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Effect of an Intervention Training Program on Hospital Acquired Infection Rates in Intensive Care Units at New-Damietta University Hospital Egypt

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Abstract

Background: Healthcare-associated infections (HAIs) are among the most prevalent side effects in patient care, accounting for a significant amount of morbidity and mortality. (HAIs) are also acknowledged to be a hazard in healthcare settings, impacting patient length of stay and increasing expenses globally.

Aim of Study: To assess the health care workers (HCWs') knowledge, attitude, and practice before and after the implementation of the health education program at Al-Azhar New-Damietta University Hospital, and to measure the incidence rates of health care associated infections within intensive care units at Al-Azhar New-Damietta University Hospital beforeand after intervention.

Patients and Methods: An interventional prospective study was carried out over 15 month and conducted on departments of intensive care units (general and pediatrics ICU) in Al-Azhar University Hospital - New Damietta. In 2 ICUs (Medical and Surgical ICU) - 20 Beds, Pediatric ICU - and NICU (Neonatal ICU) 22 beds of a tertiary Health care hospital setting Al-Azhar University Hospital from April 2019 – January 2021. Patients admitted to the selected intensive care units during the study period (either before or after the intervention), were followed-up prospectively during their stay, starting from the date of their ICU admission till the date of their discharge from the ICU. Both sexes and all age categories were included in the study.

Results: Improvement of knowledge, attitude and practice of the studied health care workers after application of health education. The highest percent of improvement was detected for attitude (43.8%) followed by knowledge (14.2%) and least improvement is detected for practice (6.41%). Improvement of overall patient infection rate (PIR), overall patient device rate (PDR) and Blood stream infection (BSI) rate after health education program application with change of rate from 26% to 9.7 for overall patient infection rate (PIR), from 32.5% to 18.8% for overall patient device rate (PDR) and from 12.6% to 6.1% for Blood stream infection (BSI) rate.

Conclusion: Application of the Health Education Program decreased the HAI levels.

Key Words: *Intensive Care Unit (ICU) – Infection control programs – HCAI.*

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Introduction

A NOSOCOMIAL infection, also known as a health-care-associated infection, is an infection obtained at a health-care institution by a patient who was hospitalized for a cause other than that infection and was not present or incubating at the time of hospitalization. Nosocomial infection is defined as an infection that occurs more than 48 hours after hospitalization **[1]**.

Healthcare-associated infections (HAIs) are among the most prevalent adverse events in patient care, accounting for a significant amount of morbidity and mortality. (HAIs) are also acknowledged to be a hazard in healthcare settings, impacting patient length of stay and increasing expenses globally. Despite substantial advancements in infection control measures, HAI continues to be a serious public health issue and a concern to patient safety across the globe **[2]**.

Bacteria, viruses, parasites, and fungus that may be found in the air, surfaces, or equipment around health facilities induce nosocomial illness. It may affect people of all ages, although the most susceptible are newborns, immune-compromised adults, and the elderly **[3]**.

In intensive care units (ICUs), HAIs constitute a severe patient safety issue. In ICUs, the risk of contracting HAI is substantially greater, with roughly 30% of patients experiencing at least one episode of HAI, which is linked with severe morbidity and death **[3]**.

The World Health Organization (WHO), in partnership with the Centers for Disease Control and Avoidance (CDC), has published a practical guidebook for the protection of nosocomial infections across the world. When doing patient care tasks, healthcare staff should employ hand decontamination, personal hygiene, personal protection equipment, and suitable techniques of managing dirty clothes, according to the guideline. It also suggests strategies for reducing environmental contamination, such as washing the hospital environment with high superheated water, sanitizing patient equipment, and preventing diseases like HIV, hepatitis B and C viruses, and tuberculosis (TB) from being transmitted to the personnel [4].

The goal of this research was to enhance the quality of health care by instituting an intervention training program for health-care-associated infections, as well as to assess healthcare workers' (HCWs) information, behaviors, and activities before and after the health education program was implemented at New-Damietta University Hospital. Our secondary goals are (i) To determine the frequency of HAIs at New-Damietta University Hospital's critical care units. (ii) To assess the intervention training program by evaluating the prevalence rates of HAIs in the chosen hospital before and after the program's implementation.

Patients and Methods

Intervention study performedover 15 month and conducted on departments of intensive care units (general and pediatrics ICU) at Al-Azhar University Hospital - New Damietta. In 2 ICUs (Medical and Surgical ICU)- 20 Beds, Pediatric ICU - and NICU (Neonatal ICU) 22 beds. Patients hospitalized to the selected intensive care units during the study period (either before or after the intervention), were followed-up on prospectively throughout their hospitalization, from the time of their ICU admission until the time of their ICU discharge.

Sample size: The sample size was determinedutilizing the formula below:

$$N = \frac{[\frac{za}{2}\sqrt{2pq} + z\beta\sqrt{p1q1} + p2q2]^2}{p1 - p2}$$

Using this equation, the sample size was calculated as follows:

For NICU: The sample size was computed using a 28.63 percent overall infection rate prior the intervention and 15.68 percent after the intervention. Given a total sample of 322 patients in the NICU, Gadallah, et al., [12] calculated that a sample of 161 patients was necessary prior the intervention and 161 patients after the intervention, with a power of 80 percent and an alpha level of 0.05.

For medical/surgical ICUs: The sample size was estimated using a 29.81 percent overall infection rate prior the intervention and 16.31 percent after the intervention. According to Gadallah et al., [12], with an alpha level of 0.05 and a power of 80 percent, a sample of 152 patients was necessary prior the intervention and 152 patients after the intervention, for a total sample of 304 patients in MICUs.

The research was carried out in three stages (pre-intervention, intervention, and post–intervention), as shown below.

Phase one (pre-intervention): Collection of data and calculation of HAI prevalence rate took place for seven months prior to the intervention, and included prospective follow-up of 350 patients (all hospitalized patients) in the studied ICUs from the date of their hospitalization until the occurring of one or more HAIs.

Phase two (intervention): The intervention took the form of a one-month training session for health care workers (doctors-nurses) in the research ICUs on recommended infection control standard considerations, including preventative bundles for urinary tract infection (including CAUTI), blood stream infection (including CLABSI), and pneumonia (including VAP).

Phase three (post intervention): Following the intervention, data was collected and HAI rates were calculated for another seven months, which involved prospectively following-up on 700 patients (all admitted patients) in the studied ICUs for the duration of their stay, starting from the date of their ICU admission until the incidence of one or more HAIs. The outcomes were compared before and after the intervention.

Data collection methods and tools: The Researcher was responsible for collecting the data using the surveillance sheet with the following data: Demographic details, Admission details, Clinical details and Laboratory details, Data relevant for identifying HAIs (CDC/NHN surveillance case definitions), to detect the presence or absence of an infection and its type if present. Denominator data was collected daily in each intensive care unit using two denominator sheet forms (one for adult ICUs and one for neonatal ICUs) to collect total number of patients, number of patients with a

central line, number of patients with a urinary catheter, and number of patients on a ventilator.

Results

Table (2) illustrates that there is statistically significant improvement of almost all elements of respiratory hygiene and cough etiquette domain of knowledge by increase of correct knowledge frequencies among studied health care workers after application of health education program including covering of their nose and mouth when coughing/ sneezing, ensuring of safe waste management and proper handling equipment soiled with blood, body fluids, and secretions.

Table (3) shows that there is statistically significant improvement by increase of positive attitude as regard attitude towards hand hygiene and wearing gloves and towards personal protective equipment and contaminated waste after application of health education program. Mean attitude score of all studied group increased significantly from 4.79 to 6.98 (p<0.001) illustrating significant improvement of attitude.

Table (4) demonstrates that there is statistically significant improvement of health care workers practice by increase frequencies of correct practice after application of health education program as regard; Hand hygiene protocols include completing hand hygiene before interaction with the patient, prior to departing from the patient's care area after interacting with the patient, and after contact with blood, bodily fluids, or contaminated surfaces.

Table (5) demonstrates that there is statistically significant advancement of awareness, attitude and practice of the studied health care employees after application of health education program with the highest percent of improvement is detected for attitude (43.8%) followed by knowledge (14.2%) and least improvement is detected for practice (6.41%).

Table (6) shows that there is statistically significant improvement of overall patient infection rate (PIR), overall patient device rate (PDR) and blood stream infection (BSI) rate after health education program application with change of rate from 26% to 9.7 for overall patient infection rate (PIR), from 32.5% to 18.8% for overall patient device rate (PDR) and from 12.6% to 6.1 % for blood stream infection (BSI) rate.

Table (7) demonstrates that there is statistically significant improvement of Overall Device associated infection (DAI) rate, ventilator associated pneumonia (VAP) rate, Catheter associated urinary tract infection (CAUTI) rate, central line associated blood stream infection (CLABSI) rate & CLU after health education program application with change of rate from 18.2% to 14.4% for overall DAI, from 18.6% to 14.4% for VAP rate and from 12.8% to 10% for CAUT rate and from 0.257 to 0.194 for CLU.

Table (1): Knowledge of the studied health care workers (concerning hand washing) during pre and post application of health education program.

Knowledge domains	Correct knowledge				MC-Nemar test	p-value
	Before health education program		After health education program			
	No=100	%	No=100	%		
Hand washing:						
- Hand washing (40-60 sec)	70	70	90	90	19.07	<0.001 *
- Hand rubbing (20-30 sec) by alcohol	75	75	87	87	11.07	0.008 *
- Before contact with a patient	66	66	77	77	10.83	0.001 *
- After contact with a patient	75	75	77	77	1.33	0.248
- Between contacts with different patients.	55	55	59	59	3.20	0.07
- After removal of gloves	59	59	67	76	7.1	0.007*
- Before handling an invasive device.	88	88	96	96	7.1	0.007*
- After contacting with blood, bodily fluids, secretions, excretions, damaged skin, or contaminated goods	87	87	99	99	11.08	0.008 *
- During patient care	65	65	87	87	21.04	<0.001 *
- Following touch with inanimate things in the patient's immediate proximity.	77	77	88	88	10.08	0.001 *

Table (2): Knowledge of the studied health care workers (concerning Respiratory hygiene and cough etiquette) during pre and post application of health education program.

Knowledge domains	Correct knowledge				MC-Nemar test	*p*-value
	Before health education program		After health education program			
	No=100	%	No=100	%		
Respiratory hygiene and cough etiquette:						
- When coughing or sneezing, cover their nose and mouth, discard used tissues & perform hand hygiene after contact with respiratory secretions	86	86.0	95	95.0	8.10	0.004*
- Adhere to appropriate practices for regular cleaning of the surroundings.	76	76.0	89	89.0	12.07	0.005*
- Ensure safe waste management	65	65.0	87	87.0	21.04	0.001 *
- Contaminated waste including blood, bodily fluids, or excretions treated as clinical waste	86	86.0	92	87.0	5.14	0.02*
- Proper handling equipment soiled with blood, body fluids, and secretions	89	89.0	95	95.0	5.14	0.02*
- Prior to using reusable equipment with another patient, thoroughly clean, disinfect, and reprocess it	95	95.0	97	97.0	1.33	0.248

Table (3): Attitude of the studied health care workers pre and post application of health education program.

	Positive attitude				MC-Nemar test	*p*-value
	Before health education program		After health education program			
	No=100	%	No=100	%		
Attitude towards hand hygiene and wearing gloves:						
- Hand hygiene before & after any direct contact with Patients	85	85.0	95	95.0	9.09	0.002*
- When handling blood, bodily fluids, secretions, and non-intact skin, gloves used	86	86.0	93	93.0	6.13	0.013*
Attitude towards personal protective equipment and contaminated waste:						
- Think that the following activities should be done during sprays of blood , excretions and secretions:						
• Wearing a surgical mask	75	75.0	95	95.0	19.05	<0.001 *
• Wearing eye goggles	55	55.0	88	88.0	32.02	<0.001 *
• Wearing gown	45	45.0	63	63.0	17.05	<0.001 *
- Found that should not recap needles after use of syringes	70	70.0	90	90.0	19.05	<0.001 *
- The waste contaminated with blood should be treating as clinical waste, in accordance with local regulations	75	75.0	89	89.0	13.07	<0.001 *
Total attitude score	4.79±2.1		6.98±1.28		*t*=15.45	<0.001*

Table (4): Practice of the studied health care workers (concerning procedures related to hand hygiene) during pre and post application of health education program.

	Correct practice				MC-Nemar test	*p*-value
	Before health education program		After health education program			
	No=100	%	No=100	%		
Procedures related to hand hygiene:						
- The HCWs is performing hand hygiene before contact with the patient.	87	87.0	96	96.0	8.1	0.004*
- The HCWs is performing hand hygiene before exiting the patient's care area after dealing with the patient.	85	85.0	98	98.0	12.07	0.0005*
- The HCWs is performing hand hygiene before performing an aseptic task (e.g. Umbilical vessel catheterization, suction of endotracheal tube, insertion of IV or preparing an injection).	75	75.0	96	96.0	20.05	<0.001 *
- The HCWs is performing hand hygiene after contact with blood, body fluids or contaminated surfaces.	90	90.0	98	98.0	7.11	0.007*
- When HCWs transfer their hands from a contaminated to a clean body place during patient care, they conduct hand hygiene.	94	94.0	97	97.0	2.25	0.13
- The HCWs is performing hand hygiene immediately after removal of PPE.	95	95.0	98	98.0	2.25	0.13

Table (5): Change of KAP score pre and post health education program among studied health care workers.

KAP score	Pre-health education Programs	Post-health education Programs	Paired *t*-test	*p*-value	% of improvement
Knowledge	22.58±2.58	25.78±5.14	5.23	<0.001 *	14.2
Attitude	4.79±2.1	6.98±1.28	15.45	<0.001 *	43.8
Practice	40.58±3.51	43.18±4.21	25.5	*p*<0.001 *	6.41

Table (6): Patient infection rate, patient day rate, and PDR by infection location in selected ICUs, before and during the intervention.

	Before	After	(Z)*p*-value
Overall PIR:			
Total no. of HAIs	91	34	(0,03)*
Total no. of patients	350	350	
Occurrence rate (%)	26	9,7	
Overall PDR:			
Total no. of HAIs	91	34	0,028 *
Total no. of patient days	2800	1800	
Occurrence frequency (%)	32,5	18,8	
HAP rate:			
Total no. of pneumonias	29	13	0,6 8
Total no. of patient days	2800	1800	
Occurrence frequency (%)	10,3	7,2	
UTI rate:			
Total no. of UTIs	26	10	0, 58
Total no. of patient days	2800	1800	
Occurrence frequency (%)	9,3	5,5	
BSI rate:			
Total no. of BSIs	36	11	0.045 *
Total no. of patient days	2800	1800	
Occurrence frequency (%)	12,6	6,1	

Table (7): Overall device associated infection (DAI) rate, by site of infection, device usage ratio (DUR), and median length of stay (LOS) in selected three (ICUs) prior to and after the intervention.

	Before	After	(Z)*p*
Overall DAI rate:			
Total no. of DAIs	51	26	0,005*
Total no. of patient days	2800	1800	
Incidence density (%)	18.2	14,4	
VAP rate:			
No. of VAPs in total	17	12	0.05*
No. of Vent. Days in total	910	950	
Incidence density (%)	18,8	14,4	
CAUTI rate:			
Total no. of CAUTIs	15	5	,005*
Total no. of urinary cath. Days	1170	500	
Occurrence frequency (%)	12,8	10	
CLABSI rate:			
Total no. of CLABSIs	19	7	,005*
Total no. of central line days	720	350	
Occurrence frequency (%)	26,33	20	
VU:			
Total no. of Vent. Days	910	950	,89
Total no. of patient days	2800	1800	
Vent. Utilization ratio	325	527	
UCU:			
Total no. of Urinary cath. Days	1170	430	,9
Total no. of patient days	2800	9963	
U.C. Utilization ratio	,417	,227	
CL U:			
Total no. of Central line days	720	350	,05*
Total no. of patient days	2800	1800	
C.L. Utilization ratio	,257	,194	
Mean LOS:			
Total no. of patient days	2800	1800	,98
Total no. of patients	350	350	
Median length of stay/pt.	8	5,1	

Discussion

We divided the health education program into three parts and applied it on 100 HCWs in this quasi-experimental prospective research. The KAP of the HCWs' personnel in terms of infection-control measures was examined in the first phase. All HCWs who took part in the first phase were given health education courses in the second phase. The HCWs' awareness, attitudes, and behavior involving infection-control policies were reviewed in the third phase. The study then developed the information of the intervention training program by evaluating the effects of a multifaceted strategy to HAIs that incorporates a slew of infection-control measures, CAUTI bundle, CLABSI bundle, HAP bundle, and HAI rate feedback on the reduction of HAIs in the selected ICUs units at New-Damietta University Hospital.

Galal et al., [5] evaluated after offering a health education program in PICUs at Cairo University Hospitals, nurses' knowledge and attitude toward infection-control measures improved. The nurses' knowledge of the types of nosocomial infections, the at-risk groups for acquiring nosocomial infections, and the metrics used to control nosocomial infections was substantially greater in the post intervention phase compared to the pre intervention phase (p>0.001), with the level of knowledge increasing 10% post intervention. Additionally, there were no statistically substantial variations in their behaviors about hand cleaning, whether prior or after wearing gloves, or toward regular hand washing, between the before and after intervention periods. However, the attitude of nurses towards the other infection-control measures has shown positive outcome at p-value less than 0.001 [5]. In the same level of agreement with Yasmine's study, the present investigation has demonstrated the impacts of health education program on the HCWs' knowledge. Where there was statistically significant improvement of almost all domains of knowledge by increase of correct knowledge frequencies among studied health care workers after application of health education program including hand washing domain, infection control process area, personal protective equipment usage, needle stick avoidance and accidents from other sharp devices, respiratory hygiene and cough etiquette. It is also indicated that the median knowledge score of all studied group enhanced significantly from 22.58 to 25.78 (p<0.001).

Moreover, the present study has shown statistically significant improvement by increase of positive attitude towards hand hygiene and wearing gloves and towards personal protective equipment and contaminated waste after application of health education program. And the mean attitude score of all studied group increased significantly from 4.79 to 6.98 (p<0.001), which is still higher than the study conducted by yasmine. This might be owing to the fact that the research participants differed. The research participants at PICUs at Cairo University hospitals were registered nurses who worked in health care facilities, and although they may have gained knowledge via their experiences and/or in-service training, they lacked an attitude regarding infection control methods. On the other hand, the current study participants are registered nurses, resident and specialist doctors with years of experience and high level of education. Galal et al., [5].

Written policies, formal training, and years of experience, according to Bianco et al., [6], contrib-

uted to an improvement in understanding, practice, and favorable behaviors regarding central line-associated bloodstream infections (CLABSI) prevention, which is one of the HAIs. They also confirmed the existing research outcome, demonstrating that answers correct about physicians' and nurses' knowledge, attitudes toward broad factors of CLABSI prevention, and HCW practice were substantially higher and very positive in respondents who worked in intensive care unit (ICU) wards in hospitals with a written policy about central vascular catheters (CVC) upkeep and active formal training **[6]**.

According to randomized controlled trial study conducted for In a study that looked at the impact of three distinct instructional programs on HCWs' hand hygiene compliance and knowledge, it was discovered that following intervention, hand hygiene compliance increased by over 20% in most departments (p<0.001). The improper usage of hand massages by nurses while wearing gloves also elevated (p<0.001). The median knowledge score increased (p<0.05) from 5.6 (SD=2.1) to 6.2 (SD=1.9). "Strong odor of hand alcohol" as a cause for non-compliance rose considerably in the departments with intervention (p=0.021) in the perception survey **[7]**.

Our study produced similar results to the study mentioned above. It is demonstrated that there is statistically significant improvement of health care workers practice by increase frequencies of correct practice after application of health education program as regard to procedures related to hand hygiene, personal protective equipment, related to injection safety and reprocessing of reusable instruments and devices. Besides the mean practice score of all studied group increased significantly from 40.58 to 43.18 (p<0.001) illustrating significant improvement of practice.

At Desta et al., **[8]**, hospital-based cross-sectional research was cariedoutin 150 health workers who were getting infection and prevention training for hospital-acquired infections. Despite the fact that 84.7 percent of the respondents were deemed educated, only 57.3 percent indicated excellent infection prevention behavior. In addition, individuals who were older, had more work experience, and had a higher educational level fared better in terms of infection prevention knowledge and practice. Infection protection practice was linked to in-service training, the availability of infection prevention supplies, and adherence to infection prevention recommendations **[8]**.

In the line the study done at DebreMarkos Hospital in Ethiopia, the current study confirmed that poor practice pre-intervention is detected among 35% of the studied cases less experience, where 66.7% of the HCWS aged 20 to 24.99 years (odds ratio=7.3), 60% of resident doctors (odds ratio=13.5), 50% of group with experience from 1-5 years. On the other hand, In both knowledge and practice of infection protection, older, more experienced, and well-educated persons were better.

In India, Suchitra et al., **[9]** investigated the effect of the intervention on levels of knowledge, attitudes, and behaviors at various time intervals. The instructional module was found to have successfully raised the (KAP) knowledge, attitude, and practice score of health care workers (HCWs) from 14% before the intervention to 94% thereafter. The number of respondents in each group rating good or exceptional in the post-education questionnaire increased over time in the research, although this decreased with time. It was discovered that various HCWs had varying levels of compliance with hand washing methods. Total compliance was 63.3 percent, with ward aides having the highest level of compliance (76.7 percent) **[9]**.

In the line with JB Suchitra' study, the current study confirmed the positive impact on the change of KAP score (p<0.001) pre and post health education program among studied health care workers. It is demonstrated that there is statistically significant improvement of knowledge, behaviors and activity of the studied HCWs after application of health education program with the highest percent of improvement is detected for attitude (43.8%) followed by knowledge (14.2%) and least improvement is detected for practice (6.41%).

In contrast, Abdel-Rasoul et al., **[10]** performed research on healthcare employees to examine their KAP in relation to nosocomial infections. It was found that, in physicians the post intervention scores did not show any significant difference in their KAP (p=2.19, 1.67, and 2.43, respectively). However, by comparing between the pre intervention and Post intervention scores among nurses, a significant increase was seen in the post intervention mean KAP score and in the attitude and practice scores by about 42 and 35%, respectively (p<0.001) **[10]**.

Moreover, they indicated that, nurses and doctors showed a significantly higher pre intervention knowledge score compared with housekeepers. This is somehow expected as the education level of the former two groups is higher than that of

housekeepers. But the practice scores showed almost no difference between the three categories, which was pointed out as alarming for the risk of spread of HAIs, because it shows that safety measures are hardly followed by the studied categories [10].

In a study undertaken by Sessa et al., [11], intriguing data were discovered regarding nurse knowledge, attitudes, and cleaning processes in Italian hospitals. The poll indicated that nurses' understanding of HAIs, especially the most frequent ones, was lacking, and only a tiny fraction of nurses said they disinfected correctly in the course of their job. Furthermore, the survey found an extraordinarily favorable attitude toward the usefulness of guidelines and protocols for disinfection processes, with a mean score of 9.1. Female nurses, as well as those with less years of experience, had a more positive attitude [11].

Similarly, the current study findings indicated that, poor knowledge pre-intervention is detected among 60% of the studied cases with some particular demographic characteristics, which are 83.3% of the HCWS aged 20 to 24.99 and from age group 45 to 60 years, with odds ratio (5 & 4.11 , respectively), 90% of nurses with odds ratio (8.14), 70% resident doctors (odds ratio=2.33), 75% of group with experience from 1-5 years (Odds ratio=5) and 83.3% of group with experience from 10-15 years (Odds ratio=3.8).

Despite the similar finding on the level of knowledge among the studied HCWs in the current study and Alessandra 'study, the present study demonstrated contradictory findings in relation to the attitude of the studied HCWs. It is reported that, poor attitude pre-intervention is detected among 70% of the studied cases with 90% of nurses have poor attitude (odds ratio=4.48, 95% CI: 1.05 -22.41).

An Intervention Training Program study was conducted MA Gadallah et al., [12] on Hospital Acquired Infection Rates in Egyptian Governmental Hospitals' Intensive Care Units revealed that, The overall patient infection rate (PIR) in the 11 selected ICUs decreased substantially from 29.87 percent before the intervention to 16.29 percent after the intervention, and the overall patient day rate (PDR) also decreased substantially after the intervention (29.59 and 19.07/1000 pt. days, respectively). Similarly, the HAP rate (12.56 and 8.23/1000 pt. days, respectively), UTI rate (7.28 and 4.62/1000 pt. days, and BSI rate (9.77 and 6.22/1000 pt. days, respectively) and BSI rate (9.77 and 6.22/1000 pt. days, respectively) all decreased considerably following the intervention [12].

The Gadallah et al., [12] study findings are consistent with the current study report, it has demonstrated that, in the selected ICUs, there is statistically significant improvement of overall PIR, overall PDR and BSI rate after health education program application with change of rate from 26% to 9.7 for overall PIR, from 32.5% to 18.8% for overall PDR and from 12.6 % to 6.1% for BSI rate. Nonetheless Incidence density of HAP rate and UTI rate has changed from 10.3% to 7.2%, 9.3% to 5.5% respectively, it was not considered as a significant change $p>.05$.

Interestingly, during the investigation of the findings in the separate ICUs (medical, surgical and pediatric), we have noticed significant change with regard to Incidence density of HAP rate and UTI rate, for instance in the pediatric ICU, the HAP rate has reduced from 12.06% to 3.3% at $p<.01$. Moreover, in the surgical ICU, the HAP rate and UTI rate have decreased significantly from 7.48% to 3.8%, 4.98% to 1.26% respectively at $p<.05$.

Makris et al., [13] studied the impact of a thorough infection control program on infection rates in long-term care institutions was shown to be positive. The test locations had 743 infections (prevalence density rate, 6.33) in the year before the intervention, whereas the control houses had 614 illnesses (incidence density rate, 3.39). The test houses recorded 621 infections in the intervention year, a drop of 122 infections (prevalence density rate, 4.15); the control homes revealed 626 infections (prevalence density rate, 3.15) ($p=.06$). As a result, an infection control program that involves hand washing as well as cleaning and sanitizing the surroundings may assist to minimize infections among the elderly in long-term care facilities [13].

Gurskis et al., [14] conducted a prospective study in pediatric intensive care units to assess the prevalence rate of HAIs following a multimodal intervention, finding that the nosocomial infection (NI) prevalence rate reduced from 15.6 per 100 patients in the pre-intervention group to 7.5 per 100 patients in the post-intervention group ($p=0.002$), and the NI prevalence density decreased from 19.1 per 1000 patient-days to 10.4 per 1000 patient-days ($p=0.015$). There was also a nearly three-fold reduce in the prevalence of pneumonia, with substantial relative and absolute risk reductions for ventilator-associated pneumonia (VAP) [14].

The findings in the current study demonstrate that there is statistically significant improvement of Overall DAI rate, VAP rate, CAUTI rate, CLAB-SI rate & CLU after health education program application with change of rate from 18.2% to 14.4% for overall DAI, from 18.6% to 14.4% for VAP rate and from 12.8% to 10% for CAUT rate and from 0.257 to 0.194 for central line utilization (CLU).

Another educational intervention research done in Madinah, Saudi Arabia, found a drop in the incidence rate of HAIs from 5.5 percent to 4% when health-care workers were given lectures **[15]**.

In the same level of agreement with the current study, another large study in 11 adult intensive care units in Turkey, carried by Sunbul et al., **[16]** they reported that the high VAP rate at baseline was lowered from 31.14 to 16.82 per 1,000 MV days after the INICC multidimensional strategy was used, resulting in a 46 percent reduction in VAP rate. VAP rates were 12 percent lower 9 months after the intervention as compared to baseline VAP rates for the three months before the intervention. These VAP rates were then reduced by another 33% **[16]**.

In Argentina, research conducted by INICC showed that using a multi-dimensional strategy to VAP, which comprises a bundle of treatments, education, outcomes and process monitoring, VAP rate feedback, and performance feedback, resulted in substantial decreases in VAP rates (51.28 vs. 35.50 VAPs per 1,000 MV-days) **[17]**.

According to systematic review and meta-analysis study, The authors found that good monitoring and control programs might avoid 30-35 percent of most healthcare-associated infections (HAIs), regardless of a country's financial level **[18]**.

According to Umscheid et al., **[19]**, up to 65 percent-70 percent of CLABSI and CAUTI cases, as well as 55 percent of VAP and surgical site infection (SSI) cases, could be prevented with current evidence-based strategies, with CLABSI having the largest number of avoidable deaths and the largest cost influence **[19]**.

Conclusions:

The use of the Health Education Program was shown to be practicable and beneficial in lowering HAI rates, guaranteeing a high level of health care service quality, patient safety, and satisfaction at New-Damietta University Hospital in Egypt, according to this research. The program was linked to a decrease in HAIs in most critical care units and HAIs in general, and it was an effective strategy for managing and avoiding nosocomial infections.

Recommendations:

The Health Education Program's incorporation into ICU settings has a favorable influence on HCWs. This is supported by the present research, which found that following the training program, a greater percentage of them had strong knowledge, attitude, and practice about the nature of infection, prevention, and control techniques for nosocomial infections. As a result, enhancing the hospital system via appropriate education programs, involving short and long-term training, is critical to improving the level of knowledge, behaviors, and practice of HCWs regarding nosocomial infections.

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تأثير البرنامج التدريبى التدخلى على معدلات العدوى المكتسبة بالمستشفى فى وحدات العناية المركزة بمستشفى جامعة الأزهر

خلفية الدراسة: العدوى المرتبطة بالرعاية الصحية هى من بين الأثار الجانبية الأكثر انتشاراً فى رعاية المرضى، حيث تمثل قدراً كبيراً من المراضة والوفيات من المسلم به أيضاً أنها تشكل خطراً فى أما كن الرعاية الصحية مما يؤثر على مدة إقامة المريض ويزيد النفقات الصحية على مستوى العالم.

الهدف من الدراسة: تقييم معرفة العاملين فى مجال الرعاية الصحية وسلوكهم وممارستهم قبل تنفيذ برنامج التثقيف الصحى بمستشفى الأزهر الجامعى بدمياط الجديدة، وقياس معدلات الإصابة بالرعاية الصحية. الإلتهابات المصاحبة داخل وحدات العناية المركزة بمستشى الأزهر الجامعى بدمياط الجديدة قبل وبعد التدخل.

المرض وطرق البحث: أجريت دراسة تداخلية مستقبلية على مدار ١٥ شهراً وأجريت على أقسام وحدات العناية المركزة (وحدة العناية المركزة للأطفال والعناية المركزة) بمستشفى الأزهر الجامعى – دمياط الجديدة. فى ٢ وحدة العناية المركزة (وحدة العناية المركزة الطبية والجراحية) – ٢٠ سريراً، ووحدة العناية المركزة للأطفال – سريراً فى مستشفى للرعاية الصحية من الدرجة الثالثة، و أقام ٢٢ ووحدة العناية المركزة لحديثى الولادة مستشفى جامعة الأزهر. تمت متابعة المرضى الذين تم قبولهم فى وحدات العناية المركزة المختارة خلال فترة الدراسة إما قبل التدخل أو بعده، بأثر رجعى أثناء إقامتهم، بدءاً من تاريخ قبولهم فى وحدة العناية المركزة حتى تاريخ خروجهم من وحدة العناية المركزة. تم تضمين كلا الجنسين وجميع الفئات العمرية فى الدراسة.

نتائج الدراسة: تحسين المعرفة والمواقف والممارسات للعاملين فى مجال الرعاية الصحية بعد تطبيق التثقيف الصحى. تم الكشف عن أعلى نسبة تحسن فى المو قف (٤٣.٨٪) تليها المعرفة (١٤.٢٪) وأقل تحسن تم إكتشافه للممارسة (٦.٤١٪). معدل عدوى مجرى الدم بعد تطبيق برنامج التثقيف الصحى مع تغير المعدل من ٢٦٪ إلى ٩.٧٪ لمعدل الإصابة الإجمالى للمريض، من ٣٢.٥٪ إلى ١٨.٨٪ للمعدل الإجمالى لجهاز المريض و من ١٢.٦٪ إلى ٦.١٪ لعدوى مجرى الدم.

الاستنتاج: تطبيق برنامج التثقيف الصحى أدى إلى إنخفاض مستويات المتلازمة العالى للرعاية الصحية.