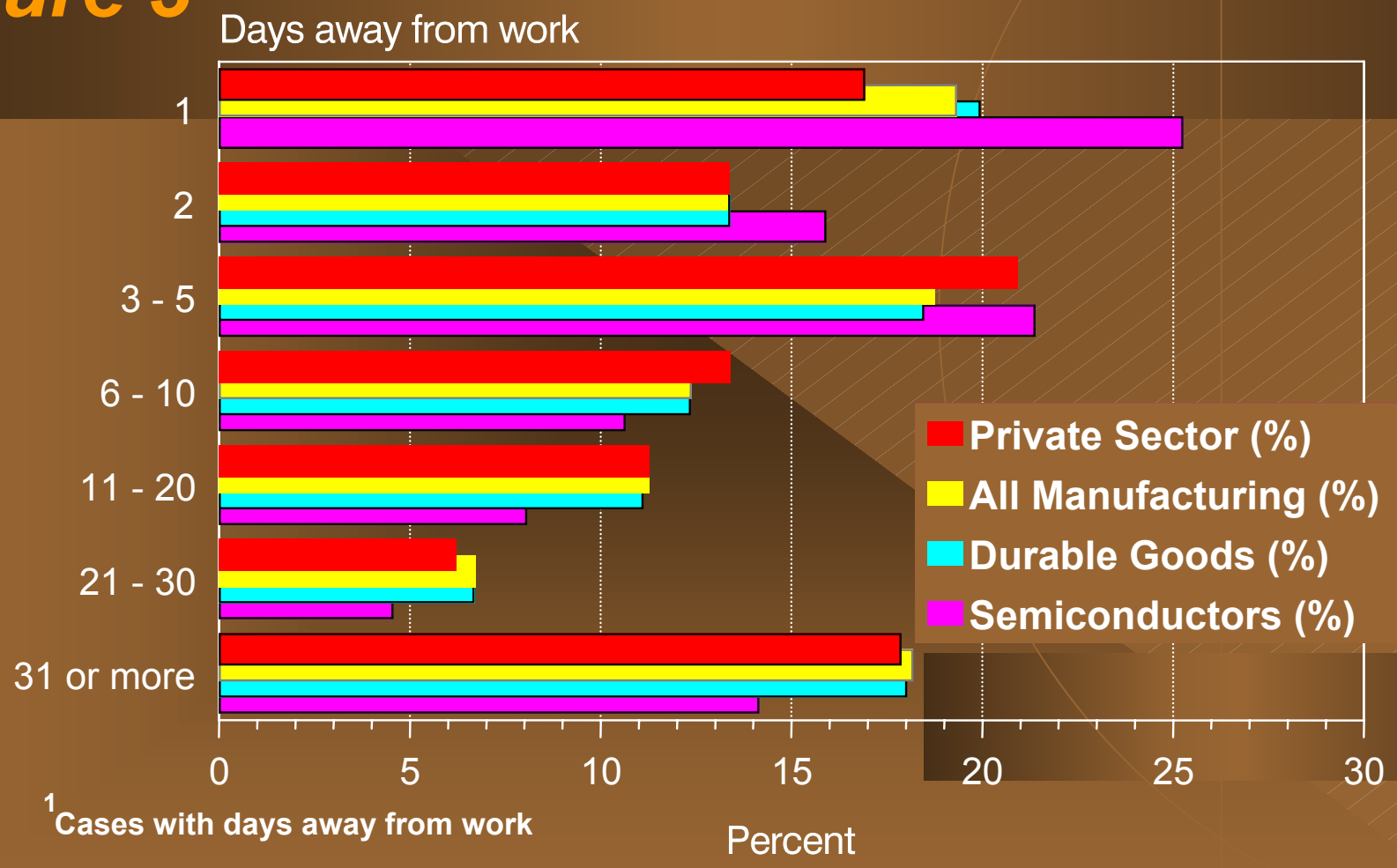
# COMPARATIVE DISTRIBUTION of LOST WORKDAY CASES[1]
## by Numbers of Days Away from Work - 1998
### Selected Industry Sectors

*Figure 3*




[1]Cases with days away from work

SOURCE: Annual Survey, US BLS, US DOL, 1998

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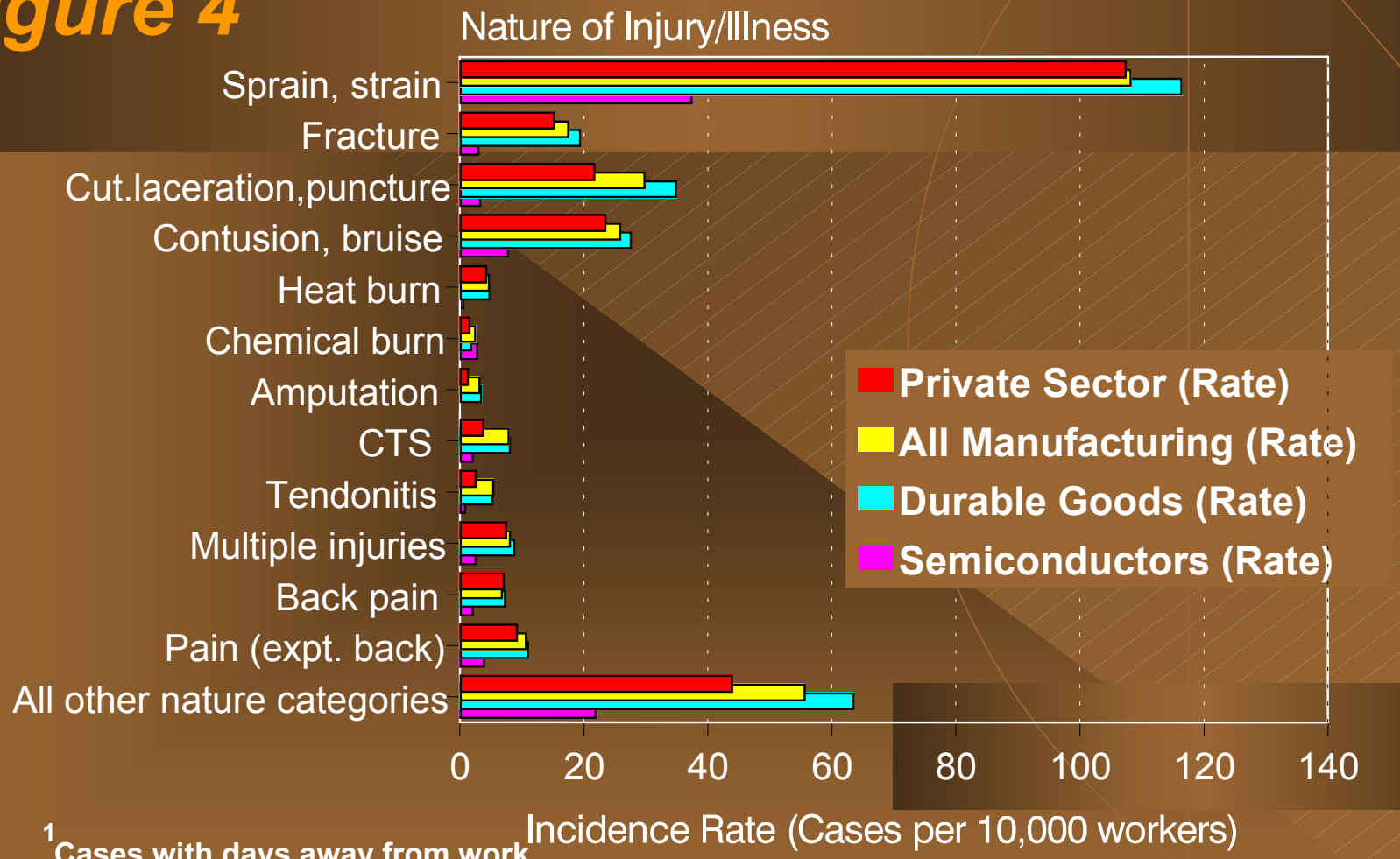
# COMPARATIVE INCIDENCE of LOST WORKDAY CASES[1]

## by NATURE of INJURY or ILLNESS - 1998

### Selected Industry Sectors

*Figure 4*




[1] **Cases with days away from work**

SOURCE: Annual Survey, US BLS, US DOL, 1998

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# OHS Annual Benchmark Survey (U.S. Data)

(Occupational Health System)

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# OHS Benchmark Survey Companies

(Approximately 80% of U.S. Semiconductor Industry)

| COMPANY | STATUS of PARTICIPATION CY 1997 | CY 1998 | CY 1999 | SCOPE of PARTICIPATION US | WORLD |
|---|---|---|---|---|---|
| Advanced Micro Devices | 4 | 4 | 4 | X | X |
| Analog Devices | 2 | 4 | 4 | X | |
| Cherry Semiconductor | 2 | (4) | (4) | X | |
| Fairchild Semiconductor | | | 2 | X | |
| Harris Semiconductor/Intersil | 4 | 4 | 4 | X | |
| Hewlett-Packard/Agilent | 3 | 3 | 3 | X | X |
| Hyundai Electronics America | | | 2 | X | |
| Intel Corporation | 3 | 3 | 3 | X | X |
| IBM | 2 | 2 | 2 | X | |
| International Rectifier | 2 | (4) | 4 | X | |
| LSI Logic | 2 | (4) | (4) | X | |
| Lucent Technologies | 2 | (3) | 3 | X | X |
| Micron Technology | 2 | (4) | 2 | X | |
| Motorola | 2 | (3) | 3 | X | X |
| NEC Electronics | 2 | (2) | (2) | X | |
| National Semiconductor | 4 | 4 | 4 | X | X |
| Philips Semiconductor | 2 | (4) | (2) | X | |
| Siliconix/Vishey | 4 | 4 | 4 | X | |
| Symbios Logic/LSI Logic | 2 | (2) | (2) | X | |
| Texas Instruments | 2 | 3 | 3 | X | X |
| VLSI Technology/Philips | 2 | 2 | 2 | X | |
| Zilog | 2 | (4) | 2 | X | |

Participation Levels:
1 Non-active participation (receive summary data/statistics as SIA member company)
2 Provide OSHA-200 Log (or equivalent) & employment statistics
3 Provide detailed case coded data mapped to OHS codes
4 Full-participant in OHS software program & benchmarking activities
( ) Expected level of participation during calendar year survey

# OHS Benchmark Survey Results 1996 - 2000

**Numbers:**

| | Employment | Cases | LWDC | LWDS | RWDC | RWDS |
|---|---|---|---|---|---|---|
| 1996 | 75,580 | 2,042 | 593 | 7,993 | 503 | 13,432 |
| 1997 | 146,799 | 3,397 | 721 | 9,808 | 820 | 22,892 |
| 1998 | 145,192 | 2,723 | 532 | 9,493 | 728 | 16,245 |
| 1999 | 138,543 | 2,227 | 559 | 7,259 | 647 | 11,769 |
| 2000 | 159,627 | 2,354 | 629 | 8,559 | 833 | 15,144 |

**Incidence Rates:**

| | | | | | |
|---|---|---|---|---|---|
| 1996 | 2.70 | 0.78 | 10.58 | 0.67 | 17.77 |
| 1997 | 2.31 | 0.49 | 6.68 | 0.56 | 15.55 |
| 1998 | 1.87 | 0.37 | 6.54 | 0.50 | 11.19 |
| 1999 | 1.61 | 0.40 | 5.24 | 0.47 | 8.49 |
| 2000 | 1.47 | 0.39 | 5.36 | 0.52 | 9.49 |

LWDC Lost workday cases (away from work)
LWDS Lost workdays (away from work)
RWDC Restricted workday cases
RWDS Restricted workdays

# OHS Case Coding Elements

- Date of Injury/illness
- Occupation (OHS code)
- Department (optional)
- Name (optional)
- SSN (optional)
- Employee No. (optional)
- Date of Birth
- Date of Hire
- Gender

- Type of event, accident or exposure
- Source of injury or illness
- Nature of injury or illness
- Part of body affected
- Cause of event, accident or exposure
- No. Lost workdays (away)
- No. Restricted workdays
- Memo/comment field

BLS (SDP) data coding element

Additional OHS data coding element

# CROSS-TABULATION TABLE NUMBERING SCHEME

| | T | S | N | P | C | J |
|---|---|---|---|---|---|---|
| T | X | 1 | 2 | 3 | 7 | 11 |
| S | X | X | 5 | 6 | 8 | 12 |
| N | X | X | X | 4 | 9 | 13 |
| P | X | X | X | X | 10 | 14 |
| C | X | X | X | X | X | 15 |
| J | X | X | X | X | X | X |

Type
Source
Nature
Part
Cause
Job

# Cross Tabulation Example - Cases

**TABLE 2A [TxN]**
**CROSS-TABULATION: TYPE of EVENT, ACCIDENT or EXPOSURE and NATURE of INJURY or ILLNESS**
**OSHA RECORDABLE CASES**

**US Semiconductor Locations - 1999**

| | Nature of Injury or Illness | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Type of Event, Accident or Exposure | Amputation | Chem Burn | Thermal Burn | Bruise/ Contusion | Cut/ Laceration | Abrasion Scratch | Fracture | Strain or Sprain | RSI/CTD | Electric Shock/Burn | Illness | Other/ns Unknown | Total |
| STRUCK BY OR AGAINST OBJECT | 0 | 1 | 1 | 48 | 83 | 8 | 11 | 29 | 0 | 0 | 4 | 7 | **192** |
| FALL OR SLIP | 0 | 0 | 0 | 46 | 10 | 1 | 17 | 109 | 0 | 0 | 1 | 8 | **192** |
| CAUGHT IN, UNDER OR BETWEEN | 0 | 0 | 0 | 17 | 16 | 0 | 3 | 10 | 0 | 0 | 0 | 0 | **46** |
| RUBBED OR ABRADED | 0 | 3 | 0 | 0 | 5 | 12 | 0 | 1 | 1 | 0 | 11 | 0 | **33** |
| BODILY REACTION: SLIP/ MOTION | 0 | 0 | 0 | 2 | 2 | 1 | 0 | 40 | 38 | 0 | 0 | 0 | **83** |
| OVEREXERTION | 0 | 0 | 1 | 2 | 3 | 1 | 0 | 230 | 351 | 0 | 12 | 6 | **606** |
| CONTACT: ELECT. CURRENT | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 1 | **8** |
| CONTACT: TEMP. EXTRM. | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | **21** |
| CONTACT: RAD., LASER, NOISE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | **1** |
| CONTACT WITH CHEM. OR GAS | 0 | 46 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 73 | 2 | **123** |
| MOTOR VEHICLE ACCIDENT | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 6 | 0 | 0 | 0 | 2 | **13** |
| ALL OTHER TYPES | 0 | 0 | 3 | 6 | 4 | 2 | 1 | 17 | 22 | 0 | 23 | 5 | **83** |
| **Total** | **0** | **50** | **28** | **125** | **124** | **27** | **32** | **442** | **412** | **4** | **125** | **32** | **1401** |

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# Cross Tabulation Example - Rates

**TABLE 2B [TxN]**

**CROSS-TABULATION: TYPE of EVENT, ACCIDENT or EXPOSURE and NATURE of INJURY or ILLNESS**
**INCIDENCE RATES**

**US Semiconductor Locations - 1999**

**Nature of Injury or Illness**

| Type of Event, Accident or Exposure | Amputation | Chem Burn | Thermal Burn | Bruise/ Contusion | Cut/ Laceration | Abrasion Scratch | Fracture | Strain or Sprain | RSI/CTD | Electric Shock/Burn | Illness | Other/ns Unknown | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STRUCK BY OR AGAINST OBJECT | 0.000 | 0.001 | 0.001 | 0.046 | 0.079 | 0.008 | 0.010 | 0.028 | 0.000 | 0.000 | 0.004 | 0.007 | **0.184** |
| FALL OR SLIP | 0.000 | 0.000 | 0.000 | 0.044 | 0.009 | 0.001 | 0.016 | 0.103 | 0.000 | 0.000 | 0.001 | 0.008 | **0.182** |
| CAUGHT IN, UNDER OR BETWEEN | 0.000 | 0.000 | 0.000 | 0.016 | 0.015 | 0.000 | 0.003 | 0.009 | 0.000 | 0.000 | 0.000 | 0.000 | **0.043** |
| RUBBED OR ABRADED | 0.000 | 0.003 | 0.000 | 0.000 | 0.005 | 0.011 | 0.000 | 0.001 | 0.001 | 0.000 | 0.010 | 0.000 | **0.031** |
| BODILY REACTION: SLIP/ MOTION | 0.000 | 0.000 | 0.000 | 0.002 | 0.002 | 0.001 | 0.000 | 0.038 | 0.036 | 0.000 | 0.000 | 0.000 | **0.079** |
| OVEREXERTION | 0.000 | 0.000 | 0.001 | 0.002 | 0.003 | 0.001 | 0.000 | 0.218 | 0.333 | 0.000 | 0.011 | 0.006 | **0.575** |
| CONTACT: ELECT. CURRENT | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 | 0.001 | **0.008** |
| CONTACT: TEMP. EXTRM. | 0.000 | 0.000 | 0.019 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | **0.020** |
| CONTACT: RAD., LASER, NOISE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | **0.001** |
| CONTACT WITH CHEM. OR GAS | 0.000 | 0.044 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.069 | 0.002 | **0.117** |
| MOTOR VEHICLE ACCIDENT | 0.000 | 0.000 | 0.000 | 0.004 | 0.001 | 0.000 | 0.000 | 0.006 | 0.000 | 0.000 | 0.000 | 0.002 | **0.013** |
| ALL OTHER TYPES | 0.000 | 0.000 | 0.003 | 0.006 | 0.004 | 0.002 | 0.001 | 0.016 | 0.021 | 0.000 | 0.022 | 0.005 | **0.080** |
| **Total** | **0.000** | **0.048** | **0.027** | **0.120** | **0.118** | **0.026** | **0.030** | **0.419** | **0.391** | **0.004** | **0.118** | **0.032** | **1.333** |

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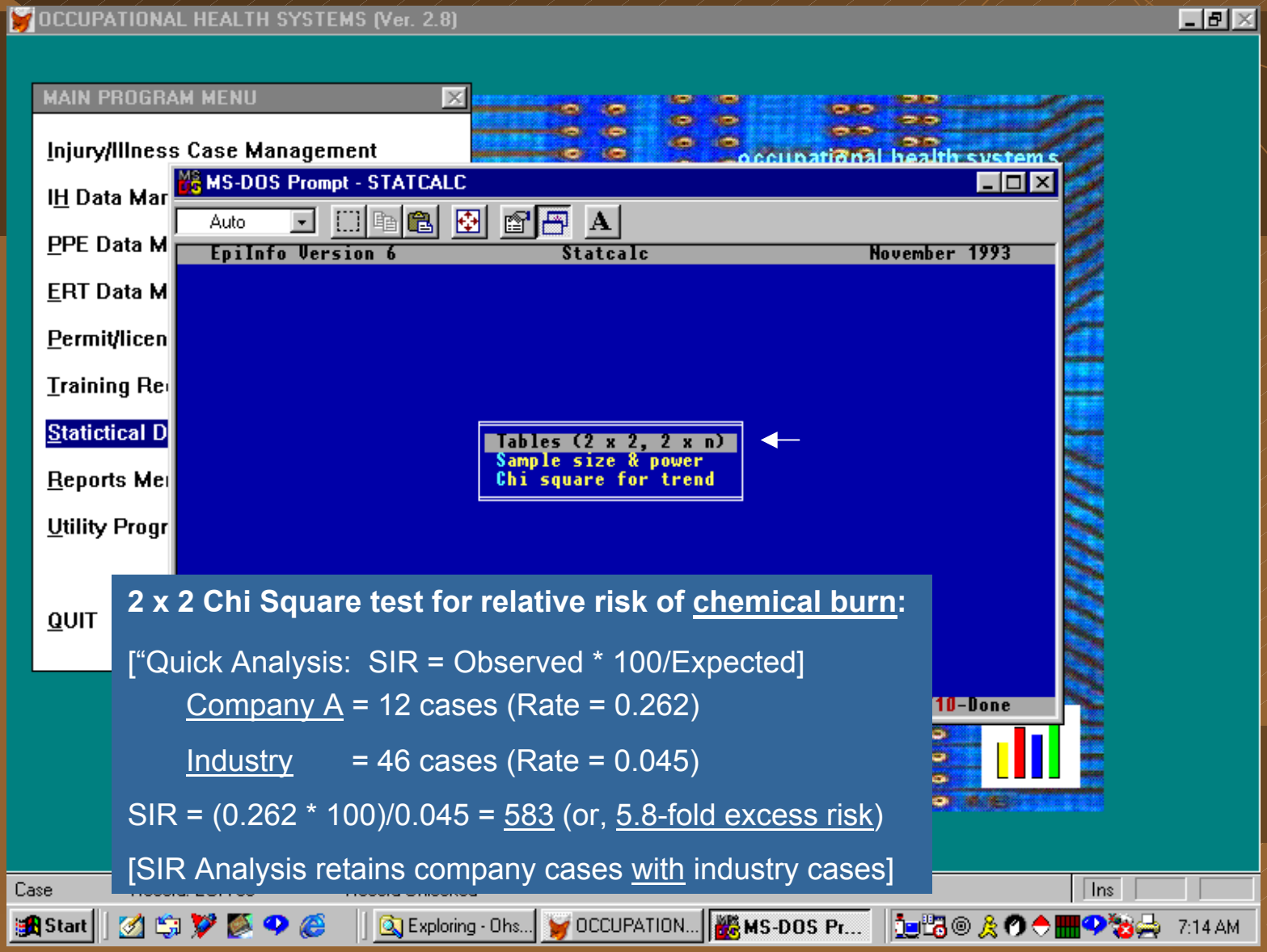
# Risk Analysis - Chi Square (Epi Info -1)




**2 x 2 Chi Square test for relative risk of chemical burn:**

["Quick Analysis: SIR = Observed * 100/Expected]

Company A = 12 cases (Rate = 0.262)

Industry = 46 cases (Rate = 0.045)

SIR = (0.262 * 100)/0.045 = 583 (or, 5.8-fold excess risk)

[SIR Analysis retains company cases with industry cases]

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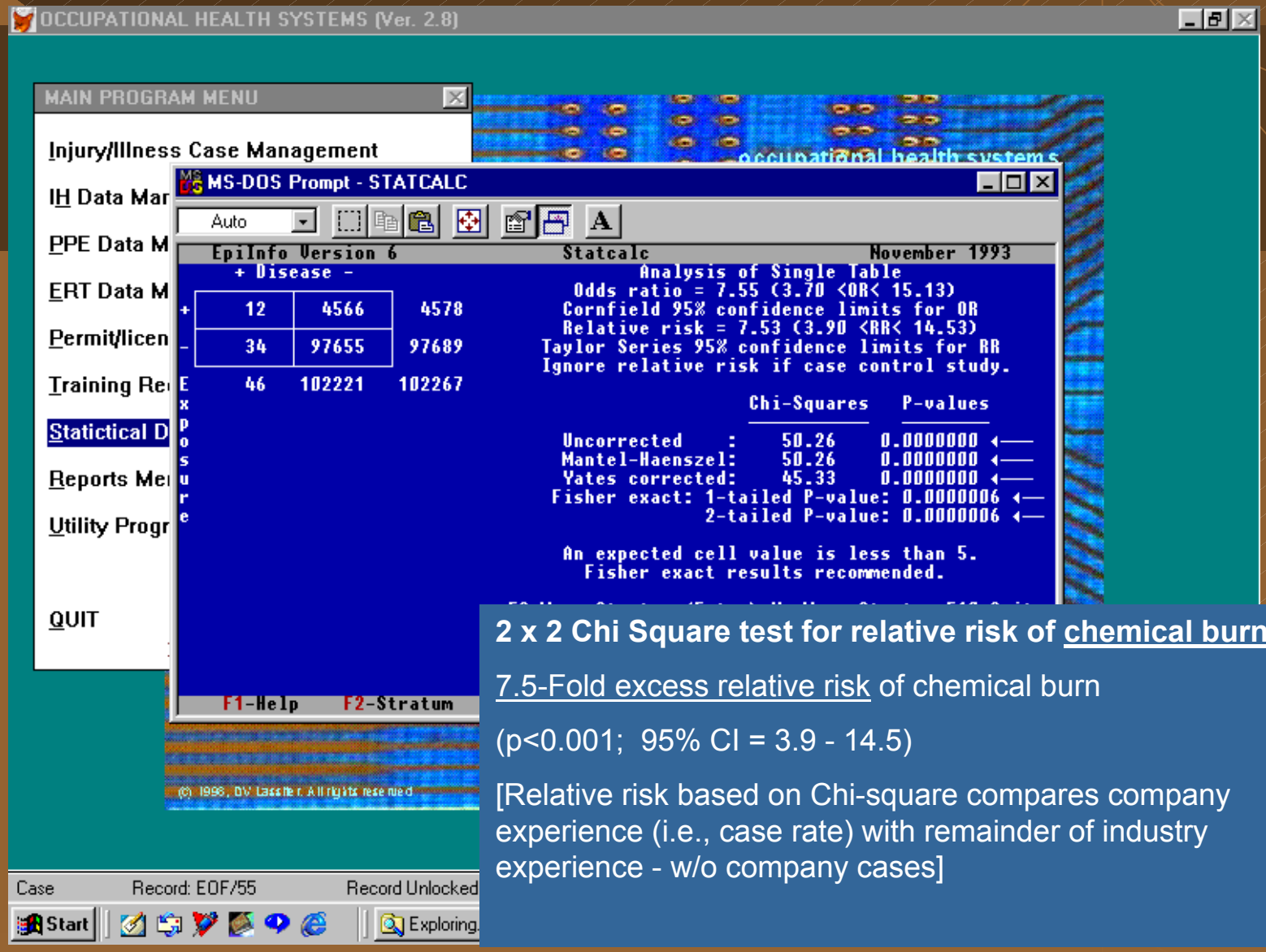
# Risk Analysis - Chi Square (Epi Info -2)




**2 x 2 Chi Square test for relative risk of <u>chemical burn</u>:**

<u>7.5-Fold excess relative risk</u> of chemical burn

($p<0.001$; 95% CI = 3.9 - 14.5)

[Relative risk based on Chi-square compares company experience (i.e., case rate) with remainder of industry experience - w/o company cases]

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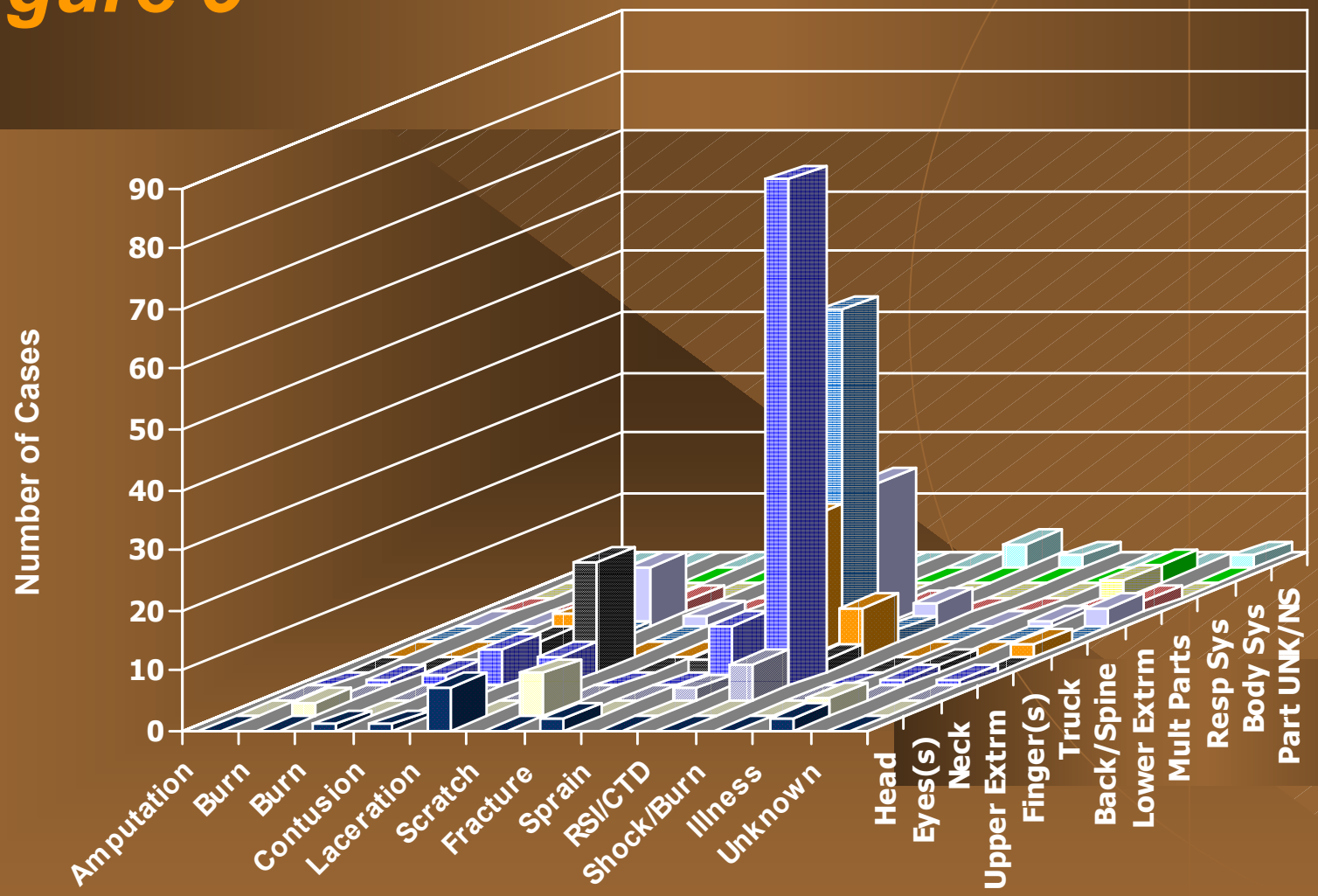
# Semiconductor Equipment Manufacturers

## Cross-Tabulated OSHA Cases - 2000

*Figure 5*

Nature of Injury or Illness by Part of Body Affected

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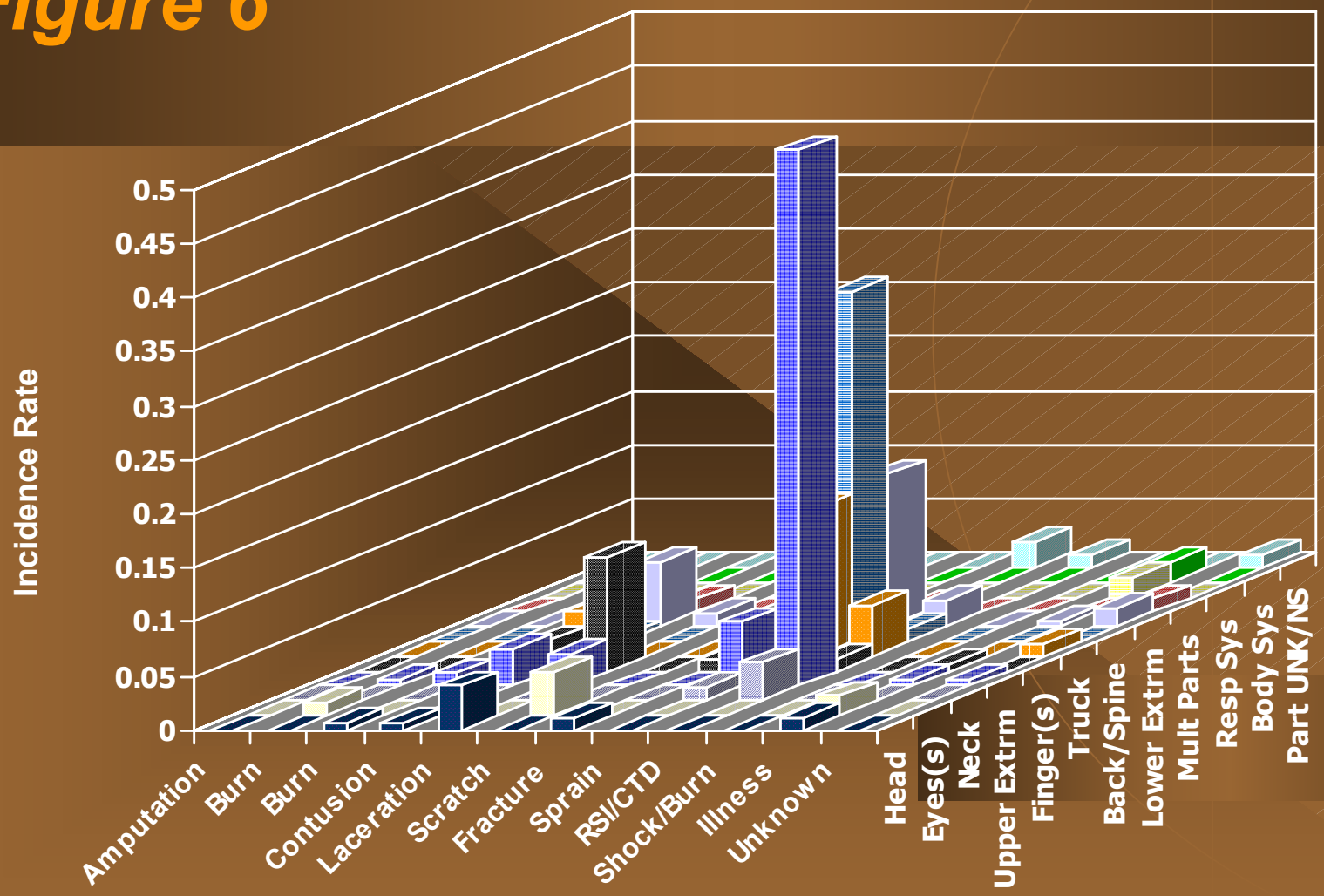
# Semiconductor Equipment Manufacturers

## Cross-Tabulated OSHA Case Incidence Rates - 2000

*Figure 6*

Nature of Injury or Illness by Part of Body Affected

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# OHS Annual Benchmark Survey (International Data)

(Occupational Health System)

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# OHS Benchmark Survey - 1999

## GEOGRAPHIC DISTRIBUTION & INCIDENCE RATES (CASES)

| | Incidence Rate* (Cases) |
|---|---|
| **Asia-Pacific (29)**<br>India (1)<br>Japan (5)<br>China (5)<br>Thailand (2)<br>Malaysia (7)<br>Philippines (3)<br>Singapore (4)<br>Taiwan (1)<br>Israel (1) | 0.18 (140) |
| **UK-Europe (11)**<br>UK (4)<br>Ireland (1)<br>France (2)<br>Germany (3)<br>Spain (1) | 0.77 (111) |
| **Latin America (2)**<br>Costa Rica (1)<br>Mexico (1) | 0.19 (7) |
| **N. America (68)**<br>USA (68) | 1.61 (2,227) |

**1999 SURVEY DATA**

1.06 (2,485)
(World-wide)

Semiconductor Industry Only

(109 Facilities)

(233,829 Workers)

*Incidence Rate = Number of cases per 100 full-time equivalent workers per year

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# OHS Benchmark Survey - 1999

## SUMMARY STATISTICS for INTERNATIONAL SURVEY - 1999

| SECTOR | COUNTRY | EMPLOYMENT | CASES | CASERATE | LWDC | LWDCR | LWDS | LWSR |
|---|---|---|---|---|---|---|---|---|
| **ASIA** | | | | | | | | |
| | CHINA | 4,288 | 25 | 0.583 | 18 | 0.420 | 1,091 | 25.443 |
| | OTHER* | 468 | 0 | 0.000 | 0 | 0.000 | 0 | 0.000 |
| | OTHER* | 3,503 | 6 | 0.171 | 3 | 0.086 | 32 | 0.914 |
| | OTHER* | 4,701 | 6 | 0.128 | 1 | 0.021 | 2 | 0.043 |
| | MALAYSIA | 21,566 | 58 | 0.269 | 47 | 0.218 | 269 | 1.247 |
| | OTHER* | 30,956 | 19 | 0.061 | 7 | 0.023 | 67 | 0.216 |
| | SINGAPORE | 5,511 | 20 | 0.363 | 19 | 0.345 | 73 | 1.325 |
| | OTHER* | 2,912 | 4 | 0.137 | 4 | 0.137 | 69 | 2.370 |
| | OTHER* | 3,289 | 2 | 0.061 | 2 | 0.061 | 5 | 0.152 |
| | **ASIA Total** | **77,194** | **140** | **0.181** | **101** | **0.131** | **1,608** | **2.083** |
| **EUROPE** | | | | | | | | |
| | OTHER* | 3,092 | 32 | 1.035 | 20 | 0.647 | 423 | 13.680 |
| | OTHER* | 2,533 | 8 | 0.316 | 5 | 0.197 | 19 | 0.750 |
| | OTHER* | 2,910 | 17 | 0.584 | 9 | 0.309 | 235 | 8.076 |
| | OTHER* | 1,041 | 16 | 1.537 | 8 | 0.768 | 8 | 0.768 |
| | UK | 4,795 | 38 | 0.792 | 30 | 0.626 | 672 | 14.015 |
| | **EUROPE Total** | **14,371** | **111** | **0.772** | **72** | **0.501** | **1,357** | **9.443** |
| **L AMERICA** | | | | | | | | |
| | OTHER* | 2,318 | 6 | 0.259 | 5 | 0.216 | 45 | 1.941 |
| | OTHER* | 1,403 | 1 | 0.071 | 1 | 0.071 | 15 | 1.069 |
| | **L AMERICA Total** | **3,721** | **7** | **0.188** | **6** | **0.161** | **60** | **1.612** |
| **N AMERICA** | | | | | | | | |
| | USA | 138,543 | 2227 | 1.607 | 559 | 0.403 | 7,259 | 5.240 |
| | **N AMERICA Total** | **138,543** | **2227** | **1.607** | **559** | **0.403** | **7,259** | **5.240** |
| **TOTAL** | | **233,829** | **2,485** | **1.063** | **738** | **0.316** | **10,284** | **4.398** |

* "Other" identifies countries with less than three (<3) semiconductor facilities in the 1999 Survey and is used to provide confidentiality

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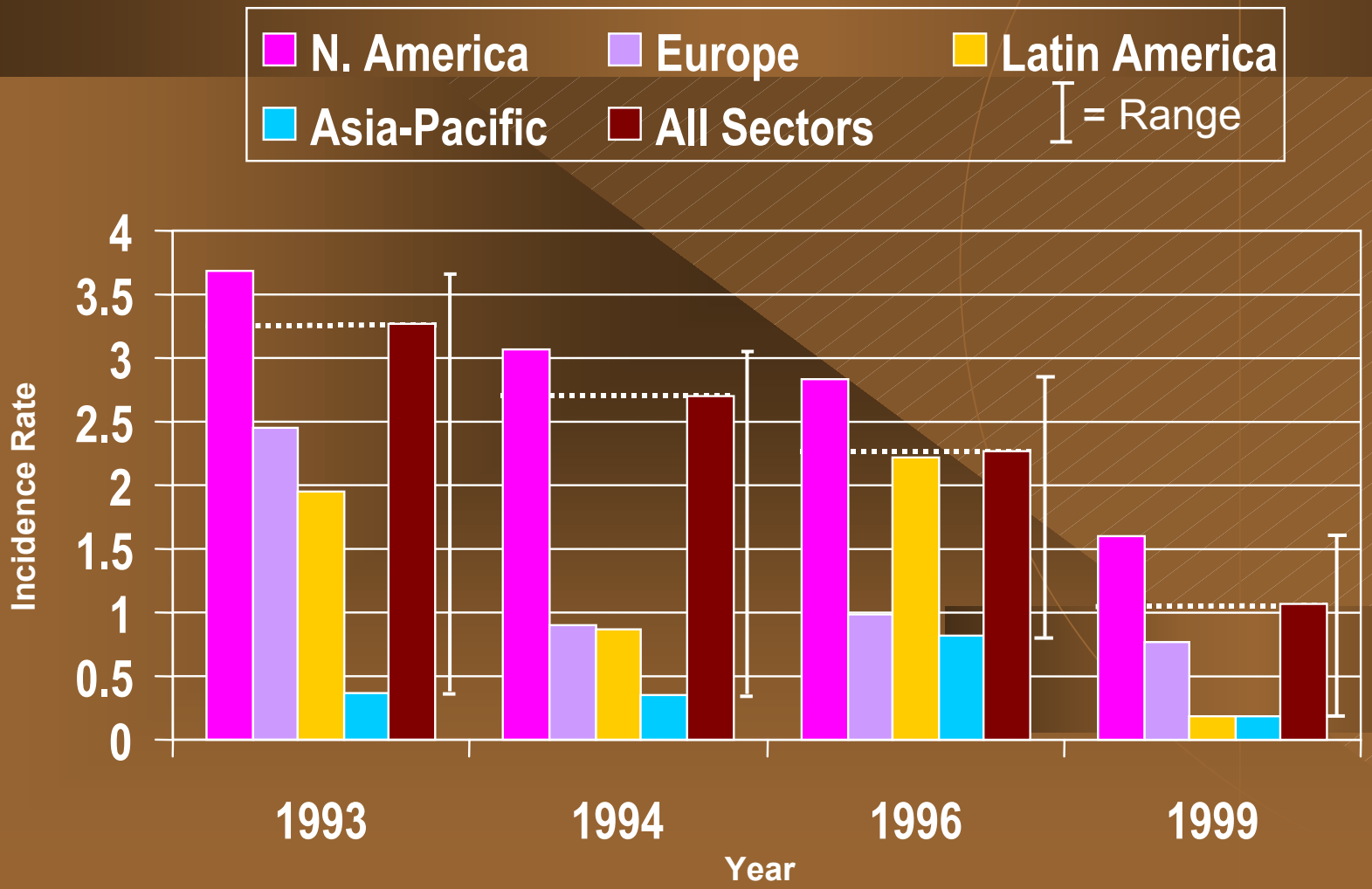
# OHS Benchmark Surveys ’93-’99

**Incidence of Work Injuries & Illnesses per 100 Workers per Year**

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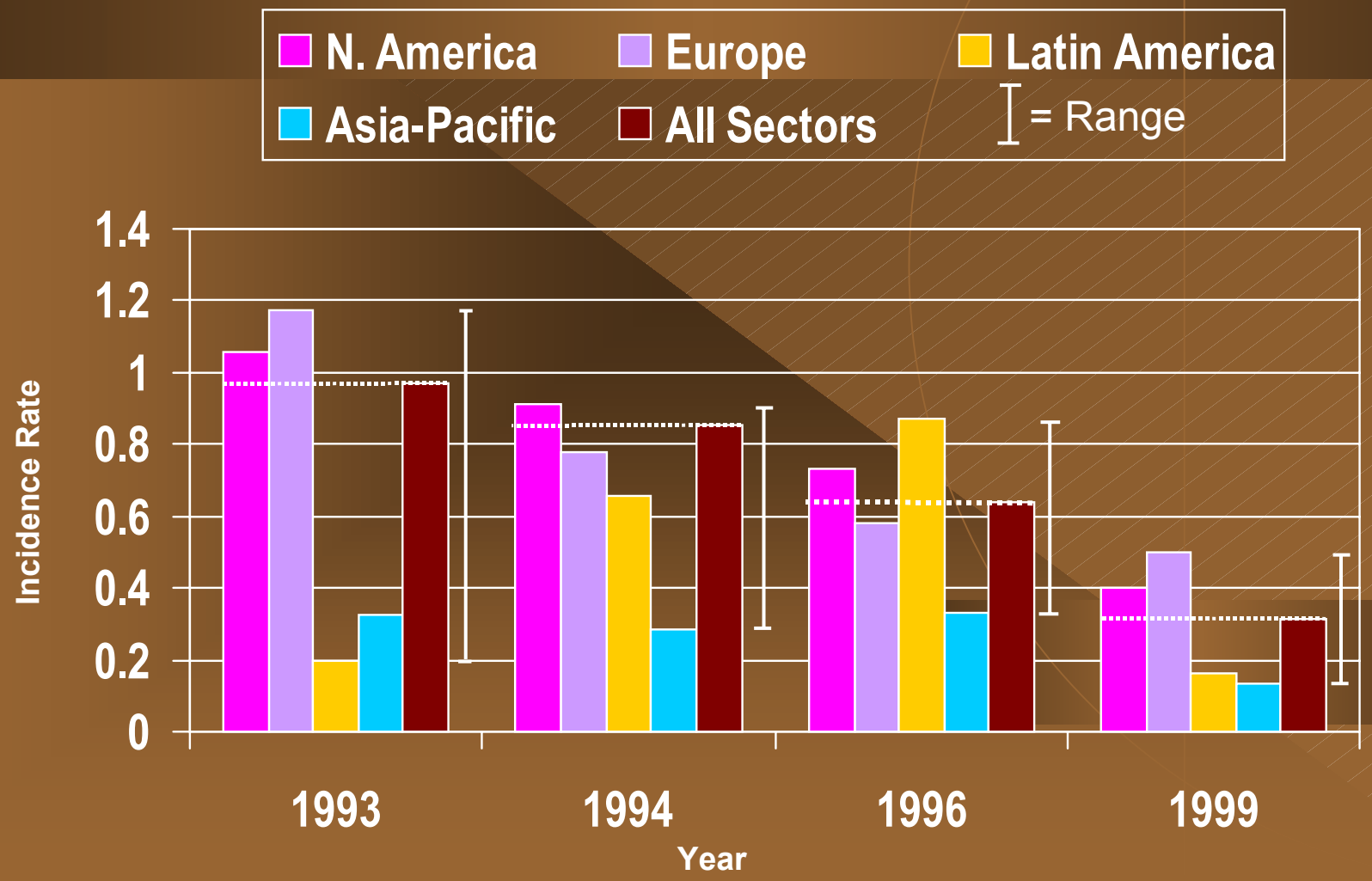
# OHS Benchmark Surveys ’93-’99

**Incidence of Work Injuries & Illnesses with Lost Days Away from Work per 100 Workers per Year**

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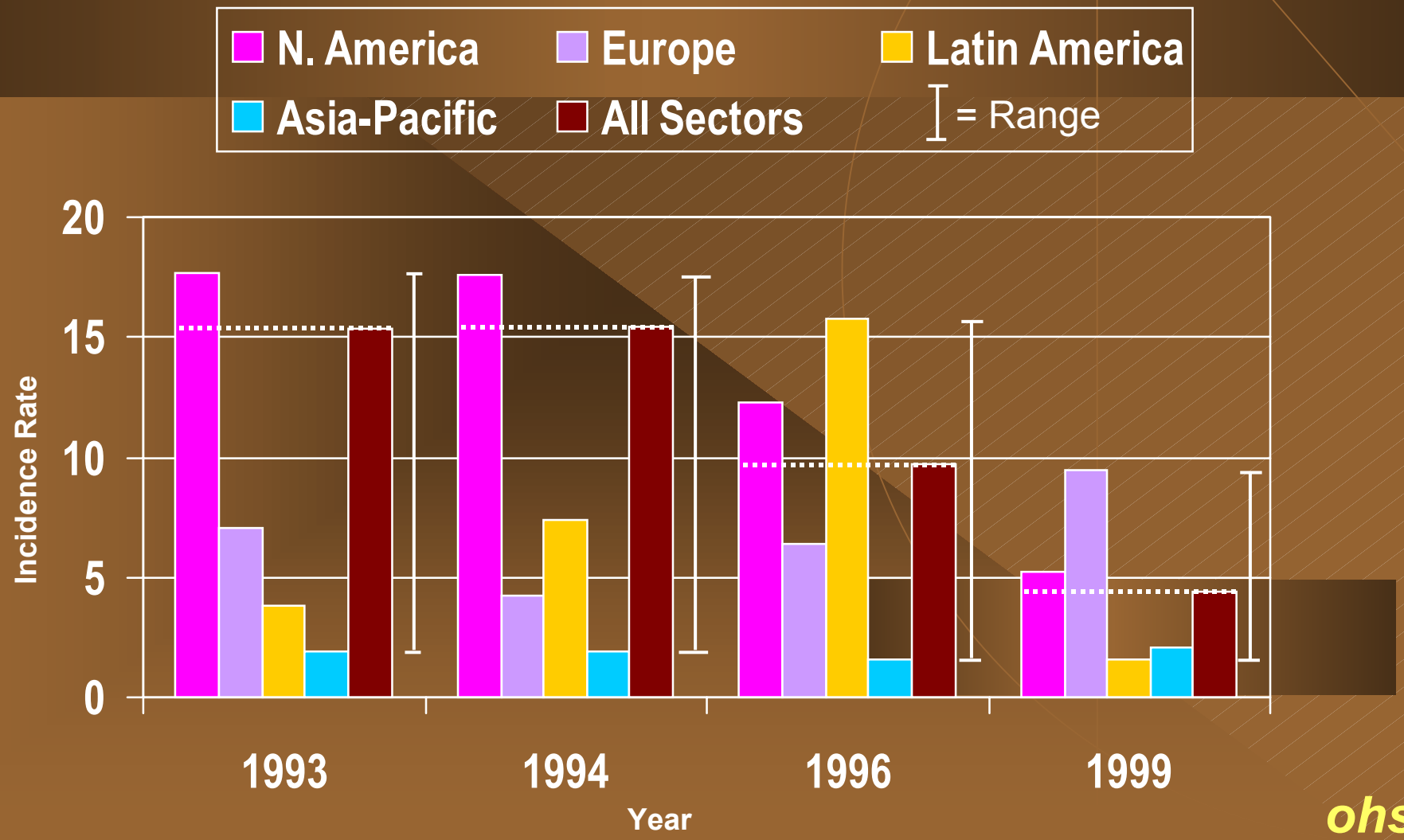
# OHS Benchmark Surveys ’93 -’99

**Incidence of Lost Days Away from Work per 100 Workers per Year**

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# Conclusions

- "Single Rate" statistic has been the accepted norm for 30 years by ESH professionals, management and employees alike
- Management "conditioned" to accept the annual "OSHA Rate" as an important benchmark ["National Beauty Contest"]
- Limited audience for present SDP data
- BLS failure to release SDP case data in usable format borders on indifference(?)

# Recommendations

- BLS should release valuable SDP individual case data by SIC code as electronic files
- SDP should code all recordable cases - not just “Lost workday” cases [OSHA 301 form]
- BLS should “foster” development of programs which actually make use of annual survey data [OSHA & NIOSH involvement]