The Effect of Intervention on the Implementation of an Incident Reporting System in Isfahan Steel Company

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Abstract

Background: Occupational injuries are a public health problem, estimated to kill more than 300,000 workers worldwide every year and to cause many more cases of disability. The aim of this study was to determine the effect of a training intervention on the implementation of an incident reporting system, perceived management commitment to safety and employees motivation to report incidents in Isfahan Steel Company.

Methods: A quasi experimental research with case (185) and control (209) groups with measurements before the implementation of the incident reporting system and one year later was used to evaluate the effect of training intervention on the implementation of the incident reporting system, motivation to report incidents and perceived management commitment to safety.

Results: The results showed that the implementation of the incident reporting system was more successful in case group than the control group especially on reporting NM's, MI's. In case group, perceived line management commitment to safety and employees motivation to report NM's, MI's significantly increased after the training intervention.

Conclusion: Training intervention could promote implementation of the incident reporting system as a key factor of management support. Although the study shows some encouraging results concerning the reporting NM's, MI's, further studies are needed to evaluate whether the introduction of an incident reporting system with feedback has an effect on the number of major incidents.

Keywords: Occupational injuries; Incident reporting system; Near miss; Training intervention

Introduction

Occupational injuries are considered as a public health problem, estimated to kill more than 300,000 workers worldwide every year and to cause many more cases of disability.1 Workplace, fatal and non-fatal injuries result into a marvelous burden on workers, their families, and society. Work-related hazards are especially severe in developing countries.2 Developing countries face unique challenges in the control of occupational diseases and injuries. Unregulated exposures to chemical and physical hazards, work that may begin in childhood, poverty and hunger, and scarce workplace health and safety resources contribute to high incidences of occupational injuries. A low level of commitment to occupational health at the nation level, common in many developing nations results in a lack of enforcement of standards; this situation also permits the operation and proliferation of hazardous workplaces.3 The control of occupational illness and injury in developing countries is also hindered by the lack of adequate surveillance.

In addition, misreporting is the well known phenomenon throughout the world. Several studies have estimated significant under-reports of injuries across all industries. Leigh et al. (2004) developed models suggesting the Bureau of Labor Statistics (BLS) Annual Survey missed from 0 to 70% of the number of injuries that was designed to capture and was between 33% and 69% of all injuries.4 Different strategies have been tried in the effort to prevent injuries internationally. One of these is inci-
dent reporting system, which initiates from high-risk industries such as aviation, nuclear power plants, and offshore oil and gas installations. These systems are becoming more and more common in conventional production plants and the use of an incident reporting system is one of the demands particular in the international occupational health and safety management system of OHSAS18001 that many foremost companies use.5

The use of incident reporting system as a way to prevent major incidents is based on two assumptions that date back to Heinrich's injury triangle model.6 First, the “safety iceberg”-assumption, which states that for every major incident that occurs a large number of related minor injuries and near-misses occur, and secondly the related “identical causation”-assumption, which assumes that these large numbers of near misses and minor incidents have the same core causes as the major incidents.

While implementing an incident reporting system, some probable problems may happen, as the success of the system depends on numerous factors. Management commitment is accepted as probably the single most important factor7 for success in any area of occupational safety, and apparently in any organizational change. This more than ever applies for top management commitment, but also line management's commitment is an important factor in altering the safety-oriented behavior of workers.8-10 In addition; the efficiency of the incident reporting system depends firmly on the employee’s motivation to report any kind of incident. At the beginning; this motivation might be low, particularly relating to small and apparently unimportant incidents such as minor cuts and bruises or near misses, as these kinds of incidents are an accepted part of daily work for many of the employees in the industrial area. Similarly, there may be a low motivation to report incidents in circumstances where employees feel they will be answerable for the incident, that is, if the required trust in the fairness of management is not present.5

Also, there are numerous causes why there might not only be a general underreporting of incidents, but also a biased reporting of incidents, as the perceived significance of reporting specific kind of incidents may be different.11

Use of an incident reporting system is somewhat a new idea and requires effective training in the workplace. It is quite clear that many challenges are presented while training in the workplace effectively introduces new ideas into the workplace which needs an understanding of the ways in which employees learn to be experienced.

This Study design is closely tied to determine the effect of a training intervention on the implementation of an incident reporting system, perceived management commitment to safety and employees motivation to report incidents, in Isfahan Steel Company.

Materials and Methods

This study was designed as a quasi experimental research with case and control groups spanning 2 years, with pre- and post- intervention measurements. The study period was from April 2005 to April 2007, with pre- and post-measurements one year after in August 2006 (T0) and 2007 (T1), respectively.

The study involved two workshops from the Isfahan Steel Company. This company as the oldest iron and steel maker of Iran was commissioned in the year 1967, located at 45 km in southwest of Isfahan city and is one of the three main sources of iron and steel in Iran.12 The selected workshops were the same in size. Both had about 300 employees occupied in production at the start of the study and after two years, the workshops had reduced their employees to 285 and 273, due to restrain and retirement. Five hundred and fifty eight workers were the employees in the company during the study period. Sampling technique was the census. Questionnaires about the motivation to report incidents and perceived management commitment to safety were used for all employees in production unit at the two workshops. At the first measurement, there was a response rate of 70% at workshop A and 78.3% at workshop B. At the second measurement, the response rate was 64.9% and 76.5%, respectively. Of the 558 employees, 394 (70.6%) completed the questionnaires at both measurements including 185 employees in the case and 209 in control groups. Although production characteristics were to some extent comparable, minor differences existed in other characteristics (Table 1). Workshop A was randomly selected as the case group.

Table 1: The demographic characteristics of workers

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Age (T1)</th>
<th>SD</th>
<th>Tenure (T1)</th>
<th>SD</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workshop A</td>
<td>185</td>
<td>37.5</td>
<td>7.8</td>
<td>10.3</td>
<td>5.5</td>
<td>100%</td>
</tr>
<tr>
<td>Workshop B</td>
<td>209</td>
<td>39.2</td>
<td>6.5</td>
<td>12.7</td>
<td>8.4</td>
<td>100%</td>
</tr>
</tbody>
</table>
In the study three different classes of reportable incidents were introduced including lost time incidents (LTIs), minor incidents (MI's), and near misses (NM's). LTIs were defined as accidents that caused more than 1 day of absence. MI's were defined as any injury occurring to a worker that either did not result into absence (e.g., a cut in the finger that does not warrant medical attention) or in less than a day absence (e.g., a bruise on the head that warrants medical attention, but the worker is sent back to work the same or next day). NM's were defined as potential risks (e.g., oil on shop floor) and incidents without any injuries to workers (e.g., a crane dropping a plate that does not hit anyone). 5

An incident reporting system was launched in the two workshops. The basic concept of the system was that employees were duty-bound not only to report LTIs but also to NM's and MI's. The information from the reported incidents was then used to set up preventive actions. The case group received a 60-minute lecture about incident reporting system and importance of this information to set up preventive actions. In addition in case group, top and line manager of company personally became involved in the implementation of the system. They were present in training lectures and emphasized on implementation of incident reporting system to decrease incidences and encouraged employees to report all kinds of incidences.

In both groups, workers were informed to make a detailed description of the reported incident and provide suggestions for preventive measures and if possible take preventive action immediately. The detailed description of the incident was then passed on to those responsible for analyzing the reports (safety committee).

The reported incidents were analyzed on a continuous basis and information about accident patterns was fed back to the workers through their supervisors and used by the safety committee to set up preventive actions. The reporting systems used at the workshops were not nameless; because the company management system was sure that it was important the people responsible for analyzing the reports had the opportunity to speak to the employees who reported the incident and collected further information if needed.

Available incident data were collected for a one year period prior to the study from the companies' old reporting method and from the new system during the study period.

For one year prior to the study, the on hand information was primarily on LTIs. These were the only ones reported since there was no legislative requirement for the workers at the workshops to report either MI's or NS's prior to the intervention. Though, at both workshops, any incident the workers wanted to report was accepted regardless of severity and length of absence, so some MI's were reported prior to the study, but not scientifically, and the information was not used to set up preventive actions.

Questionnaires were completed at meetings, where employees were trained of the scope of the study and assured on its confidential. Afterwards, the employees were permitted to fill out the questionnaire on site during work hours. The questionnaire was used two times: at baseline before the new incident reporting system to be launched (T0) and again one year later (T1).

The motivation to report NM's, MI's, and LTIs was estimated by answering how many of 11 classic incidents would be reported by the employees (the 11 typical incidents consisted of three NM's, e.g., “You almost trip over a hose placed in the walkway;” four MI's, e.g., You get something in your eye and seek medical attention. After the treatment, you return work the same day; and four LTIs, e.g., You slip in some oils on the floor and twist your ankle. You have to stay home from work the next day. Perceived management commitment to safety was measured on two levels by a single item asking how much responsibility of top and line management took for safety on a day-to-day basis, respectively. 5

In order to survey the validity of the questionnaire, we used content validity, the forward-backward process which was applied to translate [Nielsen et al. questionnaire (2006)] from English into Persian. The original questionnaire was translated into Persian by the authors, and then was translated back into English by two bilinguals who were blind to the original version. The expert panel reviewed our back-translation and some corrections were made consequently. After that, in a pilot study, the edited version of the questionnaire was submitted to a group of 15 workers from the Isfahan Steel Company. There were two purposes for this review: 1st to determine whether the worker’s understanding of the questionnaire items was the same as that of the researcher; next, whether there was any disagreement among the workers regarding their understanding of the items. Afterwards, the workers comments were taken into account and some modifications were done where essential.

SPSS software (version 16, Chicago, IL, USA) was used for statistical analysis. Chi-Square test was used in case of incident data (number of lost time injuries, minor incidents, and near misses) between groups at T0 and T1. Related sample t tests were used to identify within group differences from T0 to T1 regarding...
perceived management commitment, and the motivation to report the different kinds of incidents. Independent sample t test was used on the same measures to identify differences between groups at T0 and T1. Spearman's rho was used to calculate scale inter-correlations. A p value less than 0.05 was considered significant.

As would be predictable, the measures of top and line management's commitment to safety were highly correlated at both measurements (spearman's rho=0.49 and 0.55). The motivation to report NM's, MI's, and LTI's was inter-correlated with spearman's rho ranging from 0.15 to 0.39 with the strongest correlation between the motivation to report LTI's and MI's and the weakest between MI's and NM's. The motivation to report NM's was also moderately correlated with top (rho=0.23 at T1) and line management's (rho=0.16 and 0.27) commitment to safety.

Ethical approval of this study was gained from the Research Ethics Committee, which at the time was based at Tarbiat Modares University.

Results

In the case group, the implementation of the incident reporting system succeeded (i.e., the employees started reporting incidents), and the information was collected and utilized in setting up preventive actions. As can be seen in Table 2, there was a significant increasing the incidence of MI's and NM's during the study period. The incidence of MI's increased from 37 per million hours worked in the T0, to 49 at T1 (p=0.02). Similarly the incidence of reported NM's increased from 0 to 143 (p=0.001). At first, the incidence of LTI's increased, but after the intervention, it started to decrease but insignificantly to a level lower than before the study. Overall, an insignificant decreasing trend was observed (p=0.519).

In the control group, the implementation of the incident reporting system was not succeeded and only 12 NM's were reported. As can be seen in Table 2, there was a minor increase in the incidence of MI's in the study period. The incidence of MI's increased from 37 per million hours work in the T0, to 41 at T1 (p=0.0849). Relating to incidence of LTI's, there was an insignificant increasing trend (p=0.670).

At both measurement points, there was a significant difference at both workshops in the motivation to report the different kinds of incidents (p=0.01). As would be predictable, the employee’s motivation to report incidents was lowest relating to NM's and highest regarding the more severe LTI's. At the first measurement, the motivation to report all kinds of incidents was to some extent but not significantly higher in the control than the case group.

After the intervention, the motivation to report both NM's and MI's increased significantly in both groups (p=0.05). The motivation to report LTI's also increased in both groups, but only significantly in the case group.

There was an enhancement in the employees' motivation to report incidents in both groups during the study period, but the enhancement was the highest in the case group. At the beginning, there were no significant differences between groups in the motivation to report NM's, MI's, and LTI's, respectively. However, at the end of the study period, there was a significant higher motivation to report NM's, MI's in the case group compared to the control group. Particularly, the motivation to report NM's enhanced noticeably in the case group compared to the control group (Table 3).

Perceived top- and line-management commitments to safety were measured respectively by a single item on a five-point Likert-scale (ranging from “to a very large degree” to “to a very low degree”).

At the beginning, there were no significant differences between groups in both top and line management committed to safety. Throughout the study period, there was significant increases in top and line management committed to safety in both groups (p=0.01). At the end of the study, there was a significantly higher perceived line management's commitment to safety in the case group compared to the control group (p=0.01; Table 3).

<table>
<thead>
<tr>
<th>Workshop</th>
<th>T-1</th>
<th>T0</th>
<th>T1</th>
</tr>
</thead>
<tbody>
<tr>
<td>A NM's</td>
<td>0</td>
<td>0</td>
<td>143</td>
</tr>
<tr>
<td>A MI's</td>
<td>25</td>
<td>37</td>
<td>49</td>
</tr>
<tr>
<td>A LTI's</td>
<td>10</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>B NM's</td>
<td>0</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>B MI's</td>
<td>36</td>
<td>39</td>
<td>41</td>
</tr>
<tr>
<td>B LTI's</td>
<td>8</td>
<td>10</td>
<td>12</td>
</tr>
</tbody>
</table>

LTI's: Lost time injuries, MI's: Minor incidents, NM's: Near misses.
Discussion

This study was based on the assumption that training intervention can promote the implementation of an incident reporting system, perceived management commitment to safety and employees motivation to report incidents.

As reported in the results segment, the implementation of the incident reporting system was more succeeded in the case group than the control group especially about reporting NM's, MI's. This improvement is consistent with results of other authors.

Near misses are well-known for providing a major source of useful information for safety management. They are more frequent events than accidents and their causes may potentially result in an accident under slightly different circumstances. However, identifying near misses is not an easy task.

Some limiting factors from the viewpoint of employees were reported by Van Der Schaaf and Kanse (2004) including i) Fear of disciplinary actions based on the culture blaming employees for the lack of safety; ii) The acceptance of risks, since such events are regarded as being part of the job and cannot be prevented, as well as there is a macho culture in some industrial environments; iii) lack of feedback on how reported information has been used; and iv) the perception that data collection is difficult and time consuming.

This study attempted to remove some of these barriers by adopting some actions including i) Top and line management notifying the employees reporting near miss that may be seen as a vital step toward recognition of hazards rather than as a negative effect on safety performance; ii) The reported incidents that were analyzed on a permanent basis and information about accident patterns which were fed back to the employees through their supervisors and used by the safety committee to set up preventive actions and iii) Employees could report NM's and MI's by both computer based system (on workstations placed on the shop floor) and traditional paper based reporting system that facilitate reporting for them.

Management commitment is recognized as the single most influential factor in organizational change. This is supported by this study too. The data show that there were a significant increase in the top and line-management's perceived commitment to safety in both groups that can be caused by lunching incident reporting system. In the case group, a higher perceived line management's commitment to safety was seen due to intervention. Some studies have focused on the role of line-management in changing workers safety-oriented behavior.

The readiness and motivation to report incidents is a key factor for incident reporting system to do well. As the records show, there was a significant increase in the top and line-management's perceived commitment to safety in both groups after lunching incident reporting system. This increase was significantly more in the case group. The increase in motivation in the case group was directly caused by the undertaken intervention.

To motivate employees to report NM's can be very difficult as they habitually do not consider them important and as an accepted component of the work. This is revealed in the comparably low motivation to report NM's at the beginning (12.2% and 13.5% in case and control groups respectively). However, it is amazing that the motivation to report NM's multiplied

Table 3: Results from questionnaire data

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>T0 (%)</th>
<th>T1 (%)</th>
<th>Diff. T0-T1</th>
<th>Diff. Workshops T0</th>
<th>Diff. Workshops T1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workshop</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
<td>183</td>
<td>39.3</td>
<td>60.1</td>
<td>13.1**</td>
<td>7.5***</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td>205</td>
<td>41.9</td>
<td>52.6</td>
<td>10.7**</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>209</td>
<td>97.6</td>
<td>99</td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Top</td>
<td></td>
<td>175</td>
<td>2.6</td>
<td>3.0</td>
<td>0.4**</td>
<td>0.2</td>
</tr>
<tr>
<td>Line</td>
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<td>199</td>
<td>2.8</td>
<td>3.0</td>
<td>0.2**</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>201</td>
<td>2.9</td>
<td>2.8</td>
<td>0.1**</td>
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</tr>
<tr>
<td>Workshop</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Top</td>
<td></td>
<td>176</td>
<td>2.7</td>
<td>3.1</td>
<td>0.4**</td>
<td>0.2</td>
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<tr>
<td>Line</td>
<td></td>
<td>175</td>
<td>2.6</td>
<td>3.0</td>
<td>0.4**</td>
<td>0.2</td>
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<td></td>
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<td>201</td>
<td>2.9</td>
<td>2.8</td>
<td>0.1**</td>
<td></td>
</tr>
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</table>

* p≤0.05 ** p≤0.01
in the case group and the data show that intervention was successful in increasing the motivation to report NM's. This is actually visible that employees reported lots of NM's toward the end of the study period. In the control group, the motivation to report incidents has also increased, but not as much as the case group, and this increase is more general and in line with the general increase in management commitment due to lunch incident reporting system. It is also notable that the high motivation to report NM's in the case group was achieved without promising the employees secrecy, which usually is thought to be essential. Anonymous reporting would decrease usefulness of near miss reporting process by preventing follow-up discussion to gain extensive information that can be used to develop tactics for preventing actions.

This study had several limitations. First, there was a general lack of ability to draw causal relations. It is not possible to draw any direct conclusions from the reporting of NM's and MI's to the prevention of LTI's. Secondly, it is possible that employees in case group communicated the training content to those in the control group however; the effect of this potential cross-contamination would have been to decrease the observed impact of the intervention. Third, the one year follow-up period was relatively short and the long-term effect of intervention should be evaluated. Fourth, the study did not provide the data on the cost of the intervention and implementation of the incident reporting system. Fifth, because the data collection was not anonymous, therefore the lack of anonymity might lead to a bias in the type of reported incidents. Sixth, there may be differential report bias, where employees who received the training may be more likely to report unrealistic near miss consistent with management call attention to reporting near miss to be compared with the control group.

This study provides empirical evidences on positive effects of training intervention on the successfully implementation of an incident reporting system especially related to near misses, perceived line management commitment to safety and employees motivation to report incidents. A key issue in implementing the system is management support. Further studies are needed to determine whether the introduction of an incident reporting system with feedback had an effect on the number of major incidents.

Acknowledgement

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Conflict of interest: None declared.

References