An intervention study to evaluate compliance with personal protective equipment among workers at Textile industry

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Abstract: Workers often need to wear protective equipment to be protected from injury, illness and death caused by exposure to workplace hazards. The aim of this study is to evaluate the implemented educational intervention regarding personal protective equipment (PPE) for textile industrial workers. Quasi-experimental design was utilized to study causal relationships between variables of interest. This study was conducted in Kafr El Dawar textile industry, Behara. One hundred and twenty eight workers exposed to cotton dust were randomly selected and included in the present study. Tools of the study were structured interviewing questionnaire, educational intervention (pre/post-tests were used before and after the intervention to test the worker's knowledge) and an observation checklist was used to indicate the workers' compliance with PPE. The exposed workers' age ranges from 20 to 59 years with a mean of 44.2 ± 8.1 years. The duration of work exposure ranged from 7 to 35 years. More than 3/4 of the workers' sample was suffering from one or more symptoms of respiratory tract syndromes. Statistically significant differences was detected between workers' complains and the duration of work exposure (P<0.01). mean scores of the workers knowledge about the respiratory tract symptoms and hearing loss were increased significantly after the educational intervention (P <0.0001). there were statistical significant differences of the workers' compliance with the using of personal protective equipment, which reflects the raising of workers' awareness after the educational intervention. The study concluded that the educational intervention was effective and its results had marked improvement in workers' knowledge and compliance with the using of PPE than ever before. It is also recommended that health education programs should be developed and carried out by industrial nurse regarding PPE in other textile industries.

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1. Introduction

Workers often need to wear protective equipment to be protected from injury, illness and death caused by exposure to workplace hazards. Occupational safety and health administration [(1)] . Believes that workers are more likely to cooperate in achieving full compliance with existing standards is workers are aware of the potential health hazards in the workplace. In addition, the occupational safety and health Act of 1970 added that workers have the right to know the health hazards they are exposed to in the workplace [(2)].

Textile industry is one of the most vital industries in Egypt. The workers are exposed to different environmental factors, specially in the spinning and weaving sections, which play a role in the high incidence of industrial health hazards.[(3)]

The most important hazards are the air borne cotton dust, excessive noise, accidents and skin diseases. Cotton dust is high in Spinning operation, it has a local action on respiratory tract and can cause Byssinosis and occupational pulmonary disease.[(4,5,6)] Noise in the weaving operation has effect on hearing in many of the exposed workers. The result is the increasing rate of workers absenteeism, accidents and reducing the production rate.[(7)] Also noise affects the well-being by disrupting sleep, interrupting conversation, thoughts and hearing loss.[(2,8)] Direct contact of the skin with some irritant chemicals particularly in different stages of Dyeing operations can affect the skin and mucous membranes and others are absorbed and act and produce dermatitis for workers exposure.[(3,9)] Textile accident rate is high in different textile operations and takes the form of direct trauma, laceration, contusion, fractures and accidents involving fingers and hands. Accidents are a major cause of absenteeism among workers.[(10,11)]

In order to protect workers during daily activities, preventive measured should be implemented. Numerous studies have concerns with the preventive measures to textile hazards which include: appropriate use of industrial safety, medical and nursing services, first aid and health education[(12,13)]. Industrial safety is an elimination of exposure to hazards by environmental control and personal protection. Environmental control

used to reduce the amount of total dust in the work areas through: local exhaust system, wetting dust, substitution of nontoxic material, general ventilation of the work room and good housekeeping[14]. Personal protection is an equipment which is worn by textile workers in potentially hazardous situation. It includes mask, ear plugs, gloves and clothes.[15] Medical services are to detect the highly susceptible workers who need to be shifted to other jobs in order to prevent the disabling lung disease medical preventive programme includes: pre-employment. Medical examination, periodic special medical examination and treatment at work at emergency situation[16,17].

Industrial nurse has an important role in preventing textile industrial hazards. Her role includes determining workers health problems, identify industrial health hazards and dangerous conditions to health, plan and promote workers health by providing appropriate treatment. She participates in implementing a safety plan to prevent or minimize accidents and injuries that occur during daily activities. In educational program, she assesses workers needs, develops appropriate educational program, by using formal and informal presentation, also she has a role in training workers to use preventive measures during working, encourages workers to use health services, evaluates effectiveness of workers response to nursing actions and control of environmental factors that cause a disease[18].

Aim of the study:

The aim of this study is to evaluate the implemented educational intervention regarding personal protective equipment (PPE) for textile industrial workers

Hypotheses of the study:

There will be significant differences between workers' knowledge and compliance with using the personal protective equipment before and after the implementation of the educational intervention. The level of knowledge and workers' compliance with personal protective equipment will be improved following the educational intervention.

2. Subjects and methods:

Research design:

Quasi – experimental design was utilized in this study. Quasi-experimental studies are designed to study casual relationships between variables of interest[17]. Subjects were given a pretest, received the educational intervention and all were given a posttest. Subjects act as there own controls and intervention data were analyzed for differences.

The study setting

The study was conducted in Kafr El Dawar textile industry El Behara Government.

The study subjects

One hundred and twenty eight (10.67%) out of 1200 workers exposed to cotton dust were randomly selected and included in the present study. The exposed workers represented the morning shifts (from 8 a.m to 3 p.m), all were males, their age ranged from 20 to 59 years with a mean of 44.2 ± 8.1 years. The duration of work exposure ranges from 7-35 years/ workers are exposed to cotton dust during its production activities as; spinning, textile and dyeline operation.

Tools of data collection:

1. A structured interviewing questionnaire, comprising personal data, workers' complains and workers knowledge regarding personal protective equipment and textile induced health hazards.
2. Observation checklist was designed to evaluate the workers' compliance with the using of personal protective equipment before and after the educational intervention.

There previously mentioned tools used for assessing workers' knowledge (to score knowledge, each sub item of worker item was given 1 point) and workers' compliance (it was classified into used, used but not well maintained and not used at all) before and after the educational intervention through pre/post test for knowledge and the observational checklist for compliance with the used of personal protective equipment.

3- Educational intervention:

An extensive review of literature were carried out about cotton dust induced health hazards and the proper use of personal protective equipment. Accordingly, an educational intervention was developed about the different hazardous effects of textile process on health as well as the needed personal protective equipment. The educational intervention included; objectives, content, teaching activities and methods of evaluation for both knowledge and compliance.

Procedure:

An official permission was taken by the researcher from the factory authority. Workers who were including in this study and that willing to participate have been informed about the purpose and the nature of the study. Data were collected through structured interviewing questionnaire at the health clinic of the factory. To test the workers' knowledge, pretest sheets were distributed and filled by the researcher through 20 sessions and the educational intervention were carried out in the same sessions, discussing the direct health hazards of cotton dust, its control and the personal protective equipment (each 6-7 workers and allowed time was about 30-40 minutes for each session). One month after the last session the researcher gave the post-test to detect the improving of workers' knowledge while the observation was done through checklist for the using of the personal

protective equipment; this phase of the procedure was taking also 20 sessions (25-30 minutes for each). Limitation of the study, some workers were reluctant to participant fully in the educational intervention.

3. Results

Out of around 1200 textile exposed workers, 128 workers were randomly selected from the different departments and were included in the study. The current study explained that the majority of collectively (82.81%) of the textile workers were complaining of respiratory tract disorders (34.38%, 18.75%, 17.75% and 11.72% for cough/phlegm, wheeze, dyspnea and nasal catarrh respectively). While 14.06% of workers were having dermatitis and the minority of 7.03% with hearing lose. Table (1) shows that incidence of respiratory syndromes, hearing lose and dermatitis were statistically significant differences with the duration of workers' exposure to cotton dust (P<0.01).

As regarding the knowledge; effect of cotton dust, its control and personal protective equipment, the mans scores of workers' knowledge were improved after carrying out the educational intervention with highly significant differences (P <0.0001).

Table (2) depicts the increasing of the mean scores of the workers' knowledge regarding the respiratory tract symptoms (nasal catarrh, coughs, phlegm, dysnpnea and wheeze) with a highly significant difference before and after the educational intervention (P <0.0001). While there were increasing in the mean scores of workers' knowledge as regarding bronchial asthma and dermatitis but with no significant differences were seen. Highly significant difference was detected between the mean scores of workers' knowledge about loss of hearing before and after the intervention (P <0.0001).

Table (3) illustrates that the use of personal protective equipment by the workers before and after the educational intervention. It is apparent that all workers except one of them were using the coveralls after the intervention with significant difference (X^2=13.3, ≤0.002). There were tendency of workers' compliance with the using of protective equipment (used, used but not well maintained and not used) after the educational intervention. There were statistically significant differences between the using of the all types of personal protective equipment (P <0.001) except the using of ear plugs.

Table (1): Frequency distribution of the workers presenting respiratory tract syndromes, hearing loss and dermatitis regarding their duration of work exposure to cotton dust (n=128).

Health Disorders	Duration of work Exposure (Years)								X^2	P
	<10		10-		20-		30-			
	N=45		N=52		N=17		N=14			
	No.	(%)	No.	(%)	No.	(%)	No.	(%)		
Nasal Catarrh	3	6.7	6	11.5	3	17.6	3	21.4	12.99	<0.01
Cough and Phlegm	10	22.2	18	34.6	9	52.9	7	50.0	28.73	<0.01
Dyspnea	4	8.9	9	17.3	6	35.3	4	28.6	28.07	<0.01
Wheeze	5	11.1	10	19.2	5	29.4	4	28.6	24.26	<0.01
Hearing loss	2	4.4	3	5.8	2	11.8	2	14.3	44.3	<0.01
Contact Dermatitis	6	13.3	8	15.4	2	11.8	2	14.3	22.9	<0.01

*** Responses are not mutually exclusive**

Table (2): Comparison of mean scores of workers' knowledge regarding the effects of cotton dust, control health hazards, workers' protective equipments, respiratory syndromes, dermatitis and hearing loss before and after the educational intervention. (n=128).

Knowledge	Pre-test Mean scores ± SD	Post-test Mean scores ± SD	F-test	P-value
Effect of cotton dust on health	4.3 ± 3.03	9.7 ± 11.7	111.2	<0.0001
Control of cotton dust hazards	3.5 ± 2.30	8.3 ± 1.40	126.9	<0.0001
Workers' protective equipment	3.6 ± 2.4	7.4 ± 1.10	158.4	<0.0001
Knowledge	**Pre-test Mean scores ± SD**	**Post-test Mean scores ± SD**	**F-test**	**P-value**
Respiratory Syndromes	5.1 ± 1.2	7.2 ± 0.7	16.9	<0.0001
Occupational Asthma	3.6 ± 0.3	3.9 ± 0.2	5.56	<0.521
Hearing loss o	0.3 ± 0.5	1.4 ± 0.5	21.1	<0.0001
Contact Dermatitis	3.8 ± 0.3	3.9 ± 0.8	6.84	<0.493

Table (3): Workers compliance with the using of personal protective equipment (PPE) before and after the educational intervention (n=128).

Educational Intervention	Personal Protective Equipment																	
	Coveralls						Head cover/hat						Masks (face/nose)					
	Used		Not well maintained		Not used		Used		Not well maintained		Not used		Used		Not well maintained		Not used	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Before	112	87.5	11	8.6	5	3.9	86	67.2	29	22.7	13	10.1	16	12.5	22	17.2	90	70.3
After	127	99.2	1	0.8	0	0.0	124	96.9	4	3.1	0	0.0	89	69.5	33	25.8	6	4.7
	$X^2 = 13.3$ P<0.002						$X^2 = 37.8$ P<0.001						$X^2 = 28.4$ P<0.001					
Educational Intervention	Ear plugs						Safety gloves						Safety boots/shoes					
	Used		Not well maintained		Not used		Used		Not well maintained		Not used		Used		Not well maintained		Not used	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Before	7	5.6	21	16.3	100	78.1	9	7.0	9	7.0	110	86.0	21	16.4	12	9.4	95	74.2
After	10	7.8	30	33.4	88	68.6	12	9.4	30	23.4	86	67.2	94	73.4	22	17.2	12	9.4

* Responses are not mutually exclusive

4. Discussion:

The group that comprises the industrial working population is one of the main target that concern the work of community health nursing [3]. This study was carried out for the purpose of evaluating an implemented educational intervention regarding knowledge and compliance with the usage of persona protective equipment for textile workers. To discuss the results of the current study, the focus will be on knowledge of textile induced hazards. Protective equipment and compliance of workers with the using of personal protective equipment and some related factors such as workers' age, years of work exposure and the health complains.

It is clear that exposure to cotton dust during its manufacturing processes represents adverse effects (health hazards) on workers' health; table (1) showed some health hazards such as respiratory syndromes, contact dermatitis and hearing loss. More than 3/4 of the workers' sample was suffering was suffering from one or more symptoms of respiratory tract syndromes. The study also indicated that significant increasing tendency of textile induced health hazards (respiratory syndromes, dermatitis and hearing loss) with the increasing the duration of work exposure to cotton dust table (Table 1). These findings were in agreement with many studies showed positively relationship between the duration of work exposure and the textile induced health hazards[2,3,6].

Added that added that cotton dust may produce a variety of dermatological lesions as dermatomes of the direct irritating type were found to be more prevalent among textile manufacturing workers[19]. Also added that the cotton dusts are the chief causes of dermatitis[20], while supported the study results saying that textile workers are subjected to certain health hazards such as pneumoconiosis[21]. Making the worker aware of textile induced hazards is frequency a role of occupational health nurse[1]. Occupational health nurse contacts workers continually, evaluate the impact of any information given to them, she teaches the workers to maintain their high level of wellness[7].

Regarding the impact of the educational intervention, this study reveals that mean scores of knowledge regarding the direct effects of cotton dust on workers' health, control of cotton dust and the protective equipments were highly significant differences (P<0.0001) before and after the educational intervention (Table 2). This result indicates that the educational intervention was successful in improving the workers' knowledge. Explained the importance of workers health education programs, saying that any educational intervention will lead to improving workers' knowledge and performance as well, which reflects on decreasing the work health hazards of the workers when using the protective equipment[22].

Additionally, there were statistical significant differences of the workers' compliance with the usage of personal protective equipment (coverall, head cover, safety shoes/boots, face/nose masks and safety gloves) which reflects the raising of workers' awareness after the educational intervention table (3). These findings are in congruence with who agree with the current study and stated that half of workers were focusing on those of body parts, e.g. eye, head, hand, foot and most likely to be essential as personal protective equipment[23]. In this respect, explored that, to minimize the health hazards as well as to improve the longevity and productivity of workers, compliance with the using of occupational protective measures is essential[24].

Although there were statistical significant differences before and after the educational intervention for all personal protective equipment except the using of ear plugs (table 3) yet the

protective equipment that not used or not well-maintained equipment were highly increase. ***Occupational safety and health administration (2006)*** proposed efficient preventive maintenance programs should be available to develop a well trained staff (Safety supervisor) for helping the workers to keep the workers' protective equipment in a sound condition and function[(15)].

5. Conclusion and recommendations

The study concluded that the educational intervention was effective and its results had drastic improvement in workers' knowledge and compliance with the using of the personal protective equipment than ever before. This study recommended that each worker who works in an area that contains textile induced hazards must be provided with protective equipment that is appropriate to the specific parts of the body to be protected and for the work to be performed. Workers must be trained not only in the proper use of the protective equipment, but also in the care and maintenance of that equipment, including any pre-fitting, testing, or inspection that may be required. Health education programs should be developed and carried out by the occupational health nurse to raise the awareness of the workers regarding the proper using of personal protective equipment in other textile and other industries.

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