MJN

FACTORS AFFECTING NURSES' APPLICATION OF ENVIRONMENTAL SAFETY MEASURES TO PREVENT FALLS AMONG GERIATRIC PATIENTS IN FOUR HOSPITALS IN ALEXANDRIA

Hanaa Abou Elsoued Hussein[1*], Magda Mahmoud Mohamed[2]

[1]*Gerontological Nursing, Alexandria University, Egypt*
[2]*Gerontological Nursing, Damanhur University, Egypt*

[*]*Corresponding Author's Email: dr.hanaaabouelsoed@yahoo.com*

ABSTRACT

Background: Falls of geriatric patients during their hospitalization are important and lead to increase in the period of hospitalization with worse recovery conditions.

Aim: To determine factors affecting nurses' application of environmental safety measures to prevent falls among geriatric patients in four hospitals in Alexandria.

Materials and Methods: The study was carried out in different inpatient wards and units in four types of hospitals in Alexandria, Egypt. The study sample consisted of 296 nurses.

Tools: Three tools were used in this study: socio-demographic structured interview schedule, an observational checklist of nurses' application of safety measures and nurses' knowledge about fall prevention questionnaire.

Results: Nurses working in the private hospital had lower mean score of knowledge about fall prevention and higher mean score of applying safety measures to prevent falls than nurses working in the other hospitals. Also, there are positive significant relations between level of knowledge and application among nurses working in the governmental hospitals and there a negative relation between nurses' level of knowledge and their application in the private hospital.

Recommendations: In-service training program should be planned and offered periodically to nurses to update their knowledge and improve their skills about safety measures to prevent falls and fall-related injuries this will affect positively the quality of care provided.

Keywords: Fall prevention, Environmental safety measures, Geriatric patients, Gerontological Nurse, Patient safety

INTRODUCTION

Falls are one of the common causes of morbidity and mortality affecting the older adults' functioning abilities (Kane, Ouslander & Abrass, 2004). According to the National Center for Injury Prevention and control, falls are a leading cause of hospital - acquired injuries and are the common adverse events reported in hospitals which can prolong and complicate patient recovery (Ganz *et al.*, 2013).

With old age, the incidence of falls and the severity of fall-related injuries increase (Oliver, Healey & Haines, 2010). According to Centers for Disease Control and Prevention (CDC), falls are the leading cause of death and/or injuries in individuals aged 65 and older. Reviews of observational studies from 2008 to 2010 in acute care hospitals indicated that the fall incidence ranges from 1.3 to 8.9 falls/1.000 patient days and that higher rate occur in units that focus on elder care such as

neurology, ophthalmology, and rehabilitation units (Quigley, 2015).

In USA, extrapolated hospital fall statistics revealed that the overall risk of fall among hospitalized elderly patients is around 1.9% to 3.0% of all hospitalization and there are approximately 37 million hospitalizations each year. Hence, the resultant number of falls in hospitals might reach more than 1 million annually (Currie, 2008). Hitcho *et al.*, (2010) stated that in developed countries, the rates of falls among hospitalized elderly patients were 100\1000 annually with 30% to 50% resulting in injuries. In France, Resnick (2003) reported that 32% of geriatric patients were exposed to falls annually at acute care hospital.

Falls and falls-related injuries are among the most common yet most often preventable, adverse events involving the geriatric patient. Falls often result in various types of fractures such as shoulder, forearm, spine, pelvic and hip fractures. Additionally, lacerations, or internal bleeding, soft tissue or head injuries, and subdural hematoma (Weinberg *et al.*, 2011) may also occur. Even when falls don't lead to serious injuries, post-fall syndrome of anxiety, depression, loss of self confidence, and restricted mobility due to the fear of further falls may occur (Healey *et al.*, 2008). Inpatient falls have also been associated with longer length of hospital stay and higher rates of discharge to long term care institutions and even death (Dykes *et al.*, 2010)

Understanding the causes and risk factors of falls helps the gerontological nurses in developing a practical approach to prevent falls among geriatric patients in acute care hospitals (Chang *et al.*, 2011). According to Clinical Excellence Commission (2009), the causes contributing to falls among geriatric patients are multi-factorial and may be divided into two main groups; intrinsic factors (personal factors) and extrinsic factors (environmental factors).

The intrinsic factors of falls among the hospitalized elderly patients include the presence of acute and\or chronic medical conditions such as stroke, diabetes mellitus, hypertension, incontinence, Parkinson's disease and dementia. Additionally, multiple uses of certain medications, acute infection and acute infection,

confusion after post operation and sedation may increase the risk of fall among geriatric patient increase risk of falls due to age various changes occur which leads to muscles weakness, poor function of sensory motor, impaired gait, reduced peripheral sensation, poor reaction and impaired vision leading to the sudden fall of the patients. (Haines *et al.*, 2011).

The current study focuses on the environmental risk factors of falls. Regarding the hospital environmental risk factors of falls, it may include disorientation due to an unfamiliar hospital surrounding, noisy wards, improper calling system, unarranged furniture, poor lighting especially at night (Hunderfund *et al.*, 2011). Absent or improper bedrails, unclear pathway between patients' rooms and\or bathrooms, improperly fitting shoes and skidding slippers, also wet and slippery floors, absence of handrails in the bathroom and corridors, absence of rubber or nonskid mat inside the tub and absence of grab bars on the bathroom walls, all these increase the risk of fall (Stuart *et al.*, 2010). Also, improper use of mobility aids such as canes, walkers, and wheelchairs can cause accidental falls. In acute care hospitals, the highest incidence of falls occurs during transfer of patients from wheelchair to bed or when the patient tries to get up from a wheelchair without brakes.

In this respect, preventing inpatient falls is a challenge faced by many health care professionals especially the gerontological nurses. In acute care hospitals, gerontological nurses have a complex and potentially conflicting set of goals when caring for geriatric patients. Nurses need to deal with the problems that lead to patient's admission to the hospital, apply safety measures and help the patient to maintain or recover his physical and mental functions. Consequently, fall prevention must be placed against other priorities (Haines *et al.*, 2010).

Fall prevention approaches involve managing a patient's underlying fall risk factors, continuously monitoring the hospital's physical environment for safety measures as well as developing educational programs for the nursing and medical staff Patients' safety and modification of the hospitals' physical environment in order to increase safety awareness and reduce falls among hospitalized elderly patients Quigley *et al.*, 2009.

Significance of the study

Although the presence of various practices and the adoption of several safety measures to decrease the occurrence of falls, but these measures are not followed and /or not used effectively by nurses in all acute care hospitals. Hence this study needs to determine nurses' application of environmental safety measures in order to develop practical approaches to prevent falls and its related consequences among geriatric patients in acute care hospitals.

Aim of the Study: To determine factors affecting nurses' application of environmental safety measures to prevent falls among geriatric patients in four hospitals in Alexandria.

Research Questions

1. Do nurses apply environmental safety measures to prevent falls among geriatric patients?

2. What are the factors affecting nurses' application of environmental safety measures to prevent falls among geriatric patients in the four hospitals?

MATERIALS AND METHODS

Study design:

Setting: The study was carried out in different inpatient units in four hospitals in Alexandria, Egypt namely; the main University Hospital affiliated to Alexandria University, Gamal Abdel Naser Hospital affiliated to Health Insurance, Sharq El Madina Hospital affiliated to the Ministry of Health, and Loran Private Hospital affiliated to the Private sector. From each of the previous hospitals four inpatient units were selected based on the higher number of admitted geriatric patients (60 years and more) in these units.

Subjects: The study comprised of 296 nurses working in the previously mentioned settings who were available at the time of data collection and accepted to participate in the study. These included 80 nurses from the Main University Hospital, 156 nurses from Gamal Abdel Naser Hospital, 28 nurses from Sharq El Madina Hospital and 32 nurses from Loran Private Hospital.

Study method:

Tools: Three tools were used to collect the necessary data.

Tool I: Nurses' socio-demographic structured interview schedule.

This tool was designed by the researchers. It included the socio-demographic characteristics of the nurses such as age, sex, qualification, years of experience, and previous attendance of any training program about Safety measures to prevent falls for geriatric patients.

Tool II: An observation checklist of nurses' application of safety measures to prevent falls among geriatric patients. This checklist was designed by the researchers and included two parts to assess nurses' application of safety measures to prevent falls among geriatric patients.

Part I: It includes17 items such as orientation of the patient to the unit, instructions to the patients about when to get out of beds so that they don't rise up suddenly, the floors must be dry, the patients must wear suitable shoes, they must wear appropriate clothes, if the patient uses mobility aids, it must work efficiently and safely. Additionally, if the patient uses wheelchair, the brakes must be checked, instructions must be given to the patient about calling the nurse if he feels dizzy, weak, or tired, the call button must work properly, the light and switches must be efficient, the way to the bathroom must be clear, using unstable objects such as table tray must be avoided, patients must wear eye glasses or hearing aids if needed, and the blood pressure must be checked before taking anti hypertensive drugs.

Part II: This was designed to monitor the performance and responsibilities of nurses in the hospitals to keep the patients' surrounding safe so as to prevent falls. It includes items related to the measures performed by the nurse to eliminate environmental hazards in patients' rooms, corridors, stairs, and bathrooms. Each item in the checklist was classified as Yes"1" and No"0". The total score is divided into the following: Poor practices=<50%, Good practices=50% -≥70%.

Tool III: Nurses' knowledge about fall prevention among geriatric patients questionnaire. This questionnaire was developed by the researchers and used to assess nurses' knowledge about falls in the hospital. It includes two parts:

Part I: factors affecting fall are as follows:-

a) High risk group, medication used such as diuretics, antihypertensive drugs, hypoglycemic agents, sedatives and anxiolytics, also geriatric patient's diagnosis such as DM, hypertension, and urinary incontinence.

b) Environmental factors such as wet and\or slippery floors, inadequate light, absence of grape bar, absence or improper bed side rails and improper calling system.

Part II: Role of the nurse in the prevention of fall in hospitals such as:

a) Assessing the patient on admission.

b) Checking environment surrounding the patient.

c) Checking patient's clothes.

d) Reporting any incidence of fall.

Responses of nurses were measured on 2-point likert scale where"0"is given for incorrect answers and "1"for those who are correct. The total score is divided into the following: Poor knowledge=<50%, Fair knowledge=50-69%, Good knowledge=≥70%.

Administrative design

Ethical consideration

An official permission was obtained from the four hospital authorities after explanation of the purpose of the study and the schedule of data collection. Ethical consideration was taken through nurses' verbal consent to participate in the study. Anonymity and confidentiality of the collected data was maintained and the subjects' right to withdraw at any time was assured.

Pilot study

The study was carried out on 30 nurses working in Elhadara Orthopedic and Traumatology University Hospital. It was used to ensure the clarity of the tools, identify obstacles that may be encountered during data collection.

Fieldwork

After ensuring the clarity of the tools, the actual data collection started by personal interview with each nurse to collect the necessary data using tool I and tool III. It took approximately 10 to 15 minutes to complete the sheets. The researchers used to go to the previously mentioned settings on a regular schedule two days/week for each hospital during the morning, evening, and at night shifts. The researchers used to observe 6-7 nurses during their daily practice in the units using tool II. Each

nurse was observed for 30 minutes twice daily. Data collection started from the beginning of January to the end of June (2015) (six months).

Statistical Analysis

After the collection of data it was revised, coded and fed to statistical software IBM SPSS version 20. The given tables were constructed using Microsoft excel software. The 0.05 level was used as the cut off value for statistical significance. Descriptive statistics in the form of frequencies and percent were used to describe the categorical data variables. Analytical statistics which include Chi Square ($\chi 2$), Fisher Exact Test (FET), Student t-test, and ANOVA test (F-test) was done.

RESULTS

The present study was a comparative and descriptive study.

Table 1: Description of the studied nurses according to their socio-demographic characteristics (no=296)

Items	No. (n=296)	%
Age (in years):		
Less than 20	80	27.1
20 –	59	19.9
30 –	95	32.1
≥40	62	20.9
Mean±SD	**32.78±10.95**	
Sex:		
Female	292	98.6
Male	4	1.4
Qualification:		
Secondary Nursing Diploma	224	75.7
Technical Institute Diploma	25	8.4
Bachelor of Nursing	47	15.9
Years of experience:		
1 -	96	32.4
6 -	53	17.9
≥11	147	49.7
Mean ± SD	**9.27±6.99**	
Attendance of training about safety measures		
Yes	182	61.5
No	114	38.5

Table 1 clarifies that the age of the studied nurses ranges from 17 to 47 years with a mean of 32.78±10.95 years, 98.6% of the nurses are females. In relation to nurses' qualifications, secondary nursing diploma is reported by 75.7%, technical nursing diploma by 8.4%, and bachelor of nursing by15.9%. The table also shows that the nurses' years of experience in patients' care ranges from less than one year to eleven years and more with a mean of 9.27±6.99 years. Regarding nurses' attendance of training about safety measures to prevent falls in the hospital, more than half of them (61.5%) attended one training program.

Table 2: Distribution of the mean±SD of the studied nurses' application of environmental safety in the four hospitals (no=296)

Types of hospitals	Nurses' application of environmental safety				Total (n=296)		Test of significance	p
	Poor (n=228)		Good (n=68)					
	No.	%	No.	%	No.	%		
The Main University hospital (n=80)	73	91.3	7	8.8	80	100.0	$\chi^2=$ 48.488*	<0.001*
Mean±SD	30.36±27.43							
Gamal Abd Elnasar Hospital (n=156)	124	79.5	32	20.5	165	100.0		
Mean±SD	41.83±31.69							
Sharq Elmadina Hospital (no=28)	22	78.6	6	21.4	28	100.0		
Mean±SD	52.77±22. 38							
Loran Private Hospital (no=32)	9	28.1	23	71.9	32	100.0		
Mean±SD	80.850±19.37							
Total (no=296)	228	77.0	68	23.0	296	100.0		
Mean± SD	43.98±31.97						t=10.604*	<0.001*

Table 2 indicates that the highest mean score for application of safety measures to prevent falls among geriatric patients (80.850±19.37) is obtained by nurses working in Loran private hospital. While, nurses working in the other studied hospitals have lower mean scores 30.36±27.43 for those in the Main University Hospital, 41.83±31.69 for Gamal Abd Elnasar Hospital, and 52.77±22.38 for Sharq Elmadina Hospital and the difference was statistically significant χ2=48.488* P=<0.001*.

Table 3 reveals the safety measures applied by the studied nurses in the different hospitals. It is observed that nurses working in Loran private hospital obtained the higher mean score of applying safety measures in patients' rooms (85.2±26.20), in stairs (82.03±31.90), in bathrooms (77.68±29.04) and in corridors (64.79±18.95). The differences between the private hospital and the other hospitals are statistically significant $p=<0.001*$. Whereas, the lowest mean scores are obtained by nurses working in the Main University Hospital in stairs (0.64±3.98), in bathrooms (4.07±10.98), in corridors (21.56±24.49) and in patients' rooms (32.33±25.28). It is noted from the table that the lowest mean scores obtained by nurses in applying safety measures are found for stairs and bathrooms in the four studied hospitals with a score of 18.45±2.36 and 18.68±5.85 respectively.

Table 3: Nurses' application of environmental safety in patients' rooms, corridors, stairs, and bathrooms in the four hospitals (no=296)

Types of hospital	Patients' rooms				Corridors				Stairs				Bathrooms			
	No		Yes		No		Yes		No		Yes		No		Yes	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
The Main University hospital (n=80)	75	93.8	5	6.3	78	97.5	2	2.5	80	100.0	0	0.0	80	100.0	0	0.0
Mean±SD	**32.33±25.28**				**21.56±24.49**				**0.64±3.98**				**4.07±10.98**			
Gamal Abd Elnasar Hospital (n=156)	130	83.3	26	16.7	156	100.0	0	0.0	139	89.1	17	10.9	156	100.0	0	0.0
Mean±SD	**39.30±27.14**				**32.39±16.19**				**15.22±27.03**				**14.69±13.23**			
Sharq Elmadina Hospital (no=28)	21	75.0	7	25.0	28	100.0	0	0.0	28	100.0	0	0.0	28	100.0	0	0.0
Mean±SD	40.93±36.72				35.97±13.22				13.39±12.70				15.22±11.28			
Loran Private Hospital (no=32)	7	21.9	25	78.1	16	50.0	16	50.0	6	18.8	26	81.3	11	34.4	21	65.6
Mean±SD	85.23±26.20				64.79±18.95				82.03±31.90				77.68±29.04			
Total	233	78.7	63	21.3	278	93.9	18	6.1	251	85.4	43	14.6	275	92.9	21	7.1
Mean±SD	**42.53±31.39**				**33.30±22.32**				**18.45±2.36**				**18.68±5.85**			
χ^2(p)	69.191*(<0.001*)				121.173*(^{FE}p<0.001*)				127.647*(^{FE}p<0.001*)				186.480*(^{FE}p<0.001*)			
t(p)	9.692*(<0.0001*)				9.691*(<0.0001*)				12.290*(<0.0001*)				12.726*(<0.0001*)			

Table 4: Factors affecting nurses' application of environmental safety measures to prevent falls (A) Nurses' level of knowledge (no=296)

Types of hospitals	Nurses' level of knowledge						Total		Test of sig	P
	< 50% Poor		Fair 50 -69%		Goo d ≥ 70%					
	No	%	No	%	No	%	No	%		
- The Main University hospital (n=80)	29	36.3%	34	42.5%	17	21.2%	80	100%		
Mean ± SD	58.38±18.34									
- Gamal Abd Elnasar Hospital (n=156)	79	50.6%	41	26.3%	36	23.1%	156	100%	χ^2= 3·168	0.205
Mean ± SD	57.64 ± 18.23									
- Sharq Elmadina Hospital (no=28)	6	21.4%	15	53.6%	7	25.0%	28	100%		
Mean ± SD	58.49 ± 17. 03									
- Loran Private Hospital(no=32)	19	59.4%	7	21.9%	6	18.7%	32	100%		
Mean ± SD	52.20 ± 18.76									
Total (no=296)	133	44.9%	97	32.8%	66	22.3%	296	100%		
Mean ± SD	57.33 ± 18.21								F=0.991	0.398

Table 4 illustrates that 59.4% of nurses working in Loran Private Hospital have lower mean score of knowledge about safety measures to prevent falls among geriatric patients (52.20±18.76) than nurses working in the Main University Hospital 58.38±18.34, Gamal Abd Elnasar Hospital 57.64±18.23 and Sharq Elmadina Hospital 58.20±18.76 and nurses working in the Main University Hospital 58.38±18.34, Gamal Abd Elnasar Hospital 57.64±18.23 and Sharq Elmadina Hospital 58.20±18.76 but the difference doesn't reach to statistically significant level X^2=3.168, P=0.205.

Table 5: Relation between qualification, years of experience, and attendance of training program of the nurses and their application of environmental safety in the four hospitals (no=296)

Items	Nurses' Application of environmental safety															
	The Main University hospital				Gamal Abd Elnasar Hospital				Sharq Elmadina Hospital				Loran Private Hospital			
	poor (n=73)		Good (n=7)		Poor (n=124)		Good (n=32)		Poor (n=22)		Good (n=6)		Poor (n=9)		Good (n=23)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Qualification																
Secondary Nursing Diploma	63	86.3	4	57.1	112	90.3	24	75.0	14	63.6	3	50.0	6	66.7	13	56.5
Technical Nursing Diploma	5	6.8	2	28.2	2	1.6	0	0.0	3	13.6	1	16.7	3	33.3.	6	26.1
Bachelor of Nursing	5	6.8	1	14.3	10	8.1	8	25.0	5	22.7	2	33.3	0	0.0	4	17.4
χ^2(^{MC}p)	4.806(0.081)				6.448*(0.031*)				0.827(0.824)				1.480(0.637S)			
Years of experience																
1 -	12	16.4	0	0.0	67	54.0	5	15.6	5	22.7	1	16.7	2	22.2	4	17.4
6 -	12	16.4	2	28.6	12	9.7	7	21.9	2	9.1	2	33.3	5	55.6	11	47.8
≥11	49	67.1	5	71.4	45	36.3	20	62.5	15	68.2	3	50.0	2	22.2	8	34.8
χ^2(p)	1.451(^{MC}p=0.425)				15.430*(<0.001*)				2.254(^{MC}p=0.326)				0.626(^{MC}p=0.773)			
Attendance of training program about safety measures																
No	52	71.2	4	57.1	22	17.7	7	21.9	3	13.6	1	16.7	6	66.7	19	82.6
Yes	21	28.8	3	42.9	102	82.3	25	78.1	19	86.4	5	83.3	3	33.3	4	17.4
χ^2(p)	0.604 (^{FE}p=0.423)				0.287(0.592)				0.035(^{FE}p=1.000)				0.962(^{FE}p=0.370)			

Table 5 reflects that there is no relation between qualification, years of experience and attending of training program and application of safety measures among nurses working in Loran Private Hospital. Gamal Abd Elnasar Hospital is the only hospital where the qualification, years of experience and attending of training program of the nurses are significantly associated with their application of safety measures. 90.3% of nurses don't apply safety measures to prevent falls among geriatric patients who graduated from secondary Nursing Diploma while the lower percentage (1.6% and 8.1%) of them who graduated from technical nursing diploma and Bachelor of Nursing respectively and the difference is statistically significant with a score of $X^2=6.448^*$, $p=<0.031^*$. This table also shows the higher percentage (62.5%) of nurses who apply safety measures have ≥11 of experience in patients' care whereas, higher percentage (54.0%) of those who don't apply safety measures have one year to less than 6 years of experience with an observed statistical significant difference between them $X^2=15.430^*$, $p=<0.001^*$.

Table 6: Relation between qualifications, years of experience, and attendance of training program of the nurses and their level of knowledge at the four hospitals.

Items	Main university hospital (n=80)						Health insurance hospital (n=156)						Ministry of health hospital (n=28)						Private hospital (n=32)					
	<50% Poor (n=29)		50-<75 Fair (n=34)		≥75 Good (n=17)		<50% Poor (n=79)		50-<75 Fair (n=41)		≥75 Good (n=36)		<50% Poor (n=6)		50-<75 Fair (n=15)		≥75 Good (n=7)		<50% Poor (n=19)		50-<75 Fair (n=7)		≥75 Good (n=6)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Qualification																								
Secondary Nursing Diploma	29	100.0	27	79.4	11	64.7	75	94.9	34	82.9	27	75.0	4	66.7	10	66.7	3	42.9	11	57.9	3	42.9	5	83.3
Technical Institute Diploma	0	0.0	3	8.8	4	11.8	1	1.3	0	0.0	1	2.8	0	0.0	2	13.3	2	28.6	7	5.3	2	28.6	0	0.0
Bachelor of Nursing	0	0.0	4	11.8	2	23.5	3	3.8	7	17.1	8	22.2	2	33.3	3	20.0	2	28.6	1	36.8	2	28.6	1	16.7
χ^2(MCp)	11.660*(0.008*)						11.805*(0.006*)						2.717(0.740)						5.528(0.198)					
Years of experience																								
1 –	8	27.6	4	11.8	0	0.0	55	69.6	14	34.1	3	8.3	1	16.7	4	26.7	1	14.3	5	26.3	0	0.0	1	16.7
6 –	4	13.8	7	20.6	3	17.6	4	5.1	8	19.5	7	19.4	0	0.0	1	6.7	3	42.9	9	47.4	5	71.4	2	33.3
≥11	17	58.6	23	67.6	14	82.4	20	25.3	19	46.3	26	72.2	5	83.3	10	66.7	3	42.9	5	26.3	2	28.6	3	50.0
χ^2(MCp)	6.850(0.141)						45.066*(<0.001*)						5.051(0.233)						3.477(0.512)					
Attendance of training program about fall prevention																								
No	26	89.7	23	67.6	7	41.2	9	11.4	11	26.8	9	25.0	2	33.3	1	6.7	1	14.3	18	94.7	4	57.1	3	50.0
Yes	3	10.3	11	32.4	10	58.8	70	88.6	30	73.2	27	75.0	4	66.7	14	93.3	6	85.7	1	5.3	3	42.9	3	50.0
χ^2(p)	12.150*(0.002*)						5.521(0.063)						2.541(MC p=0.297)						7.709*(MC p=0.012*)					

Table 6 shows the relation between qualifications, years of experience, and attending training program of the studied nurses and their level of knowledge about safety measures to prevent fall among geriatric patients. Regarding Loran Private Hospital, there are no significant relation between the attendance of training programs and fall prevention, although it is observed to be statistically associated with higher level of knowledge. For clarification, 94.7% of those who have poor level of knowledge didn't attend any training program related to fall prevention and the difference is statistically significant $X^2=7.709*$, $p=0.012*$. In relation to Gamal Abd Elnasar Hospital, the results indicate that the years of experience in patients' care are statistically associated with higher level of knowledge. In other word, higher percentage (46.3% and 72.2%) of nurses who have fair and good level of knowledge respectively are found in those who have ≥11of experience in patients' care while, higher percentage (69.6%) of those who have poor level of knowledge are found in nurses who have one year to less than 6 years of experience in patients' care and the difference is statistically significant $X^2=45.066*$, $p=<0.001*$. This table also shows that in the Main University Hospital, all (100.0%) the studied nurses have poor level of knowledge are graduated from secondary Nursing Diploma while those who graduated from technical nursing diploma and Bachelor of Nursing have either fair or good level of knowledge and the difference is statistically significant $X^2=11.660*$, $p=0.008*$. Additionally, higher percentage (89.7%) of nurses who have poor level of knowledge didn't attend any training program about fall prevention. While, the higher percentage (58.8%) of nurses who have good level of knowledge have attended training program and the difference is statistically significant $X^2=12.150*$, $p=0.002*$.

Table 7:Correlation between nurses' level of knowledge and their application of safety measures to prevent falls at the different hospitals

Nurses' level of knowledge	Nurses' application of environmental safety	
	r	*p*
Type of hospitals		
The Main University hospital	0.615[*]	<0.001[*]
Health Insurance Hospital	0.608[*]	<0.001[*]
The Ministry of Health Hospital	0.564[*]	0.002[*]
The Private Hospital	− 0.052	0.776

Table 7 shows the correlation between nurses' level of knowledge about fall prevention and their application of safety measures to prevent falls among geriatric patients. It was found that there are positive significant relations between level of knowledge and application of safety measures among nurses working in the Main University Hospital $r=0.615*$ $p=<0.001*$, Gamal Abd Elnasar Hospital $r=0.608*$ $p=<0.001*$, and Sharq Elmadina Hospital $r=0.564*$ $p=<0.002*$. Meanwhile, there is a negative but not significant relation between the level of knowledge of the nurses and their application of safety measures is found in Loran private hospital $r=0.052$, $p=0.776$.

DISCUSSION

Application of safety measures to prevent falls among geriatric patients is a crucial role of the nurses. Statistics about the prevalence of falls in the different hospitals' units in Alexandria are not available as falls are not reported or recorded. So, it was essential to throw light on the nurses' awareness and their application of preventive measures to avoid falls in hospitals among geriatric patients. The present study assesses the nurses' application of safety measures during caring for geriatric patients (table 2). It is observed that more than three quarters of nurses working in the four studied hospitals have poor application of safety measures to prevent falls among geriatric patients. This may be due to lack of nurses knowledge about the application of safety measures. Table 4 also shows that the studied nurses (53.0%0 aged 30 years and above had graduated early thus, they don't have the updated knowledge. Additionally, these results may also be interpreted as about three quarters of them (75.7%) possess only a secondary nursing diploma (table 1) and they reported that they were not exposed to application of safety measures to prevent falls within their curriculum. These results are surprising in the private hospital context, where more than half of nurses (59.4%) have lower mean score of knowledge about application of safety measures to prevent falls among geriatric patients than nurses in the other hospitals. This is may be due to the vast majority (94.7%) of them have poor level of knowledge as they did not attend any training program related to application of safety measures to prevent falls among geriatric patients (table 6). All these findings are similar to those of Coussement *et al.*, (2008); Kuo-wei , Khang & Aimee, 2013 Manias *et al.*, (2008) as they indicated that 80.2% of nurses working in the medical, surgical, and geriatric units at five acute care hospitals in Singapore had poor knowledge regarding preventive fall measures in the hospitals. Moreover, a study by Peters *et*

al., (2005) aimed to investigate the knowledge and practice of nurses and assistant regarding fall prevention in acute care hospitals. Therefore this indicated that deficiency in nurses' knowledge is considered as a great barrier to application of safety measures to prevent falls.

Fortunately, the results of the current study revealed that nurses in the private hospital have lower mean score of knowledge, than nurses working in the other hospitals (table 4), they have higher mean score of application of safety measures to prevent falls among geriatric patients (table 2) and they obtain high mean scores in keeping the geriatric patients' surrounding safe as in patients' rooms, stairs, bathrooms and corridors (table 3). This may be because of the environmental context within the nurse's practice that allows, encourages, and supports good practice and performance in which the availability of equipments, supplies and facilities reinforced the application of safety and fall preventive measures. These measures include orientation of the patient, the unit makes sure the floors are dry; the patients must wear suitable shoes and clothes, proper calling system, proper bed side rails, proper and adequate light, and efficient and safe mobility aids. In addition to, adequate supervision, checking performance, accountability, punishment, incentives for good performance and continuously providing feedback, all these must be observed by the researcher during conduction of the current study. All of these drive the nurses to improve their practices and performance in order to keep patient safe and prevent falls and its related consequences. This is in congruence to finding that indicated that falls with serious injuries or falls of any kind have become tremendously rare in more than three years. This is because they follow the patients' safety guidelines by nurses and nurses' assistants (Australian Commission, 2012).

There is no doubt regarding the fact that appropriate knowledge is necessary but not adequate to apply safety and fall preventive measures in the hospital settings. In this context, the results of the present study reflected that although nurses in the University Hospital, Health Insurance Hospital and Ministry of Health Hospital have higher mean scores of knowledge about safety measures to prevent falls among geriatric patients (table 4), they obtained lower mean scores of application of safety measures to prevent falls among geriatric patients (table 2) and they obtain lower mean scores in keeping the geriatric patients' surroundings safe as in the previously mentioned locations (table 3). These results may be interpreted with on more than half of nurses working in Health Insurance Hospital (54.0%) who are recent

graduate and reported that they have one year to less than six years of experience in patients' care and the majority of them (90.3%) hold secondary nursing diploma only (table 5). Regarding nurses in the University Hospital, all (100.0%) nurses have poor level of knowledge and they graduated from secondary nursing diploma and higher percentage (89.7%) of nurses who have poor level of knowledge didn't attend any training program about safety measures to prevent fall among geriatric patients table 6.

The present findings are comparable to a study of Lakatos *et al.*, (2009), where they stated that most nurses working in different wards in acute care hospitals with a mean year of experience in patient care ranging from 1 to 4 years. Similar results were also reported by The Joint Commission's Sentinel Event database (2015). These findings can be related to the poor level of practice, inadequate patients' assessment, lack of adherence to protocols and safety practices, inadequate staff orientation, supervision, staffing levels or skills and deficiencies in the physical environment. All these factors are consistent with the environmental factors that may lead to many falls in patients' rooms, corridors, stairs and bathrooms which were observed by the researchers in the Main University hospital, the Health Insurance hospital, and the Ministry of Health Hospital. These environmental factors include wet or slippery floors, poor lightening, inefficient bedside rails, improper height of beds, unstable and unarranged furniture and lack of calling system.

Moreover, the researchers observed that nurses in these hospitals did not educate the elderly patients about fall preventive measures in different wards and units and how to keep themselves safe. This may be due to, lack of time, shortage of nursing staff, lack of facilities such as printed materials or brochure covering fall risks and preventive strategies and inadequate supervision. These factors may be considered as barriers to application of safety measures to prevent falls in the hospitals. These results are in the same line with a study of Rycroft-Malon *et al.* (2004). Regarding the correlation between nurses' level of knowledge about fall prevention and their application of safety measures to prevent falls among geriatric patients, the results of the current study reflect that there are positive significant relations between level of knowledge and practice among nurses working in the Main University Hospital, Health Insurance Hospital and Ministry of Health Hospital (table 7) and this is in the same line with a study done by Kuo-wei, Khang & Aimee, 2013.

CONCLUSION

Although nurses working in Loran private hospital apply measures to keep patients' surrounding safe in order to prevent falls among geriatric patients yet their knowledge was not satisfactory. On the other hand, nurses in the Health Insurance, the Ministry of Health, and University hospitals have better knowledge but poor practice than those in the private hospital. So, there are positive significant relations between level of knowledge and practice among nurses working in the governmental hospitals and there is negative relation between nurses' level of knowledge and their practice in the private hospital.

The current study recommended that:

1. In-service training program should be planned and must be offered periodically to nurses to update their knowledge and improve their skills about safety measures to prevent falls and fall-related injuries which will affect positively the quality of care provided.

2. Educational materials such as booklets, brochures, and posters about safety measures to prevent falls should be provided to the nurses in order to help them to follow safety measures during caring of geriatric patients.

3. Fall risk assessment tools should be applied by the nurses in order to identify geriatric patients at risk for falling on admission to the hospital. This will provide basic data to determine functional problems and intervene as early as possible.

4. Close supervision of nurses during their work to make sure that they are applying safety measures to prevent falls.

ACKNOWLEDGEMENT

REFERENCES

Australian Commission (2012). Safety and quality in health care: Standard 10 Preventing Falls and harm from falls, Safety, and quality Improvement Guide. Commonwealth of Australia, Sydney. Retrieved from: https://www.safetyandquality.gov.au/wp-content/uploads/2012/10/Standard10_Oct._2012_WEB.pdf.

Chang, C.M., Chen, M. J., Tsai, C.Y., Ho, L.H., Hsieh, H.L., Chau, Y.L. & Liu, C.Y. (2011). Medical conditions and medications as risk factors of falls in the inpatient older people: A case control study. *International Journal of Geriatric Psychiatry,* 26(6), pp 602-607.

Clinical Excellence Commission (2009). Falls Prevention. Retrieved from: http://www.cec.health.nsw.gov.au/patient-safety-programs/adult-patient-safety/falls-prevention.

Coussement, J., De paepe, L., Schwendimann, R., Denhaerynck, K., Dejaeger, E. & Milisen, K. (2008). Interventions for preventing falls in acute- and chronic-care hospitals: a systematic review and meta-analysis. *Journal of American Geriatric Society,* 56 (1) pp 29–36.

Currie, L. (2008). Fall and injury prevention. In: R. G. Hughes, Ed., Patient Safety and Quality: An Evidence-Based Handbook for Nurses, Agency for Healthcare Research and Quality, US Department of Health and Human Services, Rockville, pp 195-250.

Dykes, P.C., Carroll, D.L., Hurley, A., Lipsitz, S., Benoit, A., Chang, F. Meltzer, S., Tsurikova, R., Zuyov, L. & Middleton, B. (2010). Fall prevention in acute care hospitals: A randomized trial. *Journal of American Medical Association*, 304(17), pp1912-1918.

Ganz, D.A, Huang, C., Saliba, D., Shier, V., Berlowitze, D. & Lukas, C.V. (2013). Preventing Falls in Hospitals: A Toolkit for Improving Quality of Care. Agency for Healthcare Research and Quality. Retrieved from:https://www.ahrq.gov/sites/default/files/publications/files/fallpxtoolkit.pdf.

Haines, T. P., Bell, R.A. & Varghese, P.N. (2010). Pragmatic, cluster randomized trial of a policy to introduce low-low beds to hospital wards for the prevention of falls and fall injuries. *Journal of the American Geriatric Society*, 58(3), pp 435-441.

Haines, T.P. Hill, A.M., Hill, K.D. McPhail, S., Oliver, D., Brauer, S., Hoffmann, T. & Beer, C. (2011). Patient

education to prevent falls among older hospital inpatients: A randomized controlled trial. *Journal of Archives Internal Medicine*, 171(6), pp 516-524.

Healey, F. Scobie, S., Oliver, D., Pryce, A., Thomson, R. & Glampson, B. (2008). Falls in English and Welsh hospitals: A national observational study based on retrospective analysis of 12 months of patient safety incident reports. *Journal of Quality & Safety in Health Care*, 17(6), pp 424-430.

Hitcho, E.B., Krauss, M.J., Dunagan, W.C., Fischer, I., Johnson, S., Nast, P.A., Costantinue, E. & Fraser, V.J. (2010). Characteristics and Circumstances of Falls in a Hospital Setting: A Prospective Analysis. *Journal of General Internal Medicine*, 19(7), pp 732-739.

Hunderfund, A.N., Sweeney, C.M., Mandrekar, J.N. Jhonson, L.M. & Britton, J.W. (2011). Effect of a Multidisciplinary Fall Risk Assessment on Falls Among Neurology Inpatients. *Journal of Mayo Clinic Proceedings*, 86(1), pp19-24.

Kane, L.R., Ouslander, J.G. & Abrass, I.B. (2004). *Essentials of Clinical Geriatrics*. 5th Edition. McGraw-Hill, USA.

Kuo-wei, L., Khang, P. & Aimee, L. (2013). Preventing Falls in the Geriatric Population. *The Permanente Journal*, 17(4), pp 37-39.

Lakatos, B.E., Capasso, V., Mitchell, M.T., Kilroy, S.M., Lussier-Cushing, M., Sumner, L., Repper-Delisi, J., Kelleher, E.P., Delisle, L.A., Cruz, C. & Stern, T.A. (2009). Falls in the general hospital: association with delirium, advanced age, and specific surgical procedures. *Journal of Psychosomatics*, 50(3), pp 218–226.

Manias, E., Koh, S.S.L, Hutchinson, A.M., Donath, S. & Johnston, L. (2008). Nurses' perceived barriers to implementation of a Fall Prevention Clinical Practice Guideline in Singapore hospitals. *BMC Health Services Research*, 8(105), pages 10.

Oliver, D., Healey, F. & Haines, T.P. (2010). Preventing falls and fall-related injuries in hospitals. *Journal of Clinical Geriatric Medicine*, 26(4), pp 645-692.

Peters, M.A.J., Harmsen, M., Laurant, M.G.H. & Wensing, M. (2005). *Barriers and facilitator assessment instrument: introduction, instructions and instrument*. Nijmegen: Afdeling Kwaliteit van zorg (WOK), UMC St Radboud.

Quigley, P. (2015). Focus on Falls Prevention. *Journal of American Nurse Today*, 10(7), pp 28- 39.

Quigley, P., Hahm, B., Gibson, W., Powell-Cope, G., Sarduy, I., Tyndall, K. & White, S. (2009). Reducing serious injury from falls in two veterans' hospital medical-surgical units. *Journal of Nursing Care Quality,* 24(1), pp 33-41.

Quigley, P.A., Hahm, B., Collazo, S., Gibson, W., Janzen, S., Powell-Cope, G., Rice, F., Sarduy, I., Tyudall, K. & White, S.V. (2009). Reducing serious injury from falls in two veterans' hospital medical-surgical units. *Journal of Nurse Care Quality*, 24(1), pp 33-41.

Resnick, B. (2003).Preventing Falls in Acute Care. 2nd Edition. Springer Publishing Company. New York.

Rycroft-Malone, J., Seers, K., Titchen, A., Harvey, G., Kitson, A. & McCormack, B. (2004). What counts as evidence in evidence-based practice? *Journal of Advanced Nursing*, 47(1), pp 81-90.

Stuart, D., Rairigh-Wolfenbarger, J., Jennings, C., Tidwell, J., Coggins, D., Reed, A. & Rose, D. (2010). Reducing falls in the stroke population of an acute care hospital: a performance improvement approach. *Journal of Stroke*, 41(4).

The Joint Commission's Sentinel Event database (2015). A complimentary publication of Preventing falls and fall-related injuries in health care facilities, Sentinel Event Alert Issue 55, pages 5. Retrieved from: https://www.jointcommission.org/assets/1/18/SEA_55.pdf

Weinberg, J., Proske, D., Szerszen, A., Lefkovic, K., Clinic, C., El-sayegh, S., Jarett, M. & Weiserbs, K.F. (2011). An inpatient fall prevention initiative in a tertiary care hospital. *Journal of community Quality Patient Safety*, 37(7), pp 317-325.