Near-Miss Reporting System as an Occupational Injury Preventive Intervention in Manufacturing

Lina Lander, ScD,[1]* Ellen A. Eisen, ScD,[2,3] Terry L. Stentz, PhD,[4] Kathleen J. Spanjer,[5] Bryce E. Wendland,[5] and Melissa J. Perry, ScD, MHS[2]

Background *A database of near-misses (NM), minor injuries, and OSHA recordable injuries was established at a mid-size electrical manufacturing plant as part of injury prevention efforts. The utility of a NM reporting system was evaluated by estimating its impact on the annual incidence of minor and OSHA recordable injuries.*
Methods *Logistic regression was performed to examine the effects of predictor variables (year, age, duration of employment) on the type of event (NM, minor, OSHA recordable). Poisson regression was fit to model the annual rate of OSHA recordable injuries as a function of time.*
Results *1690 events were reported between 1999 and 2006 including 261 NM, 1205 minor, and 205 OSHA recordable injuries. The expected rate of OSHA recordable injuries decreased by 0.84 (95% CI: 0.73-0.97) annually.*
Conclusions *The implementation of a NM reporting system was associated with decrease in the rate of OSHA recordable injuries. NM reporting systems may be valuable injury interventions in manufacturing.* Am. J. Ind. Med. 54:40–48, 2011. © *2010 Wiley-Liss, Inc.*

KEY WORDS: near-miss; manufacturing; minor injury; major injury; occupational injury

INTRODUCTION

Despite industry preventive efforts, incidence rates of occupational injuries and illnesses in the United States remain high. The incidence rate of nonfatal occupational injuries and illnesses was 5.2 cases per 100 equivalent full-time workers in electrical equipment manufacturing [Standard Industrial Classification (SIC) 3825] and 4.6 cases in private industry overall in 2005 [BLS, 2005a].

Investigating only severe injuries and fatalities may provide little insight into prevention strategies for minor injuries and may encourage under-reporting of safety violations [Pransky et al., 1999]. Near-misses (NM), minor, and severe injuries appear to share similar causal factors and NM tend to occur with greater frequency [Heinrich, 1980; van der Schaaf et al., 1991; Hemingway and Smith, 1999; Marsh and Kendrick, 2000; Zohar, 2002; Wright and van der Schaaf, 2004]. Similar organizational and protective equipment risk factors (6/7), for example, were found for NM and actual needlestick injury events [Clarke et al., 2002a]. A recent study by Alamgir et al. [2009] found that contributing factors were similarly distributed for NM, minor, and major injuries. From a prevention standpoint, viewing NM, minor, and major injuries as having a common underlying cause may be especially effective because preventing NM may in turn prevent severe injuries and fatalities [Gambino and Mallon, 1991; March et al., 1991; van der Schaaf et al., 1991].

NM reporting systems may be effective tools to recognize, analyze, and monitor exposures that may be

[1]Department of Epidemiology, University of Nebraska Medical Center, Omaha, Nebraska
[2]Department of Environmental Health, Harvard School of Public Health, Boston, Massachusetts
[3]School of Public Health, University of California, Berkeley, California
[4]College of Engineering, University of Nebraska-Lincoln, Lincoln, Nebraska
[5]Square D by Schneider Electric, North America Operating Division, Palatine, Illinois
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*Correspondence to: Lina Lander, Department of Epidemiology, College of Public Health, University of Nebraska Medical Center, 984395 Nebraska Medical Center, Omaha, NE 68198-4395. E-mail: llander@unmc.edu

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associated with injuries and several industries and organizations have implemented NM reporting systems as injury preventive interventions [Wu et al., 1991; Barach and Small, 2000; Callum et al., 2001; Barger et al., 2005; Coyle, 2005]. These reporting systems generally require extensive training, resources, and a comprehensive safety culture to function effectively. There is lack of research, however, on the effect of NM and accident reporting systems on the rate of severe injuries that must be recorded under U.S. Occupational Safety and Health Administration regulations (OSHA recordable injuries) [OSHA, 2005].

The main objective of this investigation was to determine the usefulness of a NM reporting system in terms of its impact on both minor and more severe OSHA recordable injuries. We hypothesized that the implementation of the NM reporting system would reduce the rate of OSHA recordable injuries in a manufacturing facility. Since age and job experience may be associated with injury rates, we included age and duration of employment in analyses. Older workers are at higher risk of occupational injuries, and injuries experienced by older and more experienced workers tend to be more severe and require longer recovery times than injuries to younger and inexperienced workers [Pickett et al., 1999, 2001; Solomon, 2002; Grandjean et al., 2006; King et al., 2009; Kucera et al., 2009].

MATERIALS AND METHODS

Injury data from one manufacturing facility in the Midwest, with approximately 600 workers, were analyzed. The plant was a unionized manufacturer of commercial and residential electrical power distribution products including load centers and circuit breakers, arc fault circuit interrupters, multi-path surge protectors, and structured wiring systems. This study was approved by the Office of Human Research Administration of the Harvard School of Public Health.

Event Database

Recording of NM and minor injuries was implemented in 1999 as part of a management safety improvement initiative. The reporting system was launched during the monthly safety meetings by presenting management's safety concerns and explaining NM and minor injuries that require reporting. Employees were instructed to report any event that could have resulted in injury or equipment damage. Blame for each event was not assigned in order to encourage reporting and to foster a proactive safety culture. Events reported were evaluated by an investigation team consisting of the employee involved, area manager, department representative, safety representative, supervisor, and occasionally, a plant manager. The investigation team identified causal factors and determined necessary corrective actions to prevent similar incidents from occurring. Implementation of corrective actions was audited and followed-up upon with the employee involved. Corrective actions and audit records were not carefully recorded in the database and were not explored in this study. Investigation findings were publicized during the monthly plant-wide safety meetings and results were posted on plant bulletin boards.

Safety personnel entered investigation reports into the Safety Corrective Action Report (SCAR) database following a structured format (November 1999–January 2006). All NM, minor, and OSHA recordable injuries were entered into the database as separate entries in the SCAR database. This database, thus, included individuals who experienced more than one event. The SCAR database included information on the event, usually from a narrative description provided by the worker involved; date; injury location (body part involved); secondary location (left, right, top, bottom, etc.); injury type (discomfort/pain, abrasion, laceration, strain, etc.); area where event occurred, date of hire, date of birth, and investigation status. Injury location and type categories were defined, selected, and recorded in the database based on the facility safety personnel's medical knowledge and experience. The database did not include information on employees' gender or race. Total number of employees and total hours worked by all employees were used to calculate rates of events reported.

OSHA Recordable Injuries

Plant safety personnel maintained a separate database of OSHA recordable injuries from OSHA 300 logs. The OSHA 300 logs include a record of all reportable occupational injuries and illnesses such as time, location, and description of each injury or illness, job title and name of the employee involved, as well as the number of days away from work or on restricted duty [OSHA, 2005].

Each OSHA recordable injury, thus, was recorded twice, once in the SCAR database and once in the OSHA database. Only total numbers of OSHA recordable injuries were available for 1995–2001. These OSHA recordables could not be individually matched with records in the SCAR database and were excluded from the logistic regression outcome analyses. Records from 2006 were incomplete and were also excluded. Exclusion of events that occurred 1995–2001 and in 2006 resulted in removal of 87 NM and 652 minor injuries from logistic regression analyses. Records for 2002–2005 were individually matched to the SCAR database records by employees' names and event dates to determine which injuries in the database were OSHA recordable.

Event Type Classification

Upon closer evaluation of the SCAR database, misclassification of event type was evident with minor injuries

classified as NM or OSHA recordable injuries in many reports. The description of event was utilized, therefore, to determine whether a NM or a minor injury occurred. Nineteen reports (1.2%) were excluded because of insufficient information to determine the type of event (NM vs. minor injury) from the description. Events with descriptions that included ''could have resulted in injury'' or ''almost fell/got caught/etc.. . .,'' for example, were classified as NM. Events that included detailed description of injury type and location, such as ''thumb got caught. . .,'' ''struck hand with the hammer'' or ''bruised right hand'' were classified as minor injuries. Minor injuries, therefore, required first aid only. Description of event was also used to determine the type and location of the injury and these variables were added to the database. The revised SCAR database was used to evaluate the utility of a NM reporting system and its association with minor and OSHA recordable injuries.

Statistical Methods

Annual numbers of workers and hours worked by all employees (1995–2005) were obtained from OSHA's forms 300A, summary of work-related injuries and illnesses, provided by the plant personnel. Incidence rates for NM, minor injuries, and OSHA recordable injuries were calculated by dividing the number of events by the number of total hours worked by facility employees, and multiplying by 200,000 and reported as events per 100 full-time equivalents (FTE) [BLS, 2007].

Descriptive statistics (mean, standard deviation) and frequencies were computed for demographic and occupational characteristics of NM, minor, and OSHA recordable injury reporters in the manufacturing facility (1999–2005). Logistic regression was performed to examine the effects of predictor variables (year, age, and duration of employment) on the type of event (NM, minor, OSHA recordable) as estimated by prevalence odds ratios (OR) and 95% confidence intervals (CI). NM events were used as a reference group for OR estimations.

The significance of apparent trends in the proportion of minor and OSHA recordable injuries compared to NM between 2002 and 2005 was assessed using Cochran–Armitage trend test.

Poisson regression was fit using PROC GENMOD to model the annual rate of OSHA recordable injuries as a function of time (model 1):

$$\ln(\lambda) = \beta_0 + \beta_1(NM_i) + \beta_2(T_i \times NM_i) + e \qquad (1)$$

where: λ was the annual incidence rate of OSHA recordable injuries per year (1995–2005); NM_i, a binary term indicating the absence ($NM_i = 0$ for 1995–1999) or presence ($NM_i = 1$ for 2000–2005) of a NM reporting system; T_i, an indicator for year ($i = 1,\ldots,11$ for 1995,. . .,2005 respectively); and e, measurement error. The main effect of time (T_i) on the annual incidence rate of OSHA recordable injuries was not included in the model because it appeared to be nonlinear upon careful evaluation. In addition, fitting two Poisson regressions to model the annual rate of OSHA recordable injuries as a function of time before (1995–1999) and after (2000–2005) implementation of a NM reporting system yielded similar results. Model 1 which included pooled data and interaction term ($T_i \times NM_i$) was fit to save one degree of freedom and increase power. The incidence rate ratio (IRR) for one unit increase in year was:

$$IRR = e^{\beta_2} \qquad (2)$$

Expected log counts and IRRs were obtained (2) as well as their corresponding 95% CIs. Deviance was used to evaluate model fit. All analyses were performed in SAS V9.1 [SAS Institute Inc, 2004].

RESULTS

Details of annual incidence rates of five most frequently reported minor and OSHA recordable injuries by event type and body location are presented in Figures 1 and 2. The majority of events were discomfort or pain (558, 39%), followed by strain (150, 10%), laceration (115, 8%), bump (being struck by an object; 98, 7%), and bruise (70, 5%). Overall, the injury rate was highest in 2000. Upper extremities, neck, and back were the most common event locations. Neck or shoulders were mentioned in 224 (16%) reports, finger in 225 (16%), hand or wrist in 201 (14%), arm or elbow in 189 (13%), and back in 165 (12%) reports, respectively.

The manufacturing facility employed 590 workers per year on average, ranging from 756 (1999) to 366 employees (2005–2006). There were 1,690 events reported between 1999 and 2006 including 261 NM, 1,205 minor, and 205 OSHA recordable injuries. Seventy-six OSHA recordable injuries were associated with days away from work (mean 27.6, SD 45.5, range 1–180) and 44 reports included job transfer (mean 42.1, SD 52.4, range 2–180 days). The demographic and occupational characteristics of workers in the database are presented in Table I. On average, workers were 49.6 years of age (SD 8.7) and had worked at the manufacturing facility for 23.5 years (SD 8.9).

Results from the logistic regression analysis of effects of time (year), age, and employment duration on event type (NM, minor, OSHA recordable) are shown in Table II. Compared to NM, ORs of minor, and OSHA recordable injuries decreased over time (2002–2005). A trend in proportion of minor and OSHA recordable injuries compared to NM between 2002 and 2005 was evaluated using Cochran–Armitage test for trend. The trend for decreasing proportion of minor injuries compared to NM between 2002

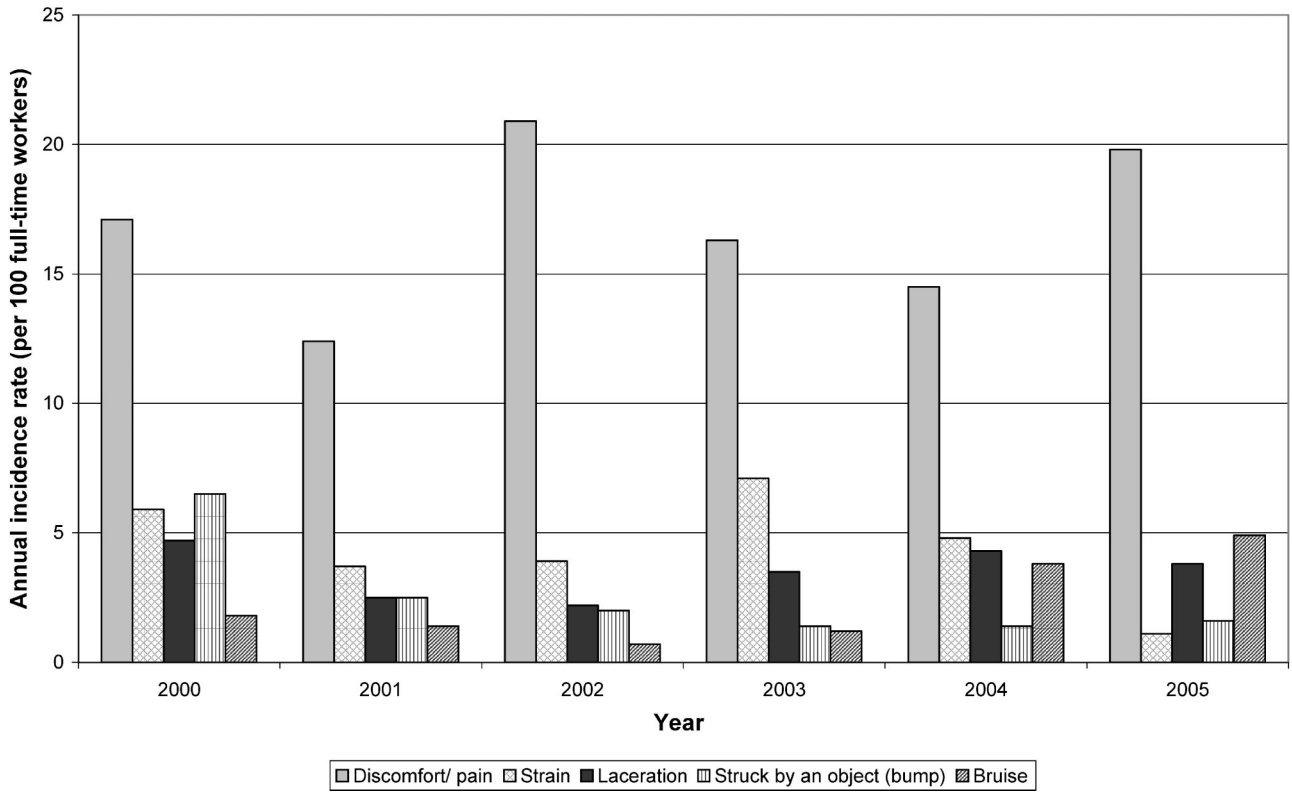


FIGURE 1. Annual incidence rates by type of event for 600 electrical manufacturing facility workers (2000–2005).

and 2005 was significant [z = −6.77, *P*-value <0.001; OR 0.15 (0.08, 0.28)]. The decreasing trend was also significant for the proportion of OSHA recordable injuries compared to NM [z = −9.08, *P*-value <0.001; OR 0.06 (0.03, 0.13)]. There was some suggestion that older workers experienced events of higher severity, although the associations were not statistically significant. Compared to NM, the odds of minor injuries appeared to increase with increasing age. Compared to NM, the odds of minor injury were 1.02 times higher for a 1 year increase in age (95% CI: 1.00–1.04). Similarly, the odds of OSHA recordable injuries increased by 1.03 for every 1 year increase in age, compared to NM (95% CI: 1.00–1.05). Duration of employment was not significantly associated with the rate of minor or OSHA recordable injuries. The odds of minor injury were 1.0 (95% CI: 0.98–1.02) compared to the odds of NM with increased duration of employment (per year). The odds of OSHA recordable injuries were 1.02 times the odds of NM with increased duration of employment (95% CI: 0.99–1.04). Age and duration of employment were not significant in the multivariate model that included year of event.

Operations were conducted in three 8-hr shifts. Of all reports, the largest percentage of employees worked during the first shift (546, 40%), followed by second (296, 21%), and third (151, 11%) shifts. One group of employees (387, 28%) worked in shifts with a changing biweekly schedule. This schedule included three consecutive 12-hr days and an additional 12-hr day on nonconsecutive weeks.

Incident reports were submitted from various production areas. The majority of reports (831, 52%) were from assembly areas of single pole and multipole breakers. There were 552 (35%) reports from components' manufacturing in molding, plating, brazing, and stamping. Power presses were used to stamp parts for single and multipole breakers. Enclosure boxes and switches were manufactured in molding using plastic injection presses. Breaker components were then coated with nickel, zinc, and tin prior to assembly in plating and welded together in brazing. Finally, 208 (13%) reports were from the tool room, where stamping dyes were made, maintenance, and shipping and receiving.

While the annual incidence rate of OSHA recordable injuries was stable at 12 injuries per 100 full-time workers between 1995 and 1998, it increased to 17.2 per 100 full-time workers in 1999 when the NM reporting system was implemented, as depicted by the solid vertical line in Figure 3. Following the implementation of the NM reporting system, the annual incidence rate of OSHA recordable injuries remained high in 2000 with 17.9 OSHA recordable injuries per 100 full-time workers, before falling to 11.3 injuries per 100 full-time workers in 2001 and eventually to 6.3 injuries per 100 full-time workers in 2005. From the IRRs, the expected rate of OSHA recordable injuries

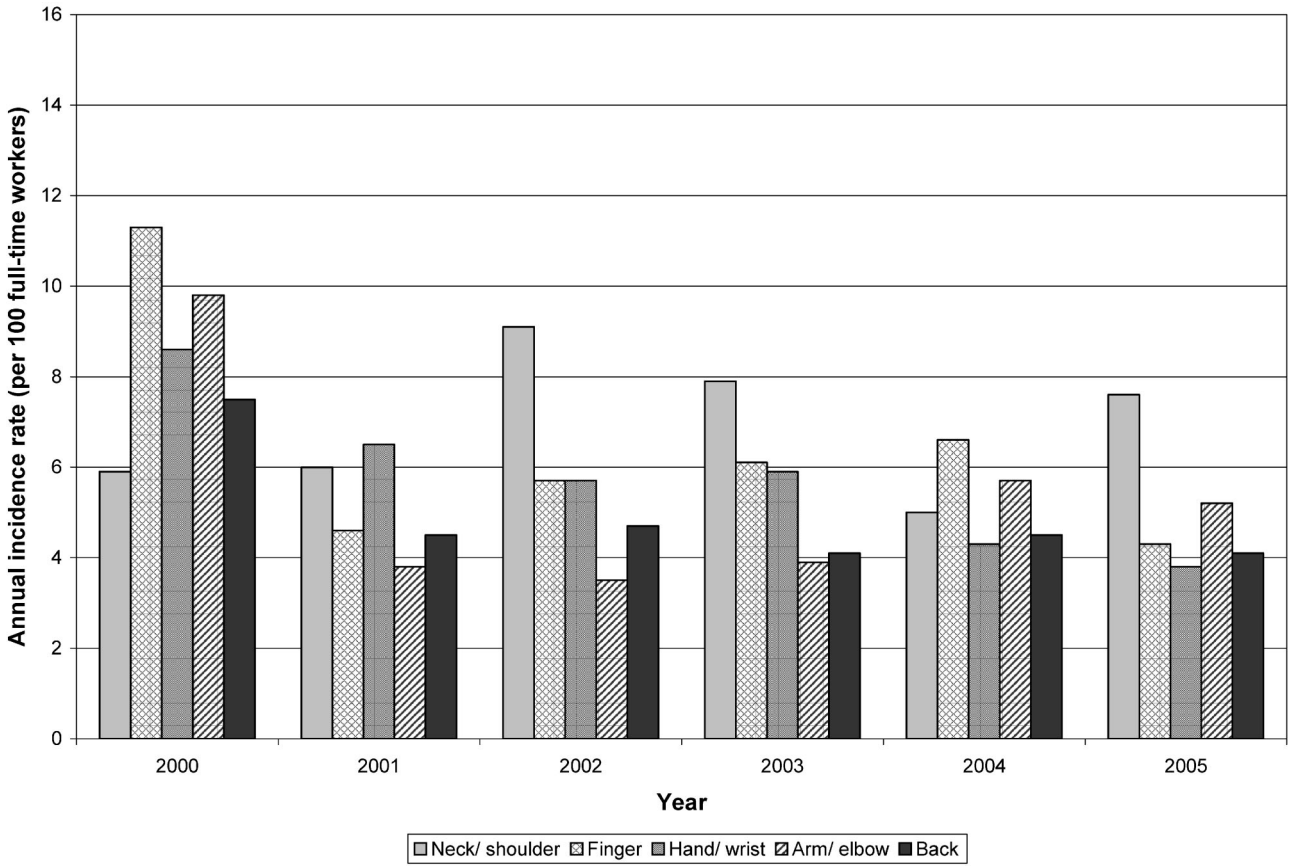


FIGURE 2. Annual incidence rates by body location for 600 electrical manufacturing facility workers (2000–2005).

decreased by 0.84 (95% CI: 0.73–0.97) [deviance (χ^2) = 3.24, df = 7, *P*-value ≤0.46; Table III). Beta of 2.32 is the intercept of the logistic regression model when all other covariates are 0, that is when the NM reporting system was not implemented (1995–1999; Table III).

Following the implementation of the NM reporting system, the annual incidence rate of minor injuries decreased over time whereas the annual incidence rates of NM increased over time. Annual incidence rates of minor injuries were 56.9, 34.4, 27.2, 29.1, 32.4, and 32.0, per 100 full-time workers for 2000–2005. Incidence rates of NM events were

TABLE I. Demographic and Occupational Characteristics of NM, Minor, and OSHA Recordable Injury Reporters in the Electrical Manufacturing Facility (1999–2005)

Characteristic	Near-miss events	Minor injuries	OSHA recordable injuries
Number of events, n[a]	261	1,205	205
Year, n (%)			
2002	13 (7.6)	162 (28.6)	77 (38.3)
2003	32 (18.7)	143 (25.3)	70 (34.8)
2004	62 (36.3)	143 (25.3)	31 (15.4)
2005	64 (37.4)	118 (20.9)	23 (11.4)
Age, mean (SD) (years)	48.6 (9.1)	49.6 (8.7)	50.8 (8.0)
Duration of employment, mean (SD) (years)	23.0 (8.9)	23.4 (9.0)	25.2 (8.3)

[a]Total do not sum to 261, 1,205, and 205 due to missing data.

TABLE II. Odds Ratios for Minor and OSHA Recordable Injuries by Year at the Manufacturing Facility (2002–2005)

Variable evaluated using logistic regression	OR (95% CI) minor injury versus near-miss	OR (95% CI) OSHA recordable versus near-miss
Years		
2002	1.00	1.00
2003	0.36 (0.18–0.71)	0.37 (0.18–0.76)
2004	0.19 (0.10–0.35)	0.08 (0.04–0.18)
2005	0.15 (0.08–0.28)	0.06 (0.03–0.13)
Age	1.02 (1.00–1.04)	1.03 (1.00–1.05)
Employment duration	1.00 (0.98–1.02)	1.02 (0.99–1.04)

OR, odds ratio; CI, confidence interval estimated using a univariate logistic regression model.

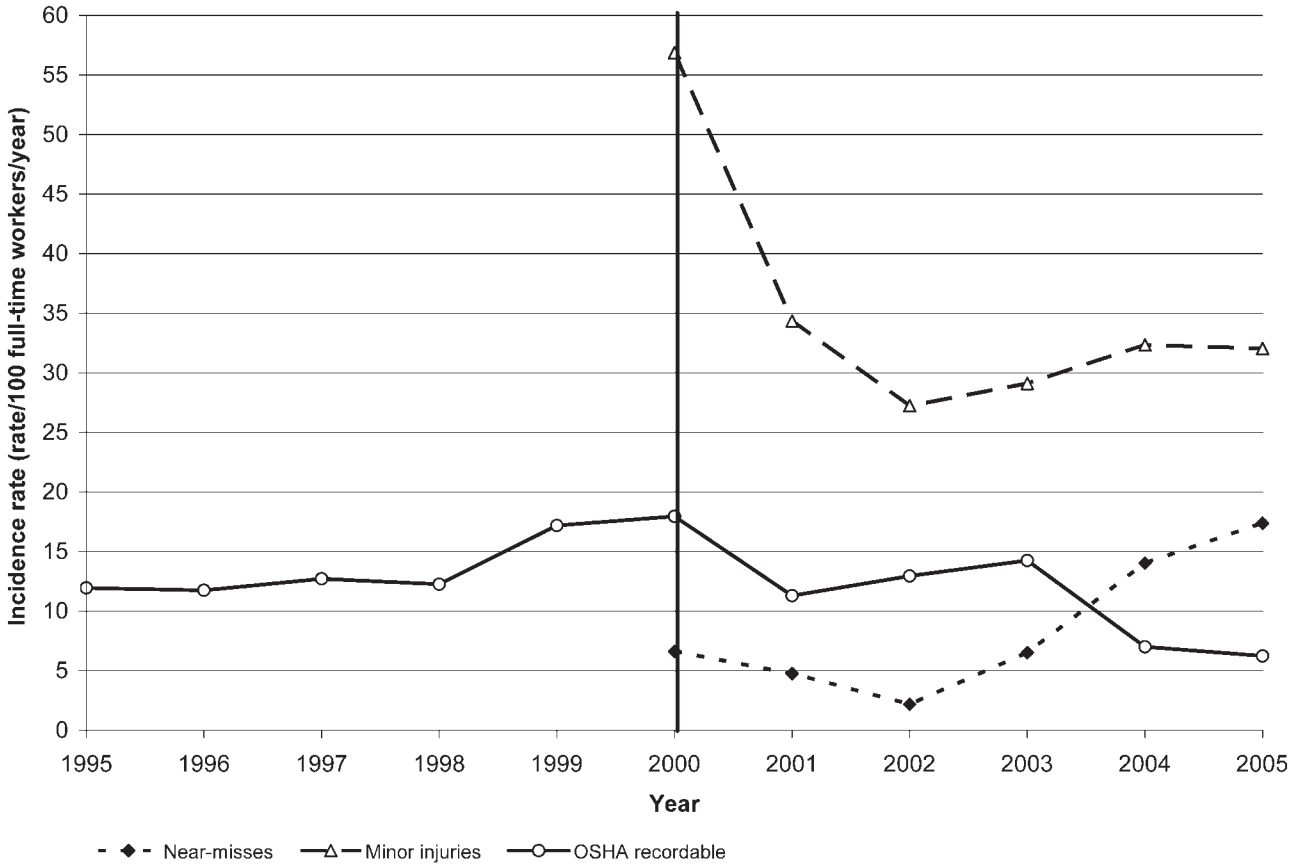


FIGURE 3. Distribution of events by year among manufacturing facility workers (N = 1,690) 1995–2005. *Solid vertical line represents onset of the near-miss and minor events reporting system (established in November, 1999).

6.6, 4.8, 2.2, 6.5, 14, and 17.4 per 100 full-time workers per year for 2000–2005 (Fig. 3).

DISCUSSION

Incidence rates of OSHA recordable injuries at the manufacturing facility evaluated in this study ranged from 11.9 per 100 equivalent full-time workers in 1995 to 6.3 in 2005 with a maximum of 17.9 in 2000. These rates were higher than the incidence rate of nonfatal occupational injuries and illnesses in the electrical equipment manufacturing industry in the United States (5.2 per 100 equivalent full-time workers) [BLS, 2005a]. In addition, occupational injuries and illnesses rates in electrical equipment manufacturing were higher than rates in other manufacturing industries. For example, the incidence rate in household appliance manufacturing was 5.4 cases per 100 equivalent full-time workers, 3.2 cases in chemical manufacturing, 2.7 cases in pharmaceutical and medicine manufacturing, and 2.0 cases in computer and electronic product manufacturing [BLS, 2005b]. Consistent with injuries in other industries [Sorock et al., 2002, 2004; Cai et al., 2005; Pollack et al., 2007], discomfort, pain, strain, and lacerations involving upper extremities, neck, and back were the most commonly reported in this plant. Occupational neck and back pain remain a significant source of morbidity and disability every year [Shelerud, 2006; Palmer and Smedley, 2007]. Susceptibility to occupational injuries may increase with age but decrease with work experience. Our data showed that the odds of minor and OSHA recordable injuries increased with age, which is consistent with previous findings that if injured, older workers tend to experience higher severity injuries and have higher fatality rates than younger workers [Grandjean et al., 2006].

TABLE III. Regression Coefficients and Incidence Rate Ratios of OSHA Recordable Injuries as a Function of Time at a Manufacturing Facility (1995–2005)

Change in rate ratio of OSHA recordable injuries per year	β (95% CI)	e^{β} (95% CI)
β_0	2.32 (1.73–2.91)	10.18 (5.64–18.44)
β_1	1.58 (0.28–2.88)	4.85 (1.32–17.76)
β_2	−0.18 (−0.32 to −0.03)	0.84 (0.73–0.97)

The main objective of this investigation was to determine the impact of a NM reporting system on the rate of minor and OSHA recordable injuries. Prior to the implementation of a NM reporting system in 1999, the incidence rate of OSHA recordable injuries appeared to increase slightly but the cause of this increase is unclear. Immediately following the implementation of the NM reporting system in 2000, the annual incidence rate of OSHA recordable injuries increased to 17.9 OSHA recordable injuries per 100 full-time workers, however, the expected rate of OSHA recordable injuries decreased by 0.84 (95% CI: 0.73–0.97) per year eventually falling to 6.3 in 2005. While the implementation of a NM reporting system was associated with a decrease in the OSHA recordable incidence rate the decline followed an initial increase and was gradual. Further investigation of the immediate effects of a NM system is necessary to determine whether the OSHA recordable rates first increase then decrease was in response to a new reporting system. Although, the OSHA record-keeping regulations were changed in 2001 to clarify and simplify reporting requirements [OSHA, 2005], we do not believe that this change likely affected reporting rates throughout the data collection period. Workers reported all injuries and NM to facility safety personnel who had been extensively trained in OSHA reporting rules and regulations and the long tenure of the facility's safety personnel provided continuity and stability in incident reporting.

According to the frequently cited H.W. Heinrich's Safety Pyramid, for every serious incident, a large number of events result in minimal impact and an even larger number of events result in no damage at all [Phimister et al., 2003; Gallivan et al., 2008]. Surprisingly, the opposite was observed in our study. The majority of events observed were minor injuries, possibly due to reporting and the relative novelty of the NM reporting system. The relative stability in the number of reported musculoskeletal injuries, such as discomfort and pain is evidence of consistent reporting of events in the facility. The decline of acute injuries such as lacerations and being struck by an object support the implementation of the NM reporting system because such a system is more likely to be effective in preventing acute injuries.

The common cause hypothesis stipulates that the causal pathways of NMs are similar to those of more severe events such as minor and OSHA recordable injuries [Wright and van der Schaaf, 2004]. While the validity of the Heinrich's pyramid has been questioned [Gallivan et al., 2008], viewing NM, minor, and OSHA recordable injuries as having a common cause may be especially attractive from a prevention standpoint because preventing NM may in turn prevent severe injuries and fatalities [Heinrich, 1980; Gambino and Mallon, 1991; March et al., 1991; van der Schaaf et al., 1991; Marsh and Kendrick, 2000; Wright and van der Schaaf, 2004; Alamgir et al., 2009]. Similar organizational and protective equipment risk factors (6/7), for example, were found for NM and actual needlestick injuries [Clarke et al., 2002a]. A railway accident investigation used a confidential incident reporting and analysis system to evaluate whether NM share causal pathways with accidents [Wright and van der Schaaf, 2004]. Study results supported the common cause hypothesis with only 3 out of 21 types of causes having significantly different proportions for the three event types investigated: ''injury and fatality,'' ''damage,'', and ''NM.'' Safety research into the causes of aviation and railway accidents has advanced the usefulness of basing accident prevention measures on minor incidents [van der Schaaf, 2002; Wright and van der Schaaf, 2004]. A recent study of NM, minor, and major injuries among healthcare workers found differences in the relative distribution of causal factors for these events. For musculoskeletal injuries, however, contributing factors were similarly distributed for NM, minor, and major injuries [Alamgir et al., 2009]. Overall, prior studies reinforce the utility of studying both major and minor injuries because they likely share common risk factors.

There are numerous benefits associated with NM reporting systems. NM and minor injuries tend to occur more frequently than severe injuries [Hemingway and Smith, 1999; Zohar, 2002] and better lend themselves to quantitative analyses than major adverse events. Additional benefits of the NM reporting system include reduced liability and blame of a NM reporter, making it easier to collect more accurate data on NM than adverse events. Underreporting of safety violations can occur if only deaths and severe injuries are investigated [Pransky et al., 1999]. In addition, recovery operations that prevent progression from NM to mishap are a valuable source of information to prevent similar incidents from occurring [Gambino and Mallon, 1991; March et al., 1991; van der Schaaf et al., 1991; Barach and Small, 2000]. NM reporting systems, thus, may be effective tools to recognize, monitor, and ultimately reduce exposures that may be associated with injuries.

Study results should be interpreted with several limitations taken into consideration. First, a voluntary reporting system was evaluated. While the reporting system was launched plant-wide and management-encouraged employees to report all events, underreporting remained a concern. Workers may be reluctant to report minor events that occurred while not following safety policies and procedures. Some of the increase in the number of NM events may be explained by increased familiarity and comfort with the NM reporting systems although this cannot be readily evaluated using these data. Additionally, the decline in the OSHA recordable incidence rate may be attributed to improvements in safety culture as NM are reported and facility improvements are implemented. Another potential limitation was that the injury database included multiple inconsistencies in coding and required evaluation of all individual records to determine whether a NM, minor, or OSHA recordable injury occurred. The reviewer relied on the event description to make such a determination and outcome misclassification may have

occurred. This misclassification would bias the results towards the null hypothesis of no association between the implementation of a NM reporting system and the incidence rate of OSHA recordable injuries.

Only the total number of OSHA recordable injuries was available for 1999–2001. Records of individual events that occurred prior to 2002, therefore, could not be matched with NM and minor injury records in the SCAR database and were excluded from analyses. Missing data could bias the results either towards or away from the null hypothesis of no association between the implementation of a NM reporting system and the incidence rate of OSHA recordable injuries. There were no data on the total number or total hours worked in each area and during each shift and rates of injuries for these variables could not be calculated. Finally, demographic and descriptive variables such as gender, race, years of experience in similar settings, number of hours worked prior to the event, or occupation were not available and could not be evaluated.

NM reporting systems already exist in military operations, transportation, aviation, nuclear power operations, petrochemicals, steel production, and medicine [Wu et al., 1991; Barach and Small, 2000; Callum et al., 2001; Barger et al., 2005; Coyle, 2005]. To be effective in reducing occupational injuries, NM reporting systems require a comprehensive safety culture [Clarke et al., 2002b,c]. In this plant, all reported events were investigated and corrective actions were implemented to prevent similar events from occurring. Periodic audits of the corrective actions were conducted to ascertain employee's satisfaction, which in turn, reinforced the culture of safety. While these data were limited, they support the implementation of NM reporting system as an injury preventive intervention in manufacturing.

CONCLUSIONS

NM reporting system is an effective way to identify and evaluate exposures that may be associated with injuries. Our data support the implementation of a NM reporting system as an injury preventive intervention. This system appeared to have an impact on the rate of OSHA recordable injuries. Further evaluation of investigation of reported events and implementation of corrective actions will strengthen NM reporting system and expand its applications.

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