Introduction

Occupational Safety

Occupational safety is an important concern for all working individuals. Worldwide, economically active individuals constitute 60-70% of the adult male population, 30-60% of adult female population, and 23% of the population of children and adolescent who are 5 to 17 years old.\(^2\) Over the course of the 20th century, substantial reductions were seen in the number of occupational deaths and injuries, at least in industrialized nations\(^2\). Nonetheless, despite this progress, safety concerns in the workplace are still paramount. An examination of the available data shows that work related injures and death occur at an alarming and unacceptably high rate throughout the industrialized and developing nations. The estimates of yearly occupational injuries ranged from 4.85 million in the Former Socialist Economies of Europe to 24.42 million in China, with an overall estimate of 100.69 million for the world. Approximately 100,000 of these occupational injuries worldwide were fatal. More recent projections by the WHO in the year 2002, using data from 1998, suggested that annually there are 270.7 million occupational injuries and 354,753 occupational fatalities worldwide\(^2\).

Not surprisingly, the economic cost of occupational injuries is staggering. This data becomes more compelling when it is noticed that reports of occupational injuries may well be underestimated. For e.g. individuals in the military are excluded from such data, and epidemiologic studies have shown that many injuries are either not reported or undocumented.\(^2\)

Among the main contributing factors to unintentional occupational injuries identified by the World Health Organization (Takala,2002)\(^2\) are poor worker-employer collaborative mechanism, lack of safety management systems, poor safety culture, poor training and lack of knowledge, and lack of incentive-
based compensation systems. Each of these contributing factors falls within the traditional purview of industrial / organizational psychology. Reducing the burden of injury is an international health goal, one that requires an interdisciplinary perspective. Injuries, whether self-inflicted, inflicted by others, or unintentional, have one thing in common, they are largely preventable.

**The Dominos Theory**

H.W.Henrich, (12) the father of Industrial accident prevention studied 75,000 cases of insurance claims and accident records of industrial plant owners. He found that 88% of accidents are caused due to unsafe actions of human beings, which is being validated by many of the modern times researchers. The same is also validated by the statistical analysis of accidents of most of the companies around the world. Henrich put forward the Dominos theory given below:

**The Accident Sequence**

![Figure 1a: The accident sequence](image)

There are five factors in the accident sequence; a preventable accident is one of the five factors in a sequence that result in injury.
The injury is invariably caused by an accident and the accident in turn is always the result of the factor that immediately precedes it.

Figure 1b: The accident sequence
Figure 1c: The accident sequence

In accident prevention the bull’s eye of the target is in the middle of the sequence – an unsafe act of a person or a mechanical or physical hazard. The occurrence of a preventable injury is the natural accumulation of a series of events or circumstances, which invariably occur in a fixed and logical order. One is dependent on another and one follows because of another, thus constituting a sequence that may be compared with a row of dominoes placed on end and in such alignment in relation to one another that the fall of the first domino precipitates the fall of the entire row. An accident is merely one factor in the sequence. If this series is interrupted by the elimination of even one of the several factors that comprise it, the injury cannot possibly occur.

The unsafe act and mechanical hazards constitute the central factor in the accident sequence.
Figure 1d: The accident sequence

Removal of the central factor makes the action of the preceding factors ineffective.

The above can be explained as follows:

1. A personal injury occurs only as the result of an accident.
2. An accident occurs as the result of a personal or mechanical hazard.
3. Personal and mechanical hazards exist only because of the fault of the person.
4. Faults of person are inherited or acquired by environment.

The successful introduction of behavior safety processes, focusing on identifying and reinforcing safe and reducing unsafe behavior, is one means of improving safety performance. These programs are not a “quick fix”. It is important not to overlook fundamental items. Organizations should begin by
concentrating on policies and systems, assessing and improving management and operational factors, training, design and so on. This behavioral science is an integral part of a comprehensive injury prevention strategy.

Causes of Injuries

<table>
<thead>
<tr>
<th>Causes of lost workdays and restricted work days injuries (result of 10 years DuPont study)</th>
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</thead>
<tbody>
<tr>
<td>• Unsafe acts associated with:</td>
</tr>
<tr>
<td>├── Personal Protective Equipments - 12%</td>
</tr>
<tr>
<td>├── Position of people - 30%</td>
</tr>
<tr>
<td>├── Reaction of people (Actions of people) - 14%</td>
</tr>
<tr>
<td>├── Tools and equipments - 28%</td>
</tr>
<tr>
<td>└── Procedure and orderliness - 12%</td>
</tr>
<tr>
<td>• Total injuries caused by Unsafe Acts – 96%</td>
</tr>
<tr>
<td>• Total injuries with other causes – 4%</td>
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<td>» Total – 100%</td>
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Source: - United Steel workers of America (14)

Application of behavioral science to injury prevention lagged behind other approaches during the last half of the 20th century. Despite recognition by injury control professionals of the importance of behavioral research in injury prevention, behavioral solutions to preventing injury were deemphasized until recently. Historically, little scholarly attention has been paid to understanding determinants of injury-related behavior or how to initiate and sustain behavioral changes. Intervention often seems to have been based on simplistic assumptions that changing people’s awareness about the injury problem would change their behavior. Many authors have noted the need to improve
behavioral interventions by using better empirical data about the determinants of behavior as well as theories and framework of pertaining to change in health behavior. A growing body of work is emerging that demonstrates the positive impact of using behavioral science approaches in order to both understand and reduce injury risk behaviors.

One of the earliest examples of the successful application of behavior modification to improve safety took place in 1970’s in the US wholesale bakery (17). Following concerns over increasing plant injury, the departmental shift with the highest injury rate was selected for a behavioral modification project. Prior to the project, little or no reinforcement was provided by management or colleges when people took time to act in a safe manner, and no opportunities were provided for employees to learn how to avoid unsafe practices. Behavioral analysis of previous accidents led to a clearly defined behavioral observation checklist describing safe and unsafe behaviors or where possible, the outcome of the behavior. Independent, trained observers measured baseline levels of safe behavior. Following baseline measurements, groups of employees took part in a thirty-minute training session, where they were shown slides demonstrating safe / unsafe behavior, focusing on behaviors with the lowest baseline level. Baseline performance was graphically displayed and employees agreed to strive towards a 90% safe behavioral goal. Over the following weeks, behavioral safety performance improved consistently exceeding goals in one area. Supervisors also deliberately made favorable comments to employees who were behaving safely on key tasks. Employee reactions to the project were favorable, although management and supervisory support was patchy. Employees subsequently took responsibility for observing and providing feedback. Over the first year of implementation, the injury frequency rate dropped from 53.8 to 10 per million man hours worked. Since then organizations have adopted variants of this approach.
There are a lot of models available for implementing behavior based safety in the market today which were developed in western countries and used by them. There is very little research done on this subject in India, and the companies in India who tried to implement the same model either were unable to implement it fully or failed fully / partially in getting the desired level of outcome from this program. A few of the reasons for failure could be the following:

1. Lack of commitment of the management towards safety in comparison to that of multinational companies.
2. Lack of specific goals and objectives at different management levels and tracking accountability for the same.
3. Imitating the model and trying to implement it in the same way in India.
4. Lack of worker’s support and co-ordination to make the implementation successful.
5. The difference in education level and understanding of workers.
6. Different cultural background.
7. Mistakes made while interpreting the model.
8. Social acceptance of accidents and its results.
9. Poor law and order situation in comparison to western countries.

Hence this research is intended to develop a model which can suit the Indian industrial scenario and industries can benefit by implementing the same.

**Aims of the research**

1. To study and analyze the reasons for accidents related to unsafe behavior of personnel.
2. Benchmarking and providing a practically workable solution to engineering industry, which will help in reducing accidents due to unsafe human behavior.