The Effect of Health Education on the Use of Personal Respiratory Protective Equipments based on BASNEF Model among Workers of Block Carbon Factory in Ahwaz

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Abstract

Introduction*: Due to the increase of occupational diseases and the importance of identifying personal protective equipments and in order to make the society sensitive to health issues, the current study was performed with the aim of determining the effect of health education on the use of personal respiratory protective equipments based on BASNEF model among workers of block carbon factory in Ahwaz.* ***Materials and Methods****: This cross-sectional study was conducted on 100 workers (case-control) of block carbon factory in Ahwaz, Iran, 2008 who were selected randomly through simple random sampling. The questionnaire designed by the researcher contains 70 questions in 5 items including demography, knowledge, behavioral beliefs, attitude, subjective norms and enabling factors which served as an instrument for data collection. Data analysis was done through* $SPSS_{16}$ *software and* χ^2 *and one-way ANOVA tests.* ***Results:*** *The mean score of knowledge, attitude, intention, enabling factors and group performance in comparison to control group had a significant post-interventional increase (p<0.00001). Furthermore, the mean score of subjective norms among experimental and control group showed no significant difference.* ***Conclusion:*** *This study indicated that educational intervention based on BASNEF model will increase the use of personal respiratory protective equipments among workers.*

Key Words: BASNEF model, personal protective equipments, health education

Introduction

Currently, about 45 % of the world's population and 58% of adults over 10 years of age are considered labor force of the world (Cohen, Colligan, 1995). The worst outcome is the risk of premature death of these labor forces. Incidents in general and specifically occupational incidents besides affecting on economical indices would cause human lesions. Although measuring all aspects of human costs such as suffering, grief of victims and their relatives despite all the efforts done in this regard is still impossible, some other aspects of it is measurable. Costs due to the lack of environmental and labor health are not easily tangible but its rate is countable in gross national income (Vicki, 2004). Many organizations make great efforts to create safety and safety inspections which results in incidents reduction, yet still many incidents occur caused by carelessness, wrong attitudes and lack of safe behaviors (Mearns, 2000 and Cooper, 1994). Worker's behaviors and their activities are also involved in many incidents.

In most cases, educating the workers about workplace hazards and the way to control them can increasingly promote safety and health (Zalewski, 2005). Published reports of International Labor Organization (ILO) show that every day 342 thousand workers are faced with occupational injuries and 600 cases lose their lives in this way. Annually, 10 million occupational injuries and 430 thousand new occupational diseases take place (Fingerhut, 2004). Factors leading to injuries exist in all workplaces and industrial and agricultural workers are most exposed (WHO, 2005). One way to prevent work place incidents is identifying and assessing their risks (Roughton, Crutchfield, 2011).

In the field of Latin America and Caribbean, 29600 occupational deaths occur in workplaces and the number of occupational incidents which lead to at least 3 days of absence from work is 22.6 million. The number of incidents reported to ILO is 6.7% of the incidents number has been estimated. Mortality and injury rate per 100000 workers are 24.9 and 18000, respectively. In the Middle East region, every year 19000 occupational deaths and more than 14 million occupational incidents which lead to at least 3 days of absence from work happen. Mortality and injury rate per 100000 workers are 20 and 15000 in this region. Incidents number reported to ILO is 0.9% of the number of incidents has been predicted (Roughton, Crutchfield, 2011). Reviewing the incidence rate of occupational incidents in Iran shows that metal parts, electrical and chemical industries are encountered with the most incidents. At risk population were 90% men, mostly uneducated and 25-29 years age group. The main three reasons for the occurrence of occupational incidents are unsafe behaviors of the workers, insecure conditions and chance (Truong, et al, 2009).

In a new report entitled culture of safety at work, ILO acknowledges that if workers, employers and governments respect to international standards of safety, damages resulting from death and occupational incidents can be stopped. According to ILO report, in some developing countries the mortality rate is four times higher than the safest industrialized countries (Truong, et al, 2009). International Labor Organization is at top of supervision on health and professional safety in all countries of the world. In 1942, the number of identified chemicals was 600000, in 1947 was about 4 million and at present is 11 million.

Annually, 1000 to 2000 new chemicals are added to these numbers whereas 100000 different chemicals are produced or consumed per year. WHO statistics state the fact that 4 million people worldwide are employed in chemical industry so that every year one million people due to exposure to non-secure chemicals are dead or become disabled (Siu, et al, 2004 and O'Toole, 2002). So from the standpoint of safety, chemical industry is among critical industries (Bahr, 1997). Generally, in association with numerous health hazards which are life threatening, behaviors, habits and life styles are of great importance. Therefore, in order to prevent and reduce these incidents the focus should be on workers' behaviors (CDC, 2002). Change of behavior issue is followed by topics such as knowledge, education, attitude and motivation. Problems existence in this regard is considered a major obstacle for management of safe behaviors (Sue, 2004). Incidents can be prevented by using appropriate personal protective equipment. To be effective, this equipment should be properly selected, worn and kept (Wilson, 2005). BASNEF is an effective model in health education especially in workers safety training. Hence, this study aimed to determine the efficacy of educational BASNEF model in promoting safe behaviors of workers and the importance of personal respiratory protective equipment in block carbon factory of Ahwaz which have many pollutants like soot.

Materials and Methods

This is a quasi-experimental interventional study in which 100 workers of Ahwaz block carbon factory participated. In this case-control study, the sample size was calculated based on mean and standard deviation, knowledge scores, model components scores with 95% confidence intervals and 80% power. The total population study which was selected through simple random sampling was 100 participants out of which 42 persons were selected for experimental and 42 for control group and 20% of these numbers were considered extra in order to prevent from sample loss. Both groups were selected from different shifts of Ahwaz block carbon factory and as far as possible it was tried to minimize the groups' contact. Since there was only one block carbon factory in Ahwaz, absolute separation was not possible between these two groups. Intervention program was done through two steps. At first step, by using a check list and confidential questionnaires based on components of BASNEF model and knowledge measurement (besides model structures) data were collected. The questionnaire and check list included 4 questions about demographic factors, 11 knowledge questions which were 4 options, 11 attitude questions with a five set Lickert scale, 9 questions with a five set Lickert scale about subjective norms, 21 questions with a five set Lickert scale about enabling factors and 4 questions about performance which were 2 options. The criterion under which variables were categorized was M±SD. Validity and reliability of the data collection tools were gained through faculty panel and re-testing (r=-0.8 was for model structures and r=-0.7 was for knowledge). Also, questionnaire validity was investigated by performing Chronbach Alpha test (cut off r=0.7).

After analyzing pre-test results, the educational intervention in four 40-minute sessions was designed and applied for workers of experimental group. Educational contents of meetings include harmful pollutants in workplace, breathing masks and their usage and dealing with dangerous situations at workplace which were designed on the basis of BASNEF model components. Teaching was done through using computer, slide and educational board in lecture method, group discussion and question & answer. Additionally, educational flash cards including a summary of all classes, types of respiratory masks and protection of respiratory system were given to experimental group. The whole workers of experimental group were present in all classes and one month after intervention data were collected again. The aim of the study and the need for keeping responses confidential were explained to workers before collecting the questionnaires and they were assured that their answers would have no effect on final occupational evaluation. The control group received no training. For the coordination and cooperation of safety and education officials a justification session was arranged. The knowledge, attitude, subjective norms, enabling factors and performance data was collected by questionnaire. Data were analyzed in SPSS software (version 16) by use of descriptive methods (mean and standard deviation) for data description and analytic methods (Independent t-test, Chi-square and Pearson correlation coefficient) for comparing mean and standard deviation , demographic categories, BASNEF model components and the relationship between the components before and after intervention in two groups.

Results

Independent t- test and Chi-square had shown no significant difference exists between control and experimental groups in terms of age (p= 0.8), marital status (χ^2= 0.3, p= 0.5), education (χ^2= 0.3, p= 0.8) and income (χ^2= 0.041, p= 0.8). The comparison of the mean knowledge score before and one month after the intervention indicates the mean knowledge score of experimental group was significantly higher than the control group after the intervention (Table 1).

Table 1. The comparison of standard deviation and mean knowledge score before and one month after the intervention between the experimental and control groups

Group	Before intervention		After intervention	
Knowledge	Mean	Standard deviation	Mean	Standard deviation
Experimental	59.2	18	84.9	9
Control	52.9	18	56.1	14
Independent t-test	p-value= 0.07		P< 0.00001	

According to the independent t-test, the mean score of BASNEF model components (behavioral beliefs, attitude, subjective norms and enabling factors) among the experimental group one month after the intervention was significantly different comparing to the control group. However, there was no significant difference in the subjective norms mean scores in both experimental and control groups and the reason could be related to the need for more work on subjective norms (Table 2).

Table 2. The comparison of the standard deviation and mean scores of behavioral beliefs, attitude, subjective norms and enabling factors before and after the intervention in experimental and control groups

Variable	Stage	Before intervention		After intervention	
	Group	Mean	Standard deviation	Mean	Standard deviation
Attitude	Experimental	37.6	9.8	66.3	4.6
	Control	35.8	11.6	8.46	14.3
	Independent t-test	p-value= 0.411		p-value= 0.0001	
Performance	Experimental	45	29.8	72	24.03
	Control	32	23.1	43	22.03
	Independent t-test	p-value= 0.017		p-value= 0.0001	
Subjective norms	Experimental	30.04	7.3	34.44	7.6
	Control	29.91	5.8	33.64	5.1
	Independent t-test	p-value= 0.921		p-value= 0.539	
Intention	Experimental	28.50	8.1	11.8	31.8
	Control	29.90	11.3	6.24	77.5
	Independent t-test	p-value= 0.4		p-value= 0.0001	
Enabling factors	Experimental	38.1	14	74.3	11
	Control	33.5	13.01	36.6	13.09
	Independent t-test	p-value= 0.08		p-value= 0.0001	

Discussion

One feature of BASNEF as a health education model compared with rest models is its stress on social norms (support of family and influential people) in addition to individual's knowledge and attitude. Actually in this model, behavior change depends upon a complex set of social and psychological factors. In general, findings of the study showed that the application of educational intervention on the basis of BASNEF model was effective on enhancing the use of safety equipments among workers of block carbon factory in Ahwaz. The initial objective of the current study is to compare the knowledge mean score of control and experimental groups pre- and post-intervention. According to the results, the knowledge mean score of experimental group had significantly increased one month after intervention in contrast to control group. Some research analyses also confirm this matter (Roughton, Crutchfield, 2011). The second objective of the study is to survey the attitude mean score of both two groups pre- and post- intervention. The obtained results indicated that the attitude mean score of control and experimental groups was not significantly different before intervention, but there was a significant difference between their attitude mean scores after intervention. This is in line with some other researches (Truong, et al, 2009 and Siu, et al, 2004).

Another objective of the present study is to compare the performance mean score of the mentioned groups in pre- and post- intervention. Findings suggest that after one month the performance mean score of experimental group was significantly different from that of control group after intervention and was also more than control group.

Totally, the effectiveness hypothesis of educational intervention on performance is accepted. Subjective norms are of BASNEF model components and one of the other objectives of the study is to measure these factors. The data analyses revealed both before or after intervention, the subjective norms mean score of control and experimental groups had no significant difference. Perhaps the reason of this non-significant difference is that more time is needed to work on subjective norms. Based on the results, 84% of the experimental group makes their friends as their pattern in using respiratory protective equipments. Enabling factors (educational flash cards and personal respiratory protective equipments) are other components of BASNEF model, assessment of which is the other objective of the study.

As findings show, enabling factors mean score had significantly increased after intervention among experimental group. Despite the accessibility of personal respiratory protective equipments was equal for both groups, but their performance was different in applying them. One of the reasons for the enhanced use of these equipments by experimental group in post-intervention stage was the increase of this group's knowledge and attitude than control group which had a positive influence on their performance. In a study done in 1999, the relationship between safety environment, performance and occupational incidents were surveyed. This two-stage study was conducted in 1990 (with 508 participants) and 1993 (with 548 participants) among workers of eight spinning wool companies. As a result, there was no significant relationship between safety attitude and the factors which are indicator of company's safety level (including organizational safety, management safety actions, safety training, and hazard identification). Also, the correlation between safety attitude and incidents rate was weak and non-significant (r=0.164) (Varonen, Mattila, 2000). In one of the Vietnam's states at 2009, using a cross-sectional study the knowledge, attitude and behavior were measured for the purpose of RATTAN craftsmen utilization of personal protective equipments in order to be immune against detrimental effects of sulfur dioxide. Face to face interviews were performed among 403 RATTAN craftsmen. Findings exhibited that good levels of knowledge and attitude were respectively 3.72% and 4.22%. The frequency of using respirator (face mask) was only 29%. Researchers suggested that applying intervening tools should be expanded to improve knowledge and attitude. Also, internship for the use of respirators and personal protective equipments need to be continuously presented for RATTAN craftsmen (Truong, et al, 2009). Some other researchers have proposed standpoints about complexity of using personal protective equipments among agricultural workers in hot and humid conditions.

They are on this view that although education and low income are involved as effective factors in limiting the use of personal protective equipments, workers' understanding of the health risks is of importance, too (Park, et al, 2009). In reviewing the impact of a designed group plan for small industries on knowledge, attitude and group behavior among workers at 1998, the results showed that the level of knowledge, attitude and behavior was significantly more in that group which had more dealt with the plan (Sohn,1998). In 2006, Palis and colleagues started a study about behaviour and belief system of farmers in 3 villages of Philippine which its findinds indicated that farmers count inability to function as the only cause of disease and not only they don't consider pesticides as a threat for their health but only a medicine for plants. They think that exposure can only occur through ingestion and inhalation not through skin. Due to these perceptions they wouldn't protect themselves properly. Therefore, the need for more health education plans is felt in order to improve farmers' belief system (Palis, et al, 2006). Laughery and Brelsford (1993) stated that as long as workers' perceptions of risks increase, they are more likely to search and read the warnings. Hence, they will use more preventative measures (laughery , Brelsford, 1993).

In 1994-2000, Mearns and colleagues conducted a similar study at North Sea, England according to which 3 important factors such as a) individual characteristics (experience, knowledge and attitude toward safety) b) job characteristics (job duties, workplace and job stress) c) party characteristics (safety culture, social support and safety management systems) affect on incidents and pseudo-incidents. In this study, management commitment to safety, job satisfaction and attitudes toward safety in comparison with the production and job opportunity have the greatest impact on workers' perceptions of risk and safety actions (Mearns, et al, 2000). A research entitled Evaluation of safety education and professional health was conducted by Alexander Cohen and Michael Colligan in 1995. More than 100 OSHA standards were ordained in the factory for controlling the risks all of which should be taught in order to reduce traumatic risk factors. From 1980 to 1986, education was used as a research effort for reducing risky and traumatic jobs. 80 research reports have been published which indicate the benefits of education in increasing the workers' knowledge.

From all above this can be inferred that specific terms are needed to show the successes and education effects regarding the common standards of the factory (Cohen, Colligan, 1995).

Despite the terms and raised doubts, the education role as an essential factor in the development and sustainability of effective risk control measures has been proved in published research papers (Cohen, Colligan, 1995). In 2004, Siu Oi-ling in his study entitled safety climate and safety performance among construction workers in Hong Kong examined the relationship between safety climate and safety attitude. This study was done in 27 construction unit at Hong Kong. The safety attitude questionnaire was used in this study which was prepared by Donald and Centre in 1993. This questionnaire was used for 6 years previously in 40 companies which its validity and reliability was confirmed by them. Data were collected and analyzed; results show that occupational damages can be predicted by safety attitudes so that control measures can be planned and implemented (Siu, et al, 2004).

In 2005, Haldiya and colleagues perused Knowledge, attitude and practices related to occupational health problems among salt workers working in a desert in india and found that a large pecentage of workers know little of their health problems, security actions and their usefulness (Haldiya, et al, 2005). A study of knowledge, awareness, practice and recommendations among Hong Kong construction workers on using personal respiratory protective equipments at risk done by Fung in 2008 show that workers' knowledge and awareness of health risks is still insufficient based on applying structured questionnaires and interviews. They are also unfamiliar with associted risks of closing the equipments properly (Tam, et al, 2008). In 2004, Kamat and colleagues from a comprehensive study of awareness and practice of health and safety in bottling plant workers found that the education has a role in better understanding of the health and safety indicators; 62 workers whom were selected randomly out of 350 participated in this study and the data was collected by taking advantage of a questionnaire (Kamat, et al, 2004). In a practical analysis made by Ferika in 2009 on evaluting the approach and styles of accomodation sector and the effects of employee trainings on the occupational safety and health in accommodation sector, this result was obtained that the employee training has a very positive effect on safety and professional health. Of course, it was clear that some accidental risks and professional diseases ae inevitable (Sarı, 2009). Laughery and Brelsford stated in 1993 that as long as employees understanding of communication hazards increases, they are more likely to search and read the warnings and therefore preventive measures are used more by them (laughery, Brelsford, 1993).

In this study, on the basis of χ^2 test almost all workers in both groups had an average level of enabling factors but, in the next stage after educational intervention, enabling factors were significantly different between these two groups (0.0001). The maximum number of the experimental group, 98% were in a high level of enabling factors while 74% of the control group were in a medium level of enabling factors. Regarding the change of subjective norms scores, findings of current research indicate that relative and absolute frequency distribution of subjective norms scores among workers of experimental and control group before educational intervention stage were in medium level which was also similar among workers of both two groups at after educational intervention stage. Therefore, no significant difference was observed in these two variables both before and after educational intervention among experimental and control groups. The difference between the obtained findings of present research and others in this regard can be due to the difference in assessment tools or in the case of subjects and interventional samples. The obtained frequency percentages of performance mean score show that in pre-intervention stage among experimental group respiratory masks are not used sufficiently. But, it gets enhanced about two times in post-intervention stage. This comparative assessment of experimental and control groups' performance mean score is one of the other objectives of the conducted study upon which this can be derived that a significant difference exists both before and after intervention between them (0.0001).

As is clear the performance mean score of experimental group is much less in the pre-education stage than post-education stage and healthy behaviors mean score is also considerably higher among them than control group. Totally, the hypothesis of educational intervention effectiveness in healthy behaviors setting is accepted. According to this study, accessibility of personal protective equipments can help to behavior change and the increased use of them. Therefore, findings of this research the same as other aforementioned ones indicate that educational intervention on the basis of BASNEF model can enhance the workers' performance relevant to prophylactic behaviors of respiratory diseases especially personal respiratory protective equipments usage. It is recommended to use this model in safety education.

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