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THE EFFECT OFAN INTERVENTION PROGRAM IN NURSES' KNOWLEDGE AND PERFORMANCE REGARDING MANAGEMENT OF HOUSE DUST MITES IN A MILITARY HOSPITAL

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Abstract

House dust mites (HDM) are microscopic arthropods live indoor and/or outdoor inhibited by vertebrates including man. This study improved nurses' knowledge and performance regarding the management of HDM to minimize nosocomial patient's exposure in a Military Hospital. All staff nurses with working experience of at least one year were included (n=60 nurses). Three tools were used for data collection: 1- a self-administered questionnaire sheet to assess subjects sociodemographicdata and knowledge regarding management of HDM, 2- an observation check list to evaluate performance as regard environmental care related to HDMs' control, and 3- practical dust collection from indicative areas whenever possible to isolate mites from dust patients' dwelling for identification following standard local and international keys. The results showed that the implementation of educational intervention program led to significant improvement of nurses' knoweledge and performance related to management of HDM post program implementation. This fact was practically approved as some nurse's requested to examine even their own homes. Also, seven species of mites were isolated.

Key words: HDMs, Hospital, Nurses, Intervention (educational) program, Checklist.

Introduction

Nursing is a profession of art and science that involves interaction with the client equipped with a touch of care. Unlike the other jobs, it opts to care to those who are sick with a sense of desire to promote wellness. As promotions of health, nurses teach, give care and treat patients. Nurses are the heart and hands of the team and they are sensation to the needs of the patient that enables them to have a good nurse-client relationship by rendering services in hands-on manner. This would mean constant contact and exposure to various infections present in hospital setting (Harris *et al*, 2012).

It is the duty and responsibility of the nurse to strictly comply and adhere to hospital prevention measures against infectious disease. Besides, nurses as health care workers should be aware of how to prevent the transmission of infectious diseases and to be knowledgeable of its potential risk (Joseph and Clifton, 2013).

Health care settings are complex environments that contain a large diversity of microbial flora, many of which may constitute a risk to clients/patients/residents, the staff and visitors in the environment. Transmission of microorganisms within a health care setting is intricate and differs from transmission outside health care settings and transmission consequences may be more severe. The high-touch environmental surfaces of the health care setting hold a greater risk than do public areas of non-health care organizations, due to the nature of activity performed in the health care setting and the transient behavior of employees, patients and visitors within the health care setting, which increases the likelihood of direct and indirect contact with contaminated surfaces (PIDAC, 2012).

On the other hand, tmites are small arachnids that comprise many thousands of species, many parasitize animals and plants. In animals and humans, these mites may produce cutaneous lesions, yield allergic reactions, or act as vectors for infectious disease (Lane and Crosskey, 1993). Most of the mite species proceed through egg, larval, nymphal, and adult stages. HDM is a cosmopolitan guest in the human habitation. They feed on organic detritus such as flakes of shed human skin and flourish in the stable environment of dwellings. House dust mites are a common cause of asthma and allergic symptoms worldwide. The mite's gut contains potent digestive enzymes (notably proteases) that persist in their feces and are major inducers of allergic reactions such as wheezing (Dancer, 2004). The mite's exoskeleton can also contribute to allergic reactions. The European HDM (*Dermatophagoides pteronyssinus*) and the American HDM (*D. farinae*) are two different species, but are not necessarily confined to Europe or North America; a third species *Euroglyphus maynei* also widely occurs (Avula-Poola *et al*, 2012).

The study aimed to improve nurses' knowledge and performance regarding the HDMs management, which could minimize patient's exposure to infection. Objectives was to assess knowledge and performance related to HDMs in the hospital environment among staff nurses, to develop and implement an educational intervention program for management of HDMs in the environment, to measure change in nurse's knowledge and performance after the program, and to assess the program effect on the rate of infection in nurses' house and hospital

Patients, Subjects and Methods

It was hypothesized that the implementation of educational intervention program will lead to significant improvement in knowledge and practice related to house dust mites among nurses' staff in a Military Hospital, and consequently will lead to significant decrease rate of infection in nurses' house and the hospital The methodology followed in carrying out the study is presented under technical, operational, administrative, and statistical designs.

A quasi-experimental study was designed with pre-post assessment to fulfill the purposes.

The nurses available during the study setting were 66 nurses. The only

inclusion criterion was a working experience for at least one year. After application of the pilot study which was carried out on about 10% of the study sample, those who remained for the study sample were 60 nurses.

Tools for data collection: Three tools were used for data collection as self-administered questionnaire, observational checklist and mites isolation (Laboratry investigation of HDMs).

Tool I: This was a self–administered questionnaire developed and consisted of the two parts: Part I: it consisted of two section: section (1) includes multiple choices questions to assess nurses' knowledge as regards general information about house dust mites such as (definition, multiplication, life cycle, transmission, disease caused by HDM, signs and symptoms, seasons and sites exacerbation of the symptoms, drugs) and section 2 which16-MCQ to assess information about housing and indoor environmental conditions and management such as (floor, duration of home, natural ventilation, artificial ventilation, presence of pets in the house, use vacuum cleaner, type of bed room mattress, type of blanket, carpets and curtains).Both section question were used as apre/post test.

Tool II: Observational check list: An observation checklist was developed by the researcher and revised by expertise based on review of pertinent literature to assess the subjects' performance as regards environmental care related to house dust mites' control .Each item or step was checked as correctly done, or not correctly done or not correctly done. It concerned with those two points: a- Unit Cleaning covered 22 items such as (changing room curtains, blankets, bed linens and pillow - cleaning carpets by vacuum ensure and supervise cleaning of carpets, refrigeration, electric fan, shower wall in the bathroom, disposal of collected vacuum bag of special air filter as HEAP filter Maintenance of the air conditions controlling of hold rodent or insects). b- Personal hygiene which covered 3 items (hair cover-nail-wear coat uniform).

Tool III: Lab investigation: Mites isolation from dust collected from patient dwelling for identification Collection of dust samples: Dust samples were obtained once a month from major foci indoor (floor, carpets, mattresses, bedding, structures where rat nets are located) during januery 2013. A vacuum equipped with a dust trap, one square meter of each place was vacuumed for one minute. All samples were put in plastic bags and stored at $4^{o}C$ to avoid proliferation (Morsy *et al*, 1994).

Isolation and identification: Ten milliliters of 90% lactic acid were added to 100-250 mg of dust sample. Mixture was boiled and diluted with 90 ml distilled water (Morsy *et al,* 1995). Mites against contrasting blue colored field were removed by a fine needle and identified. They were mounted in 2 drops of Hoyer's medium (gum Arabic 30gm, chloral-hydrate 200 gm, glycerin 20ml, water 500ml) for study (El-Sherbiny *et al*, 2010). Data were expressed as number of mites/gm dust.

Operational Design: included preparatory phase, pilot study, and study maneuver.

Preparation phase: This reviewed the local and international related literature that helped in construction of the knowledge questionnaire and observation checklist.

Pilot study: carried out on six nurses. Its aim was to test the applicability of tools, the feasibility of the study and to estimate the time needed for filling up the forms. The tools and timetable were modified and finalized according to the data obtained in the pilot study. Few modifications were done in observational checklist to make it more feasible to the Egyptian environment. The pilot sample was not included in the main study sample.

Reliability test: By using the internal consistency reliability test (Cronbach's alpha). The reliability coefficients were generally high for all questionnaires, and suitable for scientific purposes. The reliability coefficients for each questionnaire were as follow: 1- Socio-demographic data questionnaire: 0.83. 2- Knowledge Test (pre/post-test): 0.76 and 3- Observational check list: 0.79. Validity test; Questionnaire was edited considering relevancy, clarity, readability, easily to understand, sequence, and time. Study Maneuver: Done via three phases; pre-assessment, planning, implementation, and evaluation.

Pre-assessment: Questionnaire was distributed to collect their knowledge about the training needs, which was used to finalize suitable Questionnaire and to develop the main program. The self-adminstrated questionnaire was distributed and written by nurses. Regarding nursing performance a direct nurse observation method was adopted, which precluded the observation bias. Each nurse was observed for performance regards environmental care for HDMs control, by using observational checklist as practical guidelines (Hall *et al*, 2003). Data were collected a day per week from 8.0 a.m. to 14.9 p.m. This phase also involved the collection of HD from patients' homes to recover mites if present for identification. Program planning and implementation phase: Using data after analysis to pick-up the assessment needs and to self-adminterated questionnaire to develop a training program covering the concept and all about HDMs and their allergens, as well as indoor control to stop or at least minimize their pathogenesis. Program was conducted in three sessions of an hour each, using modern teaching methods, as power points, handout illustrative sheets.

Implrmental phase: This included sixty nurses divided into six groups of 10 murses each. This was done as once per week over two successive months. Each session started with a short review of the previous one. The first session was an introduction of the lecturer staff and the nurses attended. The last session was a dedication of the feedback and general discussion.

Evaluation phase: Post-test examination was done to evaluate the program effectiveness on the sharing nurses. Program feedback evaluation: nurses evaluated program items and processes on feedback questionnaire. An official permission was obtained to conduct the field activities by a form indicating the aim and scope, which was approved by the Pertinent Ethical Committee. Nurs-

es were informed about the purpose, and that names and data would be strictly confidential and free to share or to refuse and a written consent was requested.

Statistical analysis: Knowledge score: fail (<60%), pass (60-<70%), good (70-<80%), very good (80-<90%), excellent (>90%). Data were analyzed by 19 (SPSS) and presented using descriptive statistics in form of frequencies and percentages for qualitative variables, M±SD for quantitative variables. Quantitative continuous data was compared using ANOVA for multi-group comparisons. Qualitative variables were compared by using chi-square tests as suitable. Data was considered significant when p-value <0.05; p=<0.01 & <0.001 were considered high-\ly significant.

Results

The results are in tables (1 to 10) and figues (1 to 4).

Table 1: Nursing Staff (60) sociodemographic characteristics.

Age	No.	%	χ^2 test	P value
<20 years	6	10.0	65.4	0.000**
20-<30 years	44	73.3		
More than 30 years	10	16.7		
Descriptive Statistics	24.64±2.34		Range (17.0 – 42.0)	
Male	18	30.0	19.2	0.000**
Female	42	70.0		
Single	22	36.7	8.53	0.003**
Married	38	63.3		
Education Bachelor Degree	18	30.0	18.6	0.000**
Technical institute of nursing	10	16.7		
Diploma	32	53.3		
Rank Officer	22	36.7	8.53	0.003**
Sub -officer	38	63.3		
Years of Experience <5years	16	56.7	23.4	
5-<10years	34	16.7		0.000**
More than 10years	10	56.7		
Descriptive Statistics	8.33±2.67		Range (2.00 – 17.00)	
Department, Medical	26	43.3	7.80	
Department, Surgical	22	36.7		0.02*
Department, Emergency/ICU	12	20.0		

Table 2: Subjects knowledge related to HDM (Pre n=60, Post n=60)

	Satisfactory knowledge (score 60% +)				Test	
Topics	Pre-No.	%	PostNo.	%	X^2	p value
Description	20	33.3	57	95.0	49.6	<0.001**
Home remedies	21	35.0	56	93.3	44.4	<0.001**
Habitat & food	21	35.0	57	95.0	47.5	<0.001**
Life cycle	20	33.3	56	93.3	46.5	<0.001**
Pathogenicity	22	36.7	57	95.0	45.4	<0.001**
Asthma & allergies	24	40.0	58	96.7	44.5	<0.001**
Management	26	43.3	60	100.0	47.4	<0.001**

Table 3: Comparison between Nurses' knowledge Grades via program.

Knowledge Grades	Type of Intervention				χ^2 test	P value
	Pre (n=60)		Post(n=60)			
	No	%	No	%		
Fail (<60%)	38	63.3	2	3.3	61.6	0.000**
Pass (60-<70%)	18	30.0	20	33.3		
Good (70-<80%)	4	6.7	17	28.3		
Very Good (80-<90%)	0	0.0	15	25.0		
Excellent (>90%)	0	0.0	6	10.0		

Table 4: Total knowledge score % & nurses' socio-demographic characteristics:

Intervention	Sociodemographic characteristics			% Score	ANOVA	P-
Age groups	<20Y (n=6)	20-<30Y (n=44)	+30Y (n=10)			
Pre	54.34±7.55	53.83±6.24	55.65±7.21	54.73±10.65	0.319	0.728
Post	78.34±10.23	77.93±9.44	79.80±8.48	78.83±9.62	0.007	0.993
Education	Bachelor degree (18)	Technical Institute (10)	School Diploma (32)			
Pre	57.82±8.19	54.13±7.13	52.33±7.01	54.73±10.65	3.173	0.049*
Post	82.84±10.21	79.33±9.62	76.11±8.12	78.83±9.62	3.231	0.047*
Experience	<5Y (n=16)	5-<10Y (n=34)	+10Y (n=10)			
Pre	52.03±11.97	56.95±8.03	57.97±7.14	54.73±10.65	1.918	0.156
Post	77.11±7.12	79.02±8.62	82.94±8.57	78.83±9.62	3.201	0.048*

Table 5: Environmental care related to HDMs pe/post program implementation.

Performance scale:	Positive performance (score 60% +)				Test	
	Pre (n=60)		Post(n=60)			
	No.	%	No.	%	X^2	p value
1. Beds' cleaning	30	50.0	55	91.7	25.2	<0.001**
2. Windows & walls cleaning	26	43.3	52	86.7	24.8	<0.001**
3. Carpets' cleaning	22	36.7	51	85.0	29.4	<0.001**
4. Ventilation control	25	41.7	52	86.7	26.4	<0.001**
5. Bathroom cleaning	26	43.3	54	90.0	29.4	<0.001**
6. Sanitary food storage	21	35.0	50	83.3	29.0	<0.001**
7. Rodents & insects control.	24	40.0	53	88.3	30.5	<0.001**
8. Personal hygiene	31	51.7	57	95.0	28.8	<0.001**

Table 6: Total performance score% & nurses' socio-demographic characteristics:

Intervention	Socio-demographic characteristics			% Score	ANOVA	P-Value
Age groups	<20Y (n=6)	20-<30Y (n=44)	+30Y (n=10)			
Pre	50.67±12.45	52.56±10.43	54.43±11.65	54.77± 11.80	0.237	0.790
Post	71.43±10.93	73.74±9.46	76.54±10.44	73.68± 10.74	0.562	0.573
Education	Bachelor Degree (n=18)	Technical Institute (n=10)	School Diploma (n=32)			
Pre	57.82±8.19	54.63±7.54	51.76±7.62	54.77± 11.80	3.525	0.036*
Post	77.81±10.59	74.90±9.62	71.04±8.12	73.68± 10.74	3.246	0.046*
Years of Experience						
	<5Y (n=16)	5-<10Y (n=34)	+10Y (n=10)			
Pre	51.06±11.89	56.97±9.92	57.78±8.13	54.77± 11.80	2.107	0.131
Post	72.81±10.59	74.90±9.62	76.04±8.12	73.68± 10.74	1.249	0.049*

Table 7: HDM species in patients' dwelling

HDMs	No.	%	χ^2	P value
Dermatophagoides pteronyssinus	33	55.0	64.7	0.000**
Dermatophagoides farina	44	73.3		
Liponyssus bacoti	10	16.7		
Acarus siro	22	36.7		
Tyrophagus putrescentiae	33	55.0		
Laelaps nuttalli	10	16.7		

Table 8: Evaluation of subjects' houses (n=60)

Variables	No.	%	χ^2 test	P value
Age of house <10 years	14	23.3	18.0	0.000**
10-<20 years	25	41.6		
20-<30 years	16	26.7		
+30 years	5	8.3		
Descriptive Statistics	18.78±7.93		Range (4.0 –33.0)	
Floor Basement	3	5.0	65.6	0.000**
Lower floors	35	58.3		
Upper floors	20	33.3		
Roof	2	3.3		
Descriptive Statistics	4.32±1.32		Range (1.0 – 12.0)	
Ventilation Generally wsufficient	60	100.0		
Electric Fans	60	100.0		
Air conditioning	46	76.7		
Vacuum cleaning	60	100.0	120	0.000**
Its' suction power: mild	12	20.0	7.35	0.025*
Its' suction power: moderate	25	41.7		
Its' suction power: strong	23	38.3		
Home pets (dog and/or cat)	12	20.0	43.2	0.000**
Floors:Normal wood	5	8.3	36.1	0.000*
Floors: Parquet	16	26.7		
Floors: Ceramic	31	51.7		
Floors: Nature Tile	8	13.3		
Covered with Carpet	42	70.0	19.2	0.000*
Covered with Moquette	18	30.0		
Bed room: Natural Wood	31	51.7	15.4	0.000**
Bed room: Painted Wood	18	30.0		
Bed room: Nature Metallic	11	18.3		
Mattress: Cotton	36	60.0	4.80	0.028*
Mattress: Foam	24	40.0		
Mattress: Less than 5 years	22	36.7	31.7	0.000**
Mattress: 5-10 years	20	33.3		
Mattress: 11-15 years	10	16.7		
Mattress: 16-20 years	6	10.0		
Mattress: More than 20 years	2	3.3		
Curtains: Cotton	15	25.5	30.0	0.000**
Curtains: Synthetic fibers	45	75.5		
Home Exposures to Sunray	60	100.0		
Indoors Pesticides	54	90.0		

Table 9: Positive patient dwelling for HDMs vs. nurses'performance

HDM species	Positive (+ve) Negative (-ve)	Total	Performance		Test	
			+ve N=26	-ve N= 34	χ^2	P value
D. pteronyssinus	+ve	33	4	29		
	-ve	27	22	5	29.1	0.000**
D. farinae	+ve	44	13	31		
	-ve	16	13	3	12.8	0.000**
O. bacoti	+ve	10	1	9		
	-ve	50	25	25	5.43	0.020*
A. siro	+ve	22	2	20		
	-ve	38	24	14	16.6	0.000**
T. putrescentiae	+ve	33	3	30		
	-ve	27	23	4	35.0	0.000**
L. nuttalli	+ve	10	1	9		
	-ve	50	25	25	5.43	0.020*
P. consanguineus	+ve	33	1	31		
	-ve	27	25	2	47.6	0.000**

Table 10: sites of mites' recovery

Mites Recovered	Sites of collection
Dermatophagoides farinae	Indoors (bedrooms, mattress, carpets…etc.)
D. pteronyssinus	Indoors (bedrooms, mattress, carpets…etc.)
Ornithonyssus bacoti	Rodents and floor of rodents' infested areas
Acarus siro	Free living on decaying matters or flour
Tyrophagus putrescentiae	Free living outdoors on garden seeds, stored products and in and outdoor dust
Laelaps nuttalli	Rodents and/or Bats infested areas or by both
Parasitus consanguineous	Feed on acari mites, live on floor dust as non pathogic type or bio-control agent.

In Egypt, about 72 mites infesting man, animals and plants were reported till December (Morsy *et al*, 2003b) out of 50.000 spcies known worldwide

Discussion

The HDMs are the most important indoor allergens, and more dwellings have become infested, most likely as a result of increased indoor humidity due to reduced ventilation (Halken, 2004). The mean attributable fraction of adult asthma due to atopic sensitization was 30% and 18% this could mean as many as 1.2 billion people could have some form of chronic sensitization to dust mites (Soo *et al,* 2008). They reproduce quickly enough that their effect on human health can be significant. HDMs depend on moisture to survive; can be easily eradicated by simple cleaning (Xavier *et al,* 2004).

Preventing and exterminating clinically relevant concentrations of house HDM allergen in hospitals is one of the most interesting challenges. When this challenge is not met, up to 40% or more of the hospital population may be affected by allergic symptoms as conjunctivitis, rhinitis, asthma or enema. The actual size of the problem depends on the massiveness and length of exposure to mite allergens (Schantz, 2009). In Egypt, so many authors dealt with HDMs and allergens. Frankland and El-Hefny (1970) were the first to report the prevalent HDM; *D. farinae* as a cause of inhalant allergic problem particularly in children. El-Ghitany and Abd El-Salam (2012) found that simple physical control measures have the potential to contribute to control asthma symptoms in asthmatic children sensitized to HDM allergen. Saleh *et al*. (2013) was the first to study HDMs among hospitalized patients.

Generally, the nurses represent a mini-surveillance system at any hospital so if they realized the nature and role of HDMs and their allergens they might significantly reduce its prevalence; bundled school-based interventions (Toole, 2013). Thus, educational programs can significantly affect the level of knowledge and degree of performance of nurses. That may make them more efficient, with high degree of quality and suit the international nursing standards, which significantly reflected on the level of health care provided to patients (Goode *et al,* 2009).

This study was conducted in a Military Hospital, on the total number of the staff nurses, using a quasi-experimental study, aiming to improve nurses' knowledge and performance regarding the management of HDMs which in turn could minimize patients' exposure to infection.

In the present study, most of nurses were in the age group 20-30 years (73.3%) with a high significant difference ($P < 0.01$), and the majority were females (70%), 63.3% were married, 53.3% have nursing school diploma and 63.3% were officers. Patel *et al*. (2002) noticed that the lower the age the higher the level of knowledge and they explained that by fresh memory and new changed educational curricula. Sharma (2005) found that nurses with diploma degree had lower knowledge level than those with bachelor degree due to educational contents. Salonen *et al*. (2007) found that education level correlated positively to knowledge level. Mutale *et al.* (2013) reported that men nurses were 6.6%, as females are more suitable for this critical job.

In the present study, working experience ranged from 2.0-17.0 years, and 56.7% had 5-10 years experience, 43.3% were in medical departments, 36.7% in surgical departments & 20% were in high pressure areas as emergency & ICU departments. These facts have a marked input concerning evaluation. Chung (2005) explained that nurses in emergency department have higher level of knowledge by daily nature changing work or action, and contact with a variety of cases. Evans and Donnelly (2006) found that the work place markedly affected knowledge level and nurses in emergency department have higher knowledge level.

In the present study, the training program achieved significant improvement in knowledge level in all topics. Mendell *et al*. (2011) found that the majority of nurses had sufficient level of knowledge about home remedies and HDMs allergens. Sauni *et al*. (2011) reported that 60% of nurses were accounted with HDMs and asthma. Romieu *et al*. (2012) reported that nurses used simple home remedies to prevent HDMs' chronic asthmatic children. But, Fisk *et al*. (2010) found that only 25% of nurses knew about HDMs and allergy pathogenesis. But, Jaakkola *et al*. (2013) noticed that nurses did not know the home remedies role in HDM control. Menachem (2013) found that defect of knowledge was related to habitat; food and life cycle of HDMs, but had good knowledge about home remedies and pathogenecity.

The present data showed a highly significant improvement in nurses' knowledge grades in post-test as compared to pretest. All variables paving the way for program success were adopted. Casey *et al*. (2004) found that a good program is that which contents cope with objectives and needs achieved fundamental success. Tourangeau *et al*. (2006) recommended that a good program during evaluation would be effective and efficient if repeated regularly. Williams *et al*. (2007) determined the needs by good contents, good materials, effective methods and suitable physical environment. Sales *et al*. (2008) stated that if the program contents were interesting and satisfying the needs of trainees it would achieve more success. Goode *et al*. (2009) reported that to determine the training program effectiveness; it should be evaluated immediately after and long period after implementing. Kovner *et al*. (2010) mentioned that if the program achieved

about 60% improvement in knowledge level so, it proved to be a good program. Also, Ulrich *et al*. (2010) correlated the success of a program to satisfaction of all the needs of trainees.

The nurses with bachelor degree and with experience more than 10 years got significantly higher level of knowledge. The Egyptian education curriculum of bachelor degree usually contains much valuable and advanced data on critical and important medical topics. Also, long years of experience gave the nurse much practical and theoretical knowledge from the hospital environment and attendance of various training programs. Hicks *et al*. (2003) stated that every training program must contain new emerged knowledge to be more effective. Bracken (2003) found that effective training program increased the level of knowledge by more than 60%. Andersson *et al*. (2006) found that one year experience increased knowledge by 5%, and Considine *et al*. (2007) described level of knowledge, experience and skills as the triage of high quality nurse. Forsgren *et al*. (2009) explained the relation between level of knowledge and experience by that more experience means more number of cases, more contact with patients and more up to date knowledge. Gilboy and Travers (2007) found that only regular training programs significantly affected knowledge level. Proehl (2007) stated that the educational level alone couldn't be an indicator for knowledge level and should be accompanied with training programs to overcome the gap between nurses and new knowledge and daily practice. Milbrett and Halm (2009) found that regular training means adherence to the revolution of know-ledge. Also, Louis (2013) reported that by regular training the hospital guarantee that the nurses would not be left to her personal need for knowledge, and newly emerged knowledge would be coped with.

The present program achieved a highly statistically significant improvement in nurses' performance in HDMs all aspects. In pre-program evaluation beds' cleaningand personal hygiene were 50.0%, and 51.7%, while sanitary food storage and carpets' cleaning were 35.0% and 36.7% respectively. This might be due to less knowledge about food storage and carpet cleaning in HDM prevention. Maximum positive performance in immediate post-program evaluation was in personal hygiene (95.0%), while minimal one was in sanitary food storage (83.3%). Witt and Brinkhaus (2010) found that normal individuals at least 6-8 hours in not cleaned beds made them susceptible to millions of HDM. Fry and Burr (2001) noticed that proper bed cleaning and covering beds with vinyl mattress cover-soft vinyl ones noticeably eradicated HDM. Yamamoto *et al*. (2005) said that HDMs cover really works, kids with asthma who were allergic to dust mites were able to stop treatment when they used mattress and pillow covers. Ray and Smith (2008) recommended using cotton sheets, duvet covers and pillow cases that can be washed at 60^{O}C, and refused woolen blankets or quilts. Rondón *et al.* (2010) noticed that effective means in HDM control was to enclose mattress top and sides

with a plastic cover. Baroody *et al*. (2011) found that human dead skin shed was a source of storage food to HDMs and they feed on mould or fungi of numerous genera, as *Aspergillus*.

The present study revealed a significant difference between the total mean performance % score and education, and work experience; work experience affected performance by level of knowledge and skills. Almeida *et al.* (2003) found that work experience was not as important for successful job performance. Castilla (2005, 2008) and Huckman and Pisano (2006) found no relation or even negative one between work experience and performance. Bechky (2003) repoted that a mean correlation of 0.32 between work experience and job performance across a number of occupations Arthur *et al*. (2006) found a correlation of 0.18 between work experience and job performance. Reagans and Argote (2005) measured experience by counting the number of times an individual performed on a given task. O'Mahony and Bechky (2006) used time on job, or tenure, to measure work experience. Christian *et al.* (2011) correlated job performance with transformational leadership, organizational justice, and work engagement. Giller (2008) correlated performance level to nurse knowledge level acquired during her career. Ng and Feldman (2008) liked good performance with young age and that young nurses were more motivated than older ones. Posthuma and Campion (2009) found that older nurses were more dependable than younger ones and motivated however in different ways. Kacmar *et al*. (2009) considered personal psychology and the good mental abilities as the only indicator for good performance. Karriker and Williams (2009) found that good performance was acquired by training on skills and organization welling to improve human performance. Almalki *et al*. (2012) found that respondents were dissatisfied with their work life, and that major influencing factors were the unsuitable working hours, lack of nurses' facilities, inability to balance work with family needs, inadequacy of vacations time for nurses and their families, poor staffing, management and supervision practices, lack of professional development opportunities and an inappropriate working environment in terms of the level of security, patient care supplies and equipment, and recreation facilities (break-area), without significant differences between nurses' education level and location of education.

Arshad *et al*. (2007), Brugge *et al*. (2007), and Clare *et al*. (2007) found significant effect of physical control on reduction of the frequency of HDM induced asthma, even reducing its severity and the need for hospitalization. But, Kaditis *et al*. (2007), Kercsmar *et al*. (2006), and Marks *et al*. (2006) did not to find an evidence to support the previous hypothesis

In the present study, the nurses' house age ranged from (4-33), and most of them were living in homes within the age category 10-20years (41.6%). Zöll-ner *et al*. (2005) found strong positive relation between old houses and prevalence of HDMs. Rook (2004) explained that relation by those most old houses con-

tains many cracks, older furniture and higher humidity that represents good environment for HDM growth. Romagnani (2004) also correlated the age of the house with HDM induced asthma due to bad ventilation and improper maintenance of wall painting and the furniture.

Most nurses were living in homes within lower floors (58.3%). Haby *et al*. (2001) noticed that lower floors are usually closer to streets, with improper ventilation making good chance for HDM growth. Krieger *et al*. (2009) found that the level of humidity which is positively related to growth of HDM increase markedly in the lower floors. All nurses were living in homes with sufficient general ventilation, having fans and 76.7% have air conditioning Mite densities tend to be high in warm, humid climates. Masoli *et al*. (2004) found that the life cycle of the HDM was influenced by ambient relative humidity and temperature. Pearce *et al*. (2007) found that as relative humidity rises above the critical equilibrium humidity, feeding, mating, and egg production all increase and as it falls, mite activity is reduced until death occurs secondary to dehydration. No doubt, ventilation control reduced indoor humidity (dehumidifiers). But, Kay (2001) mentioned that portable dehumidifiers were unable to reduce either humidity or mite allergen levels. In another study, Georgy *et al*. (2006) noticed that mite allergen levels were unaffected by heat exchangers despite maintaining indoor relative humidity at less than 40%. However, Blay *et al*. (2003) was able to maintain relative humidity at less than 51% throughout a 2-year period in approximately half of the homes tested, and mites and mite allergen in the carpets from these homes decreased by 78%.

All nurses use vacuum cleaner, but 41.7% with moderate suction power. Infante *et al*. (2001) recommended that vacuums with a water filter are preferable to those with a disposable paper bag as the water vacuum removes a greater range of particle sizes than paper-bag types. Wrzesniewski *et al*. (2003) said that the most important tool for managing HDMs was the vacuum cleaner. Regular, thorough vacuuming of carpets, furniture, textiles and other home furnishings such as draperies kept HDMs low. Ane *et al*. (2005) after applying the physical measures for HDM control specially vacuuming and bed cleaning they found that distribution of asthma severity classes was 7.5, 17.5, 30, and 45% of children with intermittent, mild persistent, moderate persistent, and severe persistent asthma, respectively. Distribution changed significantly ($p = 0.000$) at 16 weeks after implementation of the physical control measures, with the frequencies of intermittent and mild persistent asthma increasing to 17.5 and 35% of children, respectively, while those of moderate and persistent asthma decreasing to 25 and 22.5% of children, respectively. Besides, frequency of uncontrolled asthma among the children was 25%, which was significantly lower than that at baseline Zedan *et al*. (2009) found that vacuuming the living room and bedroom at least twice a week and vacuuming carpets more than

once weekly can reduce the incidence of childhood asthma markedly.

In the present study, 80.0% of nurses did not have pets. Frew (2003) advised to keep pets out of the bedroom; to prevent build up of dander in the room and wash the pet twice weekly, preferably outdoors. Platts (2003) recommended for pet lover, locate the sleeping quarters as far from yours as possible and furnish their sleeping area so it can be cleaned easily. Morgan *et al*. (2004) found that pets with fur or feathers contribute to the dander in the dust and increase food source for mites.

The nurses' homes were with ceramic floors (51.7%) and with overlying carpets (70.0%). Lophua *et al*. (2003) reported that hardwood or vinyl floors with washable area rugs are ideal, If carpets can't be replaced. Crocker *et al*. (2008) found that carpet created a perfect haven for HDM populations. Parker *et al*. (2008) recommended to have it steam cleaned at least once a year, springtime is best, thus can get rid of dead skin; the main feed of HD Krieger *et al*. (2009) suggested anti-allergenic carpeting, wooden floors or tile or terrazzo flooring to reduce HDM.

Nearly half of the nurses have beds made from natural wood, with cotton mattress (60.0%) which rarely since more than 20 years (3.3%), and home curtains made from synthetic fibers (75.5%), but all frequently exposes their homes to sunrays, while (90.0%) uses pesticides. Mattress was the most important item in the home to keep clean and HDMs-free (Causer *et al*, 2004). Emin *et al*. (2004) found that it is better to avoid using feather pillows and duvets as they are difficult to wash. Man made fiber pillows and duvets can be washed at 60 degrees centigrade or cold washed with an anti-dust mite wash additive. Eggleston (2005) found that encasing mattresses, duvets and pillows in micropore, allergen proof covers can prevent mite allergens escaping. Eggleston *et al*. (2005) added that it was essential to follow the manufacturer's recommendations regarding cleaning, which normally require that these are removed and washed at high temperatures once a week and the mattress must be well aired whilst washing takes place, which killed mites and washed out their allergens. If bedding cannot be hot washed at a minimum of 60 degrees centigrade, use a dust mite wash additive. Woodcock *et al*. (2003); Terreehorst *et al*. (2005) and Dharmage *et al*. (2006) reported that the use of an impermeable mattress cover as a single intervention neither improved the clinical asthma symptoms nor reduced mite allergen level at 12 months

In the present study, seven species of mites were recovered from 73.3% of collected samples. The commonest was *D. farina,* while least was *O. bacoti* & *L. nuttalli*. *D. farina* was the commonest HDM as a finger print in childhood asthma occurrence (Shim *et al,* 2003; Paul *et al,* 2004; Nuhoglu *et al*, 2007; Soo *et al.* 2008; Daniel and Robert, 2009). Also, there was significant relation between nurses' performance and their positive dwelling for HDMs. This agreed with many authors (McIntire *et al,* 2003; Carter *et al*, 2003; DeMeer *et al,* 2005)**.** Others minimized the role of

HDM in dwellings in nurses' performance (Gonzalez *et al,* 2005).

Many Egyptian authors dealt with HDS. But, this is the first recovery of seven HDMs in a military hospital. In descending order were *D. farinae, D. pteronyssinus, O. bacoti*, *A. siro*, *T. putrescentiae, L. nuttalli,* and *P. consanguineus*. The presence of mites in and out doors in a hospital and homes of medical personnel pave the way to consider HDM as occupational and/or nosocomial disease (Saleh *et al*, 2013).

Conclusion

The knowledge and performance regarding management of house dust mites in a military hospital before implementing the educational training program was not satisfactory or nil, but after implementing the training program, the results showed highly significant improvement in their level of knowledge and performance. The educational course for nursing staff on HDMs and allergy proved to be fruitful. The majority of nurses were very interested and collected dust from the hospital residence or even from their own homes where some had children suffered from allergy. Patients were at risk of nosocomial infection.

Recommendations

Nurses dealing with patients in rural and urban areas must be accounted with HDMs and allergens and gain a better understanding of the cleaning care and adequately discharge these duties in daily practice. Undoutedly, illustrative refresh courses with handout sheets or booklet is a must. The following recommendations are suggested for hospitals and student hostels:

1- Allergic patients should avoid dust. 2- Regarding house dust mites control, the following measures are recommended (removal of carpets from bed rooms of house dust sensitive patients, cleaning of beds and carpets using advanced vacuum cleaner of high power of suction, blankets and pillow cases must be exposed to sun before kept in closed places and use of indoor safe acaricides, if it is a must). 3- A mite map should be established in Egypt by making a survey of mite species in rural and urban area. 4- Skin prick test is a good negative test and should be used as a screening test, and positive results should be confirmed by ELISA test. 5- Blood eosinophilic count is a must in diagnosing atopic diseases. 6- Culturing of different mite species to prepare different antigens to be used in allergy diagnosis and more species should be included in skin testing, as it might happen that some patients could be missed if only one or two species is tested. 7- Hyposensitization therapy by species specific allergens is a future recommended hope. 8- Introduction of molecular cloning techniques in allergen identification and sequencing, production of recombinant allergens for management of mite-allergic patients (especially asthma) to reduce asthma mortality and morbidity. 9- Wide scales vaccines. 10- Purification of antigen for skin test and ELISA to be specific.

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