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Nurses Patients Ratio and its Effect on Patient's Safety

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Abstract:
Background: Nurse to patient's ratio having great effect on quality of patients care provided especially patient's safety. **Aim:** This study aimed to determine the effect of nurse patient's ratio on patient's safety. **Research design:** descriptive, correlational research design was used. **Setting:** The study was conducted at Assiut Fever Hospital (Isolation, Hemodialysis and Health insurance units). **Subject:** 55 nurses were observed. **Tools :** Personal data sheet and patient's safety observational check list were used. **Results:** Nurses shortage appear in dialysis unit followed by health insurance unit and the highest percentage of shortage appear in isolation unit (53.4%, 61.5%, and 72%). Nurse patient's ratio have positive relation with nurses' application of general and medication safety standards in morning shift (0.748, 0.778) respectively. There is a positive relation between the nurse patient's ratio in evening shift (100%), but in night shift was (98.2%) for not met general patient safety standards and 100% for medication safety standards **Conclusion:** There were statistically significant differences between nurses' application of patient's safety standards dimensions and nurse patient's ratio in the three shifts **Recommendation:** Developing strategies to use nurse patient's ratio effectively and provide continuous training for nurses about national patient's safety standards.

Keywords: Patient's safety & Nurse patient's ratio.

Introduction
Nurses are the largest group of health care providers in the health care organizations who offering direct patients care for making a significant contribution by calling attention to problems and the cutting-edge solutions that have been seen to help improve patient's safety and quality of care. Nurses are providing care as safe as possible, they are an indispensable part of the multidisciplinary teams as they provide innovative solutions to improve safety and ultimately benefits for patients they cared for **(Abbott, et al., 2012).**

The issue of nurse –patient ratio (NPR) is global challenge and has extensively been debated. It seems to be a direct relation between the number of nurses and the quality of nursing care that an institution is able to provide. As workloads become more substantial and number of nurses per patients diminishes, patients and healthcare workers the world are increasingly at risk **(Ball, et al., 2014).**

Generally, the NPR has more direct impacts upon nurses and patients as it is described by **Lucero, et al. (2010)** as the number of patients each nurse has to care for at any specific point of time. This can be measured for an entire health facility, but it is more accurate to measure it separately for each ward in a hospital, as different types of wards require different types of care**. Qureshi, et al, (2018)** added that the nurse patient ratio is a term to describe the number of patients assigned to each nurse.

The American Nurses Association **(ANA, 2013)** supports a legislative model in which nurses are empowered to create staffing plans specific to each unit. This method allows hospitals to establish staffing levels that are flexible and accountable for changes including the intensity of patients' needs, the number of admissions, discharges and transfers during a shift, levels of nursing staff and their experience, layout of the unit, and availability of resources, such as ancillary staff and technology. The ratio of nurses on a particular floor, to the number of patients, must match the patients acuity level 1:6 is the normal ratio in inpatient unit as (medical and surgical) unit and 1:2 in an ICU units **(Hospital Consumer Assessment of Healthcare Providers and Systems, 2015). Qureshi**, **et al, (2018)** added that nurse patient ratio may be 1:1 for the sickest patients, nurse patient ratio is based on guidelines from professional organizations and accreditation bodies to maintain desired level of patient safety.

Safety is fundamental principle of patients care and a critical component of total quality management, safety needs a complex system-wide effort, involving a wide range of actions in performance improvement, environmental safety, including infection control, safe use of medicines, equipment safety, safe clinical practice and safe environment of care.

It embraces nearly all health care disciplines and actors, and thus requires a comprehensive multifaceted approach to identify and manage actual and potential risks to patients safety in individual services and finding broad long –term solutions for the system as a whole **(Stavrianopoulos, 2012).**

Wilson & Kurz, (2012) defined patient's safety as the effort of identification, assessment, and prioritization of risks followed by coordination and economical application of resources to minimize, monitor and control the probability and impact of unfortunate events. **World Health Organization, (2014)** defined patient safety as an indicator of quality patients care, aimed at making health care safe for both clients and health care team. Consequently, patient's safety is as a cornerstone of high-quality health care. It's a mean to provide care more safe and secure, prevents harm make nursing care in more progress and prevent unexpected accident, it has greater effects on outcomes of care such as mortality and morbidity **(Khater**, **et al., 2015)**.

Patients safety is indistinguishable from the delivery of quality health care**,** many authors view the quality of health care as the overarching umbrella under which patient safety resides. **(Institute of Medicine, 2013)** patient's safety is an important measure in assessing the quality of health care. There is a growing recognition of the need to establish a culture in hospital focused on patients safety, relatively it is a new concept in healthcare organizations **(Graban, 2018).**

Safety culture in which adverse events can be reported without people being blamed and that when mistakes occurs. Therefore, if hospitals wants to improve patients safety, it is important to know more about the views of their staff in relation to the culture of patients safety. Which is referred to patient climate is the overall behavior of individuals and organizations, based on a common set of beliefs and values that are aimed at reducing the opportunities for patient harm **(Reis, et al., 2018).**

Significance of the study:

Patient safety is considered one of the most important outcomes in the health care organizations as it considers one aspect of evaluating quality of patient care, consequently the improvement system of patients safety emphasized on nurses' patients ratio which has an effect on the quality of care provided to the patient. So, the present study will be conducted to assess nurses' patient ratio that affect patient safety at Assiut Fever Hospital which affiliated to Ministry of Health and population.

Already scientific researches have been carried out on this subject internationally by **Clarke & Donaldson, (2008):** who submitted a research about nurse staffing and patient care quality and safety, in addition to **Rochefort, et al., (2015)** who studied how to Improve patient safety by optimizing using of human resources in Canada, finally **Abdalla & Abdalla, (2017)** also reported that nurses are a key to ensure patient's safety. While nationally there wasn't researches about nurses-patients ratio and its effect on patient's safety.

Aim of the study:

Determine the effect of nurse patient ratio on patient's safety at Assiut Fever Hospital.

Research questions:

Does nurses-patient ratio have significant effect on patient's safety at Assiut fever hospital?

Subjects and Methods

Research design:

The present study was carried out using descriptive correlational research design

Setting:

The present study was conducted at Assiut Fever Hospital which affiliated to Ministry of Health and Population, with bed capacity 292 beds distributed on 10 units serving patients with fevers, liver disease and digestive system disorders. Number of nurse's (155) and the hospital serves Assiut governorate. The present study was conducted at three departments (Isolation department, Health insurance department and Hemodialysis department**.**

Sample:

Total number of nursing staff included in the study (55 nurses) works at 3 units; Isolation unit (38), Hemodialysis department (7) and Health insurance unit (10).

Tools of the study:

The data needed for the present study was collected using two tools:

Tool (I): Personal Data Sheet: was designed to collect personal data about nursing staff which including gender, age, educational qualification, and years of experience.

Tool (II): Patient safety observational checklist adapted from Egyptian Hospital Accreditation Standards, (Ministry of Health and population, 2012): used to determine nurses' performance regarding patient safety standards, it consists of two parts; **Part I** General patient safety standard which consists of (12) dimensions; 1) Patient identification includes (7items), 2) Critical results (10 items), 3) Verbal orders (6 items)**.** 4)Awareness of medical team regarding verbal orders, 5) Prevent faulty connection or disconnection of all types of pipes and catheters, 6) Evaluate the probability of a patient falling,7) Reduction or prevention any specific risk of falls, 8) Evaluate the probability of risk of exposure to bed ulcers, 9) Reduction or prevention of exposure to bed

ulcers, 10) Alarms are designed in a way that suits the place and is clearly audible, 11) Presence of a documented system for shift handover, and 12) Medical team are committed to shift handover system.

Part II Medication safety standards has ten dimensions; 1) Medication management (6 items), 2) Medication storage (7items), 3) Drug description, 4) Giving medication includes (10 items), 5) How to deal with similar medications, 6) How to deal with concentrated solutions, 7) How to separate medications, 8) How to discriminate medications, 9) Receiving drugs list during admission, and 10) Receiving drugs list during discharge.

Scoring system

Scoring of observation during three shifts were described as follow: Not Met=0, Partially Met= 1 Met=2, Not applicable= NA. The total score was totaled then the percentage was measured accordingly A=95% mean standards are met, B=80% mean standards are partially met and C=70% mean standards are not met.

Methods:

Administrative design:

An official approval had been obtained to collect necessary data from the Dean of Nursing Faculty, Assiut University, Director of Assiut Fever Hospital, Nursing Director, and Head of each department

Pilot Study:

Pilot study was carried out to assess tool clarity, applicability, time estimate before actual data collected and to identify problems that may encountered during the actual data collection phase. It applied on 6 staff nurses that represented 10% (n= 6) of total participants. Data collected from the pilot study was analyzed. No changes were done for the study tool, also the nursing staff included in the pilot study not included in the total study sample.

Field work:

The researcher met with each nurse to explain the purpose of the study and to ask for participation. After obtaining verbal consent, the researcher in this phase observed the nurse in each shift, 3 time consecutively from the beginning to the end of shift and this repeated during the three shifts while providing nursing care in morning, evening and night by using observational check list. This phase took about 8 months from the end of May 2019 to the end of January 2020.during data collection the researcher calculate actual and target number of nurses based on Ministry of Health and population standard.

Ethical consideration:

The study proposal was approved by Ethical Committee at faculty of nursing, Assiut University. The oral consent was obtained from nurses who would participate in the study. Confidentiality of obtained data was assured, and the nature, purpose and the aim of the study was explained to all nurses before starting of data collection.

Statistical analysis:

Collected data were verified prior to computerized data entry and analysis using SPSS version 20, statistical software package for social science. Data were presented using descriptive statistics in the form of frequencies, percentages, mean, standard deviation, range, Chi-square test was used to compare between quantitative variables. Independent sample t-test was used to compare quantitative variables. Anova test was used for more than two groups and Pearson correlation analysis was used for assessment of the inter-relations among quantitative variables. Statistical significance was considered at P-values ≤ 0.05 significant.

Results

Table (1): Percentage Distribution of Nurses According to their Personal Data at Assiut Fever Hospital (N=55).

Personal Data	No.	%
Gender		
Male	10	18.2
Female	45	**81.8**
Educational Qualifications		
Bachelor Degree in Nursing science	12	21.8
Diploma of Secondary Nursing School	13	23.6
Diploma of Technical institute of health (General nursing branch)	30	**54.6**
Age (Mean±SD)	**30.13±7.87**	
24 – 33 years	42	**76.4**
More than 33 years	13	32.6
Years of Experience (Mean±SD)	**8.24±8.8**	
Less than 5 years	32	**58.2**
From 5 – less than 10 years	10	18.2
10 years and more	13	23.6

Table (2): Distribution of Actual and Target Numbers of Nurses in three Selected Units at Assiut Fever Hospital (N=55).

Departments	Shift	Actual number			Target number based on national standard			Shortage	
		Manager	Nurse	Total	Manager	Nurse	Total	No	%
Dialysis Unit (Beds No.=7)	Morning	1	2	3	1	2	**3**	0	
	Evening	1	1	2	1	2	**3**	1	
	Night	1	1	2	1	2	**3**	1	
	Total	**3**	**4**	**7**	**3**	**6**	**9**	**2**	
FTE =1.6					5	10	**15**	**8**	**53.4**
Health insurance unit (beds no.=45	Morning	1	5	6	1	5	6	**0**	
	Evening	0	2	2	-	5	5	**3**	
	Night	0	2	2	-	5	5	**3**	
	Total	**1**	**9.**	**10**	**1**	**15**	**16**	**6**	
FTE =1.6					2	24	26	**16**	**61.5**
Isolation Unit beds no.= 52	Morning	3	26	29	3	26	29	**0**	
	Evening	3	2	5	3	26	29	**24**	
	Night	2	2	4	3	26	29	**25**	
	Total	**8**	**30**	**38**	**9**	**78**	**87**	**49**	
FTE =1.6					15	125	140	**102**	**72**

Table (3): Mean and Standard Deviation of Nurses Application of all Dimensions of General Patient's Safety Standards in Different Shifts at Assiut Fever Hospital (N=55).

General Patient's safety Standards	Max Score	Morning	Evening	Night	P. value
		Mean±SD	Mean±SD	Mean±SD	
▪ Patient identification	14	13.66±0.59	3.5±2.22	1.36±2.12	0.000
▪ Critical results	20	19.57±0.84	11.79±2.06	10.54±1.74	0.000
▪ Response to verbal orders	14	13.82±0.44	5.9±1.56	4.84±1.13	0.000
▪ Awareness of verbal orders	2	2±0	1.95±0.34	1.96±0.27	0.000
▪ Prevent faulty connection of pipes	2	1.96±0.11	0.57±0.52	0.24±0.37	0.000
▪ Evaluating patients fall	2	1.88±0.23	0.51±0.5	0.34±0.46	0.000
▪ Measures to prevent patients falls	2	1.83±0.28	0.28±0.31	0.18±0.34	0.000
▪ Assess and record bed ulcers	2	1.89±0.2	0.48±0.33	0.38±0.4	0.000
▪ Measures to prevent bed ulcer	2	1.89±0.2	0.37±0.32	0.32±0.41	0.000
▪ Alarms in suits place and audible	2	1.95±0.12	0.5±0.46	0.47±0.5	0.000
▪ There is a system of documenting shift hand over	2	1.98±0.12	1.76±0.39	1.34±0.74	0.000
▪ Commitment to shift hand over	2	1.98±0.1	1.78±0.1	1.76±0.16	0.000
Total Score	66	**64.24±1.71**	27.7±5.12	**22.08±6.28**	0.000

*One-way ANOVA test, * statistically significant difference (p≤ 0.05) ** highly statistically significant difference (p≤0.005).*

Table (4): Mean and Standard Deviation of Nurses Application of all Dimensions of Medication Safety Standards in Different Shifts at Assiut Fever Hospital (N=55).

Medication Safety Standards	Max Score	Morning	Evening	Night	P. value
		Mean±SD	Mean±SD	Mean±SD	
Medication management	12	11.79±0.63	5.14±1.55	2.8±3 as	0.000
Medication storage	14	13.56±0.85	5.68±1.83	3.54±2.01	0.000
Drug description	2	1.88±0.4	0.61±0.38	0.21±0.34	0.000
Giving medication	18	17.87±0.23	12.08±3.92	11.31±4.57	0.000
Dealing with similar medications	2	1.95±0.12	0.32±0.38	0.1±0.21	0.000
Dealing with concentrated solutions	2	1.85±0.25	0.36±0.35	0.3±0.38	0.000
Separation of medications	2	1.86±0.2	0.28±0.35	0.22±0.3	0.000
Discrimination medications	2	1.86±0.22	0.37±0.37	0.24±0.34	0.000
Receiving drugs list during admission	2	1.8±0.35	0.47±0.47	0.39±0.5	0.000
Receiving drugs list during discharge	2	1.81±0.28	0.36±0.54	0.33±0.42	0.000
Total Score	58	**56.3±1.8**	25.66±5.99	**19.59±10.28**	0.000

*One-way ANOVA test, * statistically significant difference (p≤ 0.05) ** highly statistically significant difference (p≤0.005).*

Table (5): Relation between Patient's Safety Standards with Nurse Patient's Ratio at Assiut Fever Hospital (N=55).

General Patient's safety Standard	Morning		Evening		Night		P. value
	Actually nurse (38)		Actually nurse (9)		Actually nurse (9)		
	No.	%	No.	%	No.	%	
Met	46	**83.6**	0	0.0	0	0.0	**<0.001**
Partially met	9	16.4	0	0.0	1	1.8	
Not met	0	0.0	55	**100.0**	54	**98.2**	
R	**0.748**		**-**		**0.770**		
P	**<0.001****		**-**		**<0.001****		
Medication Safety Standard							**<0.001**
Met	42	**76.4**	0	**0.0**	**0**	**0.0**	**<0.001**
Partially met	13	23.6	0	**0.0**	**0**	**0.0**	
Not met	0	0.0	55	**100.0**	55	**100.0**	
R	**0.778**		**-**		**-**		
P	**<0.001****		**-**		**-**		

- *Chi square test for qualitative data between the two groups*
  **Significant level at P value ≤ 0.05, **Significant level at P value ≤ 0.005*
- *Spearman's Correlation, **Statistically Significant Correlation at P. value <0.01*

Table (1): Shows that the highest percentages of nurses (81.8%) were females, more than half of them have diploma of technical institute of health and had years of experience less than 5 years (54.6%, 58.2%) respectively, more than three quarter of them aged from 24 -33 years old (76.4%),

NB. Target numbers was calculated by multiply actual number of nurses which defined of nurses number 1.6 % (full time equivalent) according to Ministry of health and population, **(2012).**

Table (2): Reveals the distribution of actual and target numbers of nurses in selected units per shifts, there are adequate numbers of nurses in morning shift, while nurses shortage appear in dialysis unit followed by health insurance unit and the highest percentage of shortage appear in isolation unit in both evening and night shift (53.4%, 61.5%, and 72%) respectively.

Table (3): Appears that there are statistically significant differences between nurses' application of all general patient's safety standards dimensions in the three shifts. p≤ 0.000. Moreover, nurses achieve highest mean score in application of all general patient's safety standard dimensions in morning shift (64.24±1.71), meanwhile nurses achieve lowest mean score in application of all general patient's safety standard dimensions in night shift (22.08±6.28).

Table (4): Reveals that there statistical significant difference between nurses application of all medication safety standards dimensions in three shifts P ≤ 0.000 Also, nurses achieve highest mean score in application of all medication safety standard dimensions in morning shift (56.3±1.8), while lowest mean score appear in night shift (19.59±10.28).

Table (5): Shows that the nurse patient's ratio have positive relation with nurses application of general and medication safety standards in morning shift (0.748, 0.778) respectively. There are positive relation between the nurse patient's ratio in general and medication safety standards in evening shift (100%) for both, but in night shift was (98.2%) for general patient safety standard and 100% for medication safety standard.

Discussion

The present study was conducted with the aim to determine the effect of nurse patient's ratio on patient's safety at Assiut Fever Hospital in Assiut city. The present study confirmed that the highest percentage of studied nurses were female. More than half of them have diploma of technical Institute of Health and had less than 5 years of experience, more than three quarter of them aged from 24 -33 years old **(Table1)**.

The findings of the present study revealed that the distribution of nurses in the three selected units, actual number of nurses matched the target number in morning shift only, but there was shortage in both evening and night shift at dialysis unit, health insurance and isolation unit (53.4%, 61.5%, and72%) respectively **(Table 2).**

From the researcher point of view this is because the general mal-distribution of nurses from Ministry of Health and Population as the actual state practice act gives nurses right to work at she life to keep family integrity, this mal-distribution may affect generally all vital Hospitals (University Hospitals, Ministry of Health and Population Hospitals and Insurance Hospital) so hospital directors try to idealize the number in morning shifts (to cope with the peak of the work).

The findings of present study goes in the same line with study done by **Barker& Nussbaum, (2011)** and **El Seesy& El Sebaey, (2015)** as they found that nurses in morning shift account nearly half of the total number of nurses, But **Ferri, et al., (2016)** was in contrary with the present study findings as they found that more than three quarter of nurses works night shift, also less than one quarter of nurses works in morning shift, when studying the impact of work shift on psychological and physical health of nurses in general hospitals.

The present study findings revealed that there are a significant statistical differences between nurses application of all general patient's safety standards dimensions in the three shifts, also nurses achieve highest mean score in application of all dimensions of general patient's safety standards in the morning shift and the lowest mean score in the night shift **(Table3).** This may be due to presence of nurse managers in morning shifts more than in evening and night shifts who provide close supervision also adequate number of nurses in morning shift which provide excellent chance to care for patients in comfortable manner but in night shift there are shortage of nurses leads to inability of nurses to apply all dimensions of general patient's safety standards.

This finding supported by **El-Demerdash, & Obied (2017)** as they found that more than half of nurses don't apply patient's safety in evening and night shifts due to inappropriate nurse patient ratio. Also **Abdel-latif, et al. (2018)** confirmed the present study finding as they found that the highest percentage of observed nurses in the morning shift adherent to the national standards of patients safety, while the least percentage of nurses' adherent to the national standards of patients safety was observed at the night shift.

The current study findings reveals that there are highly significant statistical difference between nurses application of all medication safety standards dimensions in three shifts. Also**,** nurses achieve highest mean score in application of all medication safety standard dimensions in morning shift, while nurses achieve lowest mean score in application of all medication safety standard dimensions in night shift **(Table 4).**

From the researcher's point of view, medication safety standards in morning shift is applied more than others shifts because of periodic inspection by the quality improvement teams (pharmacist, nurse and physician) and safety medicine committee which provide continuous and daily round, close supervision in morning shift.

The present study findings agree with study done by **Cho, et al., (2015)** as they found that there was significantly relationship between shortage nurses patient ratio and medication administration and medication management standards. In addition to the current study findings consistent with study done by **Treiber & Jones (2018**) as they confirmed that more than half of the root causes of sentinel events during application of medication safety standards was nurse's shortage especially in both evening and night shifts. In addition to **Araby, et al., (2018)** as they found that the highest percentage of occurring in medication safety standard errors because of inadequate nurses' number working in night shift. And **Salami, et al., (2019)** agree with the present study findings that more than three fourth of nurses apply medication management during the morning shift, but the lowest percentage of nurses apply these standards in evening and night shift.

The current study found nurse patient's ratio have positive relation with nurses' application of general and medication safety standards in the morning shift. There are positive relation between the nurse patient's ratio in general and medication safety standards in the evening and night shift **(Table 5).**

This can be explained by the presence of adequate number of nurses which permit completing the procedures and standards in the morning shift more than other shifts and the presence of continuous inspection, follow up by quality improvement committee and infection control committee.

The study done by **Aly, (2014)** goes in the same line with the present study findings as he found the majority of nurses reported that work load and inadequate number of nurse to patient especially in the night and evening shifts increase patient injury related to falls, decubitus / pressure ulcer and medication administration error, when studying the impact of nursing safety climate on reporting patient safety events, and **Rahman, et al., (2015)** similarly indicated that suitable nurse patient's ratio has positive relation with nurse's application of general patient's safety and medication safety standards, when studying nurse level of education, quality of care and patient safety.

In the same line with the present study findings **Driscoll, et al., (2018)** found significant correlation between total nurses patient ratio and lower incidence of hospital acquired pressure ulcers, when studying the effect of nurse-to-patient ratios on nurse-sensitive patient outcomes.

Conclusions

- Highest percentage of study sample were female more than half of them have diploma degree from technical institute of health (General nursing branch) and more than 5 years of experience.

- There are adequate numbers of nurses in morning shift, while nurses' shortage appears in dialysis unit followed by health insurance unit and the highest percentage of shortage appear in isolation unit in both evening and night shift
- There is statistically significant difference between the nurse patient's ratio with application of general and medication safety standards in morning shift. Nurse patient's ratio have positive relation with nurse's application of general and medication safety standards in morning shift. In contrary there are positive relation between the nurse patient's ratio with not met general and medication safety standards in evening shift for both.

Recommendations

Based on the results of the current study, it was recommended that:

1. Provide enough resources which required for applying the national safety standards.
2. Encourage close supervision and evaluation until patient safety standard application become adherent in all nurse attitude.
3. Establish patient safety committee as a part of quality improvement committee.
4. Reward nurses who become role model in application of patient safety standard.
5. Provide continuous training for nurses about national patient safety standards.
6. Create disciplinary policies for nurses who not committed to apply of national safety standards.
7. Ministry of health and population make study of distribution of nurses all over the country to overcome this problem

References

- **Abbott, A., Fuji, K., Galt, K. & Paschal, K.(2012):** How Baccalaureate Nursing Students Value an Inter professional Patient Safety Course for Professional Development. International Scholarly Research Network ISRN Nursing Volume 2012, Article ID 401358, 7 pages doi:10.5402/2012/401358
- **Abdel-latif, R., Ezz Elden, N. & Abdel-Alim, E. (2018):** Nurses Adherence to the National Standards of Patient Safety. The Medical Journal of Cairo University, 86 (September), 3359 - 3367. www.medicaljournalofcairouniversity.net
- **Abdalla A., & Abdalla A. (2017):** Nurses are a key to ensure patient safety: A systematic review. International Journal of Research Studies in Medical and Health Sciences, 2(9), 10-15.
- **Aly, N. (2014):** The impact of nursing safety climate on reporting patient safety events in some Egyptian nursing units. European Scientific Journal, 10(36), 111-133.
- **Aray, E., Eldesouky, R. & Abed, H. (2018):** Medical errors among nurses in the university Hospital of Benha, Egypt: forms, underlying factors and reporting. Biomedical Journal, 1, 8.
- **All, J., Murrells, T., Rafferty, A., Morrow, E., & Griffiths, P.(2014):** 'Care left un done' during nursing shifts: associations with workload and perceived quality of care. BMJ quality & safety, 23(2), 116-125.
- **Barker, L. & Nussbaum, M. (2011):** Fatigue, performance and the work environment: a survey of registered nurses. Journal of advanced nursing, 67(6), 1370-1382.
- **Cho, E., Chin, D., Kim, S. & Hong, O. (2016):** The Relationships of Nurse Staffing Level and Work Environment with Patient Adverse Events. Journal of Nursing Scholarship Jan;48(1):74-82. doi: 10.1111/jnu.12183. Epub 2015 Dec 7.
- **Clarke, S., Donaldson, E. (2008):** Nurse staffing and patient care Quality and Safety California, Pennsylvania
- **Driscoll, A., Carroll, D., Dalton, S., Deaton, C., Jones, I., Lehwaldt, D., McKee, G., Munyombwe, T.& Astin F. (2018):** The effect of nurse-to-patient ratios on nurse-sensitive patient outcomes in acute specialist units: a systematic review and meta-analysis. European Journal of Cardiovascular Nursing, 17(1), 6-22.
- **El-Seesy, N. & El-Sebaey, F. (2015):** Emergency Department Nurses' Perceptions toward Factors Influencing the Occurrence of Medication Administration Errors Alexandria University, Department of Nursing Administration, Faculty of Nursing, Alexandria, Egypt Aug 19, 2015J 4: 289. doi:10.4172/2167-1168.1000289
- **El-Demerdash, S. & Obied, H. (2017):** Intensive Care Unit Nurses' Uncertainty and Patient Safety Culture. International Journal of Studies in Nursing, 3(1), 110.
- **Ferri, P., Guadi, M., Marcheselli, L., Balduzzi, S., Magnani, D., & Di Lorenzo, R. (2016):** The impact of shift work on the psychological and physical health of nurses in a general hospital: a comparison between rotating night shifts and day shifts. Risk management and healthcare policy, 9, 203.
- **Graban, M. (2018):** Lean hospitals: improving quality, patient safety, and employee engagement. Productivity Press.
- **Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS), (2015):** Survey -Analyses – Summary and results April 2014 to March 2015 https://medical –dictionary. The free dictionary
- **Institute of Medicine (IOM), (2013):** Health IT patient safety: Building Safer Systems for Better

Care (National Academy Press, 2012) (hereinafter (IOM Report), 21, available at http:/ www. Iom .edu/ Reports /2011/Health IT and Patient safety: Building Safer Systems for Better Care .aspx (Last accessed May 17, 2013).

- **Khater, W., Akhu-Zaheya, L., Al-Mahasneh, S., & Khater, R. (2015):** Nurses' perceptions of patient safety culture in J ordanian hospitals. International Nursing Review, 62(1), 82-91.
- **Lucero, R., Lake, E. & Aiken, L.(2010):** Nursing care quality and adverse events in US hospitals. J ClinNurs. 2010 Aug;19(15-16):2185-95. doi: 10.1111/j.1365-2702.2010.03250.x.
- **Ministry of Health, (2012):** Egyptian Hospital Accreditation standards, Egyptian Patient Safety, Egyptian Medication Management, Egyptian Information Management No.1Pp.1-16.
- **Qureshi, S., Purdy, N., & Neumann, W. (2018):** Simulating the Impact of Patient Acuity and Nurse-Patient Ratio on Nurse Workload and Care Quality. In Congress of the International Ergonomics Association (pp. 528-535). Springer, Cham.
- **Rahman, H. & Mu'taman Jarrar, M. (2015):** Nurse level of education, quality of care and patient safety in the medical and surgical wards in Malaysian Private Hospitals: A cross-sectional study. Global journal of health science, 7(6), 331
- **Reis, C., Paiva, S., & Sousa, P. (2018):** The patient safety culture: a systematic review by characteristics of hospital survey on patient safety culture dimensions. International Journal for Quality in Health Care, 30(9), 660-677.
- **Rochefort, C., Buckeridge, D., & Abrahamowicz, M. (2015**): Improving patient safety by optimizing the use of nursing human resources Published: 14 June 2015
- **Salami, I., Subih, M., Darwish, R., Al-Jbarat, M., Saleh, Z., Maharmeh, M., & Al-Amer, R. (2019):** Medication administration errors: Perceptions of Jordanian nurses. Journal of nursing care quality, 34(2), E7-E12.
- **Stavrianopoulos, T. (2012):** The development of patient safety culture. Health Science Journal, 6(2), 201.
- **The American Nursing Association, (2013):** "Nurse Staffing Plans and Ratios," December, 2012. (accessed January 17, 2013).
- **Treiber, L. & Jones, J. (2018):** After the medication error: Recent nursing graduates' reflections on adequacy of education. Journal of Nursing Education, 57(5), 275-280.
- **Wilson, D. & Kurz, J. (2012):** Risk Management in Tissue and C ell Processing. Tissue and Cell Processing, 27-43.
- **World Health Organization, (2014):** Guide for Developing National Patient Safety Policy and Strategic Plan . Patient Safety unit/ health systems and services cluster , WHO African Region , Brazzaville . December 2014.