JRHS 2015; 15(2): 109-112

JRHS
Journal of Research in Health Sciences
journal homepage: www.umsha.ac.ir/jrhs

Original article

Effect of STOP Technique on Safety Climate in a Construction Company

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ARTICLE INFORMATION

Article history:
Received: *24 January 2015*
Revised: *26 February 2015*
Accepted: *08 April 2015*
Available online: *11 April 2015*

Keywords:
Safety Climate
Construction Company
Project

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ABSTRACT

Background: Safety programs are a core part of safety management in workplaces that can reduce incidents and injuries. The aim of this study was to investigate the influence of Safety Training Observation Program (STOP) technique as a behavior modification program on safety climate in a construction company.

Methods: This cross-sectional study was carried out on workers of the Petrochemical Construction Company, western Iran. In order to improve safety climate, an unsafe behavior modification program entitled STOP was launched among workers of project during 12 months from April 2013 and April 2014. The STOP technique effectiveness in creating a positive safety climate was evaluated using the Safety Climate Assessment Toolkit.

Results: About 76.78% of total behaviors were unsafe and about 54.76% of total unsafe acts/ at-risk behaviors were related to the fall hazard. The most cause of unsafe behaviors was associated with habit and unavailability of safety equipment. After 12 month of continuous implementation the STOP technique, 55.8% of unsafe behaviors reduced among workers. The average score of safety climate evaluated using of the Toolkit, before and after the implementation of the STOP technique was 5.77 and 7.24, respectively.

Conclusions: The STOP technique can be considered as effective approach for eliminating at-risk behavior, reinforcing safe work practices, and creating a positive safety climate in order to reduction incidents/injuries.

Citation: Darvishi E, Maleki A, Dehestaniathar S, Ebrahemzadih M. Effect of STOP Technique on Safety Climate in a Construction Company. J Res Health Sci. 2015; 15(2): 109-112.

Introduction

Frontline employees, management, and organizational factors are introduced as key factors in analyzing major accidents[1]. Many accidents such as Chernobyl disaster and Bhopal tragedy cannot be explained by a simple sequence of equipment failures. In order to address their root causes properly we have to consider organizational and human factors[2,3]. In other words, culture and behavior contexts effect on work procedures. Hence, safety culture or climate was recognized as an effective factor to these accidents[4].

Positive safety culture or climate is a critical factor in reduction of unsafe behaviors among workers in the job sites[5]. NIOSH defines safety culture as the underlying organizational principles, norms, commitments and values related to the operation of safety and health, as well as its importance compared with other workplace goals[6].

Today, safety programs are a core part of the safety management in workplaces. They can enhance workplace safety culture or climate, thereby, reduce incidents and injuries[7, 8]. Besides, safety programs can modify worker's behavior, raise overall safety awareness, reinforce safe working practices, and eliminate at-risk behaviors by developing communication and observation skills[9]. Some approaches focus on improving and developing behavior-based safety. These programs have been used for identifying, observing, training and reinforcing safe behaviors and also eliminating unsafe behaviors in the workplaces.

Behavior and training-based safety programs are one of the effective approaches in the construction sites[10]. Lingard et al. improved site housekeeping using behavior-based safety program at seven public housing construction sites in Hong Kong[11].

Construction sites are one of the high risk fields so that 18.3% of all fatal work injuries in the U.S are due to construction sites[12]. Hence, construction companies can use safety programs to improve and develop safety culture or climate.

The purpose of this study was to examine a safety program's effectiveness as STOP technique in building a positive safety climate in a petrochemical construction company.

Methods

This cross-sectional study was carried out in a petrochemical construction project in Kurdistan Province, the west of Iran from April 2013 and April. The study population were all the contractor's male workers employed in the different workstations of the project (n = 270).

In the first stage, the data relating to safety climate of the company were collected using The Safety Climate Assessment Toolkit (SCAT)[13,14]. The toolkit has been designed to provide appropriate measures of safety climate. It covers four dimensions including organizational context, social environment, individual perception, and work environment[14].

According to the toolkit, the data related to safety climate were collected from three separate and independent sources including "attitudes assessment and questionnaires", "face to face interviews and discussion groups", and "structured behavioral and observations". The toolkit gives an overall measure of the prevailing climate for safety in 17 scopes using from 43 questions. For all of the items in the toolkit, a score is computed. All scores have a scale ranging from 1 to 10 scales. The safety climate measures can be plotted to provide a graphical representation for each item. Therefore, an overall picture of the present state of the organization can be observed. The results of the toolkit indicate strengths and weaknesses of various parts of organization. Generally, a score below 6 is inferred as a sign of weakness.

In the second stage, in order to improving and developing safety climate, a behavior and training-based safety program, STOP technique, was launched for one year interval in the company.

Finally, in order to investigating the effect of the STOP safety program in creating of a positive safety climate, the safety climate assessment toolkit was used again after 12 months of continuous implementation the program.

STOP technique

It is a behavior modification program in a structured and systematic manner. In this program, people are observed while working then will be talked about safety in order to prevent unsafe acts recurrence, eliminating at-risk behavior on the spot, and reinforcing safe behavior. Flowchart explanation of the safety training observation program is presented in Figure 1.

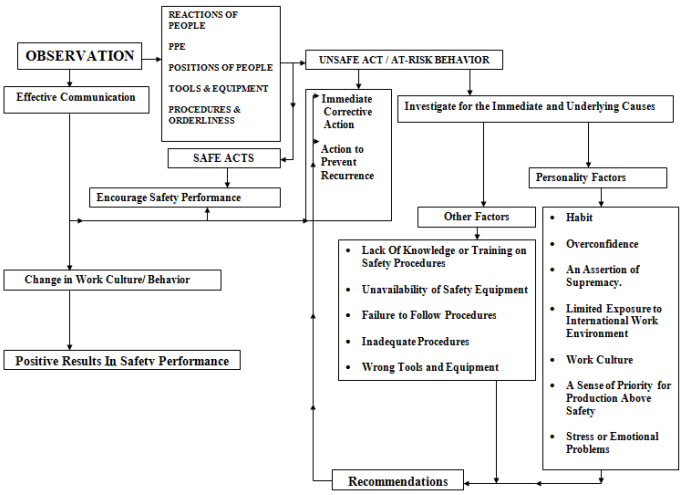

Figure 1: Flowchart explanation of the safety training observation program

The main objectives of the STOP technique are to eliminate high risk behaviors, behavior modifying, employees changing, perspective about safety, encouraging safe work practices, addressing unsafe behaviors in the workplace, and creating a safety culture in which everyone can prevent injuries and occupational illnesses.

The STOP technique was implemented as presented in Table 1. The STOP safety cycle has 5-step, including Decide, Stop, Observe, Act, and Report. In the cycle, safety training and observation process is performed. The items that must be considered by the observer are reaction of people, proper use of personnel protective equipment, position of people, tools and equipment, procedure and orderliness. During the observation, safe and unsafe behaviors in the workplace were recognized. The underlying and root causes of unsafe behaviors were investigated by talking with the people during the training process in the spot.

Table 1: 5-step cycle of the STOP technique

Step 1	Decide	That safety is an important priority. Allocate time to audit people's work practices and behaviors on the job. Prepare for the observation of PPE, positions, procedure etc.
Step 2	Stop	Near enough to the person so that you can see clearly what he or she is doing. Be alert for evaporative acts in the first 10-30 seconds
Step 3	Observe	Everything the person is doing, in a careful, systematic way - Reactions of people, PPE, Positions, Tools & Equipment, and Procedure & Orderliness
Step 4	Act	By talking with the person to reinforce safe work practices and address unsafe behaviors
Step 5	Report	Your observations and actions on a "stop safety OBSERVATION CARD"

Results

The descriptive results showed that mean (±SD) of the studied workers' age and work experience was 35.8 (±5.5) year, and 14.5 (±5.5) year, respectively, and all workers were contractor's employees.

After 12 months of implementation the STOP program, the number of the observations 1120 was reported based on the annual working hours of 270 full-time workers in the STOP observation card. The numbers of unsafe and safe acts were 860 and 260, respectively. The unsafe behaviors were recognized in four hazard category (Table 2).

About 54.76% of total unsafe acts/ at-risk behaviors were related to the fall hazard. In addition, the rates of unsafe behaviors were identified using STOP technique during 12 months is plotted in Figure 2.

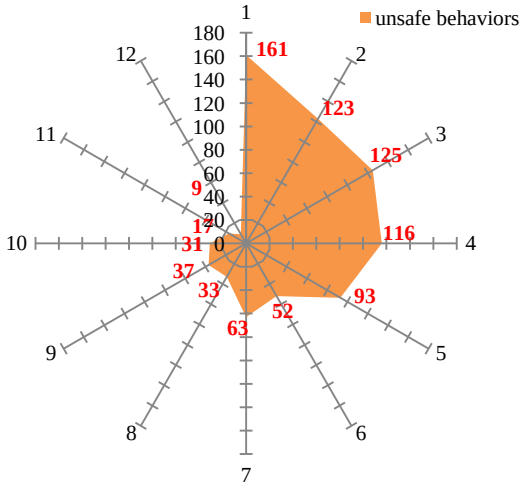

Figure 2: The rates of unsafe acts/ at-risk behaviors during 12 months

The results of underlying causes and also affecting factors in unsafe acts/ at-risk behaviors are presented in Table 3.

Table 2: At-risk behaviors Identified in the safety program in four hazard category

Unsafe act/ at-risk behaviors	Number (%)
Fall	
Working 2 m above the ground without protection	36 (4.2)
Exposed holes	42 (4.8)
Altering any component of a fall protection system that exposes oneself or others to a fall hazard	108 (12.5)
Improperly using a stepladder	24 (2.8)
Unsafe loading and handling	33 (3.8)
Disuse or Misuse of fall protection equipment	144 (16.7)
Falling objects and equipment	84 (9.8)
Electrical	
Working on live electric without proper PPE or authorization	69 (8.0)
Working within 3 m of power lines	12 (1.4)
Removing of safety device protecting persons from live electricity	22 (2.6)
Caught in between	
Working in unprotected trenches or digs	19 (2.2)
Reckless operation of equipment	12 (1.4)
Caught in a machine	4 (0.5)
Struck-by	
Disregarding danger tape or barrier	83 (9.7)
Struck-by equipment	69 (11.2)
Crossing of hazard points without proper authorization	99 (11.5)

Table 3: Underlying causes and affecting factors in unsafe acts/ at-risk behaviors

Personality/other factors	Percent
Habit	24
Overconfidence	8
An assertion of supremacy	5
Work culture	19
Language barrier	3
Lack of knowledge or training on safety procedures	2
Unavailability of safety equipment	30
Inadequate procedures	2
Wrong tools and equipment	7

The results of safety climate surveys using of SCAT, Pre- and Post- implementation of STOP are shown in Figure 3.

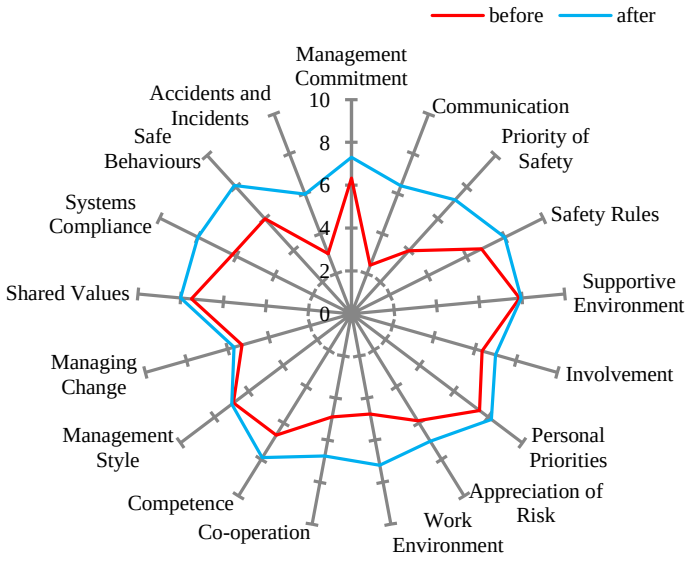

Figure 3: Profile of safety climate statues Pre- and Post- the safety program

Before launching the STOP program, the average score of safety climate was estimated 5.77 that was representative of safety climate weakness in the project. The average score of 5-scope of safety climate including "Communication", "Priority of Safety", "Work Environment", "Cooperation", and "safe behaviors" were less than 6. After 12 months of implementing the STOP program, the average score of safety climate was estimated 7.42 using SCAT.

Discussion

Building and improving of a safety climate or culture in the workplaces are considered as an important aspect of a sound safety management system. Therefore, the positive safety culture and climate play a critical role in reducing accidents. Organizational culture factors have an effect on safety culture and climate and reduction of accidents[15].

The data resulted from assessment of the observations using STOP program showed that 76.78% of total behaviors were unsafe. Lack safety awareness and training of safe working practices and the importance of safety equipment's were the main causes of unsafe acts and at-risk behaviors. Behaviors indicate attitude. Before launching of safety program, because of the negative attitude of people to the multi dimensions organizational, safety, individual, and workplace, the average score of safety climate in project was poor.

The STOP technique has been used as an alternative approach to improve a complex phenomenon such as a safety culture and climate. The STOP technique developed communication skills and therefore raised overall safety awareness. The strength of the STOP technique was continuous training and observation in workplace. Continuous training and observation are statistically more effective than using training or visuals alone related to the unsafe acts/at-risk behaviors[16]. Continuous training and observation for employees increased their understanding of the safe working procedures. People's motivation for work safely increases when they understand the main reasons of safe working practices. Thereby, by following safe working practices and procedures, people are protected from unnecessary exposure to hazards in workplaces. Therefore, the STOP technique made regular work and continuing effort to upgrade safety performance. Managers, supervisors or team leaders are accountable for the safety of every person in their area of responsibility. Furthermore, continuous training and observation for managers developed safety skills of leaderships hence, increased management's commitments to safety of their subordinates.

The STOP technique caused safety as a high priority and thus makes it equal to quality, morale, cost, and production.

Many studies support the claims of behavioral safety proponents in improvement of safety culture or climate. Yeow et al. used an outcome-and-behavior-based safety incentive program. They claimed that the program created a positive safety climate and reduced the accidents by 75%[17]. Moreover, Jin et al. studied a safety program launched by Messer Construction Co. in the U.S. building construction industry based on by Cooper safety culture model. They also examined the program's effectiveness in building a positive safety culture. The results from multilevel safety climate surveys showed overall positive employees perceptions of the safety program in terms of awareness, acceptance, accountability and other dimensions[12].

Therefore, after 12 months of continuous implementation the safety program, safety climate survey showed that overall workers perception of the safety shifted to positive condition, thereby safety climate score enhanced.

Conclusions

This study presented an effective safety program for creating a positive safety climate, in typical construction project. It seems that the STOP technique modified the employee's perception and increased safety's awareness, because the unsafe behaviors were reduced more than 50%. Hence, The STOP technique can be considered as effective approach for eliminating at-risk behavior, reinforcing safe work practices, and creating a positive safety climate in order to reduction incidents/injuries.

Acknowledgments

The authors would like to thank manager and workers of petrochemical factory for their cooperation.

Conflict of interest statement

The authors have no conflict of interests to declare.

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