American Journal of Nursing Research, 2020, Vol. 8, No. 4, 452-462
Available online at http://pubs.sciepub.com/ajnr/8/4/5
Published by Science and Education Publishing
DOI:10.12691/ajnr-8-4-5

Nurses' Satisfaction Related to Implementing Patient Acuity Tool-Based Assignment

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Received April 06, 2020; Revised May 08, 2020; Accepted May 15, 2020

Abstract Nurses' assignment that based on patient acuity tool scores regulates the number of nurses on a shift according to the patients' needs, thus balancing nurses' workload and enhancing nurses' satisfaction with assignment. This study aimed at assessing nurses' satisfaction related to implementing of patient acuity tool-based assignment. Experimental posttest only design was used**.** This study was conducted in critical care units at the Menoufia University Hospitals in Shebin Elkom. Simple random sample of nurses was selected from the previous units that was divided equally into two groups: experimental group (n=89) and control group (n=89). Additionally, all first line managers of the same units were selected (n=33). Tools used for data collection included: **(1):** Nurses' Satisfaction with the Methods of Assignment questionnaire (posttest only). **(2):** First line managers Opinion Sheet to measure their opinion regarding implementation of the acuity tool-based nurses' assignment. Results of the current study revealed that the majority of nurses in the experimental group were satisfied with method of assignment that based on acuity scores after implementation of the program. Also, there was no statistically significant difference between nurses' satisfaction in the experimental group and their personal data except regarding their educational level and years of experience that was highly statistical. In conclusion, implementation of Kidd et al., new patient acuity tool was effective in improving nurses' satisfaction with assignment. Moreover, the highest percentage of first line managers agreed on implementation of the patient acuity- tool based assignment. Continuous incorporation of the patient acuity tool in nurses' assignment and generalization in other nursing units is a significant implication to promote proper distribution of nursing shift assignments and better nurses' satisfaction.

Keywords: *nurses' assignment, patient acuity, nurses' satisfaction, critical care units*

Cite This Article: Marwa Hassan Ageiz, and Hind Hassan Abd El-mageed, "Nurses' Satisfaction Related to Implementing Patient Acuity Tool-Based Assignment." *American Journal of Nursing Research*, vol. 8, no. 4 (2020): 452-462. doi: 10.12691/ajnr-8-4-5.

1. Introduction

Nurses' Assignment refers to a written delegation of tasks in order to care for a bunch of patients by trained nurses assigned to the unit where assignments of accountability provide the structure for nursing care delivery in most in-patient hospital settings and optimally match individual nurse characteristics to specific patient needs [1].

To be equitable, assigning nurses should be based on: firstly, nursing needs of every patient and time approximately required for caring for him. Secondly, the skill level, the capabilities, previous experiences and the interest of the staff nurses. Thirdly, the job description [2]. Also, it must be planned every week, and revised every day if necessary to ensure care continuity, take into account all the direct, indirect and unit activities, consider the assigned duties and the geographical location of the unit to save time and effort of nurses, it must be balanced among nursing staff and never to give the same duty to more than one staff nurse [3].

Traditional system of staff assignment included volume-based assignment, which based on patient census without consideration of the acuity of the patient, the competency of nurses and workload demanded of the nurse. Consequently, the nurse may not have the time or ability to recognize changes in the patient's condition [4].

Improper nurses' assignment that based on traditional methods often leads to negative consequences for both patient and nurses: First, Patients in critical care units are vulnerable and need more nursing care due to the complexity care, patient acuity, and co-morbidities. Failure to identify patient decline, lack of knowing when to escalate care and the deficiencies in not recognizing and responding to patient deterioration can have significant effects on patient outcomes [5,6].

Second: when nurses' assignments are not consistent, objective, and quantifiable, nurses' dissatisfaction results [5]. Nurses' dissatisfaction can produce barriers to the ability to adapt and threaten teamwork spirit that are so important to quality patient care Moreover, feeling of incompetency and frustration are created among nurses. [7].

The advanced system of staff assignment based on Patient Classification/Acuity system that refers to

measurement systems in nursing which reflect actual patient care needs for staffing purposes [8]. Acuity tool-based assignment is an evidence-based method to use an objective acuity tool to establish nurses' assignments. The intended tool utilized both clinical patient criteria and workload indicators for scoring patients from 1 to 4 based on their acuity level. Acuity tool used to measure the intensity of nursing care required by a patient also evaluates the complexity of patient care and assigns a numeric value based on predetermined criteria [9].

Kidd et al.'s [10] developed their own acuity tool that examined five acuity categories of criteria. These categories included, the complicated procedures, the education, the psychosocial or therapeutic interventions, the oral medications, and the complicated I.V. drugs and other medications (Appendix I) *Chiulli et al.* [11] developed an acuity tool which incorporated clinical severity and nurse workload indicators to determine acuity and is used to make nurses' assignments in alignment with appropriate skill mix and staffing ratios**.**

According to an acuity-based staffing system, number of nurses per shift can be regulated according to the patients' needs not according to patient census. Through trialing the acuity tool, nurses were "able to have an objective tool to use in assessing patient acuity to provide safe care, adjust staffing ratios, and balance unit workload [12].

Nurses' assignment that based on acuity system provided the nurses with the power to score their patient, and then report to the charge nurse so that assignments of the next shift are quantifiable and equitable. It also gives them the opportunity to assess the level of patient safety risk [9]. Nursing sensitive indicators such as falls, pressure ulcers, nosocomial infections, medication errors, patient satisfaction, and pain management depend mainly on the nursing care and are affected by the ability that nurses have to identify and intervene when a patient has any changes [13].

Nurses' assignments that based on patient acuity scores helped nurses to add value as they included in evaluating their own workloads and taking decisions related to resources. Nurses are able to categorize patients according to certain criteria which is essential to drive nurses' competencies, providing nurses with autonomy and professional independence, improves ownership of their practice, enhances job satisfaction, and promotes advocacy for patients [10].

1.1. Significance

According to researchers' observations in the clinical settings, nurses' assignments were made according to traditional method by assigning blocks of rooms to nurses usually in sequential order or distributing equivalent number of patients among nurses which led to grouping patients with high needs together thus, misbalancing workloads. Additionally, nurses are overburdened by the care requirements for multiple patients which decrease the ability to recognize subtle changes or meet all the needs for care. Consequentially, the aim of this study was to assess nurses' satisfaction related to implementing of patient acuity tool-based assignment.

1.2. Research Question

1. Will the experimental group be satisfied with the implementation of the acuity tool-based assignment after the training program?
2. Is there a difference in nurses' satisfaction between both groups regarding the methods of assignment after the training program?
3. Is there relation between satisfaction of the experimental group post-intervention and their personal data?
4. What are first line managers' opinions regarding the implementation of patient acuity tool-based assignment?

2. Methodology

2.1. Design

Experimental, posttest only (after 3months), control group design was utilized.

2.2. Setting

This study was conducted in critical care units at Menoufia University Hospitals, Shebin El-kom, Menoufia governorate, Egypt.

The critical care units included:

1. General Intensive Care Units in Emergency Hospital which has three specialties (medical intensive care unit, cardiac intensive care unit, and psychiatric intensive care unit),
2. Pediatric Intensive Care Unit and Anesthesia Intensive Care Unit in Specialty Hospital.
3. Intensive Medical Care Unit in Main University Hospital

2.3. Study Subjects

The participants of this study included:

- Simple random sample of nurses was selected from the previous units that was divided equally into two groups: experimental group (n=89) and control group (n=89). **[Total= 332]**
- All first line managers of the studied critical care units (n = 33).

2.4. Sample Size

The sample size was calculated using the following formula [14]:

$$S = \frac{X^2 NP(1-P)}{d^2(N-1) + X^2 P(1-P)}$$

2.5. Data Collection Tool

Tool 1: ***Nurses' Satisfaction with the Methods of Assignment Questionnaire*** which was developed by the researcher based on review of literature to measure nurses' satisfaction with assignment after implementation of acuity tool-based assignment**.**

The tool consisted of two main parts

Part 1: included personal data of study subjects (age, gender, marital status, educational qualification, years of experience and clinical area)

Part 2: included 25 items divided into two main dimensions: criteria of proper nurses' assignment (12 items) and outcomes of proper assignment (13 items).

Tool 2: ***First line managers' Opinion poll sheet Regarding Patient Acuity Tool implementation:***

This tool was developed by the researcher based on review of literature and consisted of 10 items to measure first line managers' opinions regarding implementation of the acuity tool for nurses' assignment.

Scoring system of tools:

Tool 1: The subjects' responses were rated on a three-point Likert Scale (disagree, neutral and agree). Disagree item was assigned a score of "one", neutral item was assigned a score of "two", and agree item was assigned a score of "three". Nurses' satisfaction was reflected according to their level of agreement as the following:

- Satisfied (>75% of total score)
- Not satisfied (≤75% of total score)

Tool 2:

The subjects' response was rated on a three-point Likert Scale (disagree, neutral and agree). Disagree item was assigned a score of "one", neutral item was assigned a score of "two", and agree item was assigned a score of "three". Therefore, based on this scoring their agreement of acuity tool implementation rated as the following:

- Disagree (≤ 55%)
- Neutral (55% - 77%)
- Agree (77%)

Validity of tools:

A jury of five experts in nursing management was assigned to assess face and content validity of the tools. Based on this jury, some items were rephrased and the tools appeared to be valid for actual data collection.

Pilot Study: before actual data collection, pilot study is conducted by the researcher by distributing questionnaire on 10% of study sample from different clinical areas who were not included in the main study sample to fill out the questionnaire to ascertain clarity and applicability of the study tool and to determine obstacles that may be encountered during data collection.

Reliability of tool:

A test- retest reliability was conducted for the tool (1) and tool (2), the reliability coefficient was **(**Cronbach's α =0.89) & (0.96) receptively.

2.6. Procedures

I: Preparation phase:

• Sampling frame and subjects' selection:

Researcher got a list of all nurses and first line managers actually worked at the critical care units before starting the program implementation. A code sheet was developed. Then, the researcher assigned code numbers randomly to every participant by pulling a number from the pool who were later assigned into control group and experimental groups.

• Educational materials:

The researcher prepared educational courses regarding definition, importance, principles of Nurses' assignment, outcome that achieved by proper nursing assignment, factors affecting assignment pattern, direct and indirect patient care services, methods of patient care delivery, factors contribute to choose which modes will be used in delivering patient care, and selecting the optimum mode of organizing patient care.

Educational courses also were prepared regarding patient classification systems, patient acuity, importance of using acuity-based assignment, comparing equality in nurses' assignments before and after implementing acuity-based assignment, patient-related factors included in the acuity tool and acuity tool-development strategies.

II. Implementation phase:

- Educational sessions were provided by the researchers for first line managers and the experimental group nurses regarding theoretical content of the program through PowerPoint presentation in the teaching room.
- Training sessions about utilization and filling out the acuity tool also provided for study subjects in a group setting and individually**.** Specific examples of typical patients on the unit and case studies were provided to facilitate application of tool from actual patient data and to practice assigning acuity scores to their patient groups.
- Nurses were trained on calculation of acuity level for each patient by summing up required numbers throughout all acuity categories to get a complete acuity score starting from 1 to 60 then handing out these tools to their first line managers. Rating options on the tool range from one through four, in which 1 indicating low acuity and 4 indicating high acuity.

Acuity category scores calculated as follows:

Level 1 acuity 1: 15.
Level 2 acuity 16:30.
Level 3 acuity 31: 45.
Level 4 acuity > 45 or new admission.

- First line managers were educated and trained concerning their role in acuity tool-based nurses assignment including: -
  - Collecting the acuity tool from each nurse, examine and record acuity scores, evaluate these scores of each patient through walking round on the unit.
  - Revising the list of nurses in the next shift, develop unit acuity score and acuity tool-based nurses' assignment sheet for the oncoming shift based on acuity scores. (Appendix II, III) [15].
  - Abide by the rules that govern equitable nurses, assignment such as, the average distribution of total acuity between highest and lowest nurse assignments not exceed 5%. Proper matching between nurses' experience, preferences, personality, and safety and patient needs, thus balancing workload among the nurses. [16]
- The researchers were available during variety of shifts and to answer any questions, address concerns, and remediate the implementation of the acuity tool. Also, to provide additional informal individual training sessions and coaching on the use of the acuity tool**.**

- Multiple copies of the Unit Acuity Score worksheets and assignment sheets were made and placed on a clipboard where the assignments were written.

III. Evaluation phase:

- To assess impact of the training program, A posttest assessment was conducted by the researchers after 3 months to obtain tangible results concerning nurses' satisfaction with assignment that based on acuity scores and first line managers' opinions regarding of implementation of acuity tool.

Ethical Considerations

A letter of approval was secured from the dean of Faculty of Nursing to the director of the hospital and nursing director at which study was conducted. The participants were asked orally for their participation approval. The researchers clarified to the participants that their participation in the study is optional and they are able to withdraw from the study at any time. Additionally, research subjects' anonymity and confidentiality were secured by explaining to subjects that, no names on the questionnaires were written and all information was required for research purpose only.

2.7. Data Analysis

The collected data was refined by the researcher for any repeated or missed responses, then computerized, coded, analyzed and tabulated. Data were statistically analyzed using an IBM personal computer with Statistical Package of Social Science (SPSS) version 22 (SPSS, Inc, Chicago, Illinois, USA). Quantitative data were presented in the form of mean ($\bar{X}$), standard deviation (SD), range, and qualitative data were presented in the form numbers and percentages. Chi-square test ($\chi 2$): was used to study association between two qualitative variables. Fischer exact test: for 2 x 2 tables when expected cell count of more than 25% of cases were less than 5.

3. Results

Table 1 presented personal data of the studied subjects (experimental group and control group). As indicated in this table, the highest percentage of both groups was between 30-40 years old, females, had a bachelor degree in nursing, and married. Regarding their years of experience, the highest percentage of studied group worked from five to ten years but in control group the highest percentage worked more than ten years. The highest percentage of studied group (34.8 %) was from general intensive care unit and (32.6%) of control group was from anesthesia care unit There was not significant difference between both groups regarding all demographic characteristics.

Table 2 presented percentage distribution of nurses' satisfaction with the methods of nurses' assignment among the study subjects. (Post intervention). As indicated from the table, the majority of nurses in the experimental group are satisfied with the method of assignment post intervention, while majority of nurses in the control group were unsatisfied post intervention, therefore there was highly statistically significant difference between both groups (experimental group and control group) regarding satisfaction with assignment.

Table 3 illustrated mean and standard deviation of nurses' satisfaction regarding methods of nurses' assignment among the study subjects (3 moths post intervention). As revealed from the table, there was highly statistically significant difference between both groups (experimental group and control group) regarding satisfaction about criteria and outcome of nurses' assignment. Additionally, experimental group had high mean and standard deviation regarding satisfaction of assignment after training on implementation of acuity tool-based assignment.

Table 1. Personal Data of the study subjects (n =178)

Socio demographic characters		Experimental group (n=89)		Control group (n=89)		χ^2	P value
		No.	%	No.	%		
Age / years	<20	10	11.2	9	10.1	0.252	0.969 (NS)
	20 – 30	34	38.2	36	40.4		
	30 – 40	40	44.9	38	42.7		
	>40	5	5.60	6	6.70		
Gender	Male	18	20.2	13	14.6	0.977	0.323 (NS)
	Female	71	79.8	76	85.4		
Marital state	Single	19	21.3	30	33.7	3.41	0.064 (NS)
	Married	70	78.7	59	66.3		
Educational level	Diploma	16	18.0	15	16.9	2.04	0.360 (NS)
	Technical institute	29	32.6	36	40.4		
	Bachelor	44	49.4	38	42.7		
Experience years	Less than 5	15	16.9	13	14.6	0.407	0.816 (NS)
	5 – 10	38	42.7	36	40.4		
	More than 10	36	40.4	40	44.9		
Clinical area	Anesthesia ICU	30	33.7	29	32.6	0.479	0.923 (NS)
	General ICU	31	34.8	28	31.5		
	Pediatric ICU	15	16.9	18	20.2		
	Medical ICU	13	14.6	14	15.7		

NS: non significant.

Table 2. Percentage Distribution of Nurses' Satisfaction with the Assignment among the Study Subjects. (3 months post intervention). (n=178)

Studied variables	Experimental group (n=89)		Control group (n=89)		χ^2	P value
Nurse satisfaction	No.	%	No.	%		
Satisfied (>75% of total score)	73	82.0	19	21.3	65.6	0.001 (HS)
Not satisfied (≤75% of total score)	16	18.0	70	78.7		

HS: High significant

Table 3. Mean and Standard deviation of Nurses' Satisfaction Regarding Methods of Nurses' assignment among the Study Subjects (3 months Post intervention) (n =178)

Studied variables	Experimental group (n=89)	Control group (n=89)	t-test	P value
	Mean ±SD	Mean ±SD		
Satisfaction regarding criteria of assignment	32.6±5.55	24.3±4.33	11.0	0.001(HS)
Satisfaction regarding outcome of assignment	35.5±6.16	25.5±5.39	11.5	0.001(HS)
Total satisfaction	68.1±10.8	49.9±8.64	12.3	0.001(HS)

HS: High significant.

Table 4. Relationship between Satisfaction of the Experimental group Post Intervention and Their Personal Data (n = 89)

Socio demographic characters		Nurses satisfaction				Test of sig.	P value
		Satisfied (n=73)		Not satisfied (n=16)			
		No.	%	No.	%		
Age / years	<20	8	11	2	12.5	χ^2 4.12	0.245 (NS)
	20 – 30	26	36	8	50		
	30 – 40	36	49	4	25		
	>40	3	4	2	12.5		
Gender	Male	17	23.3	1	6.20	FE 2.36	0.176 (NS)
	Female	56	76.7	15	93.8		
Marital state	Single	19	21.9	3	18.8	FE 0.078	1.00 (NS)
	Married	57	78.1	13	81.2		
Educational level	Diploma	11	15.0	5	31.3	χ^2 6.73	0.034 (S)
	Technical institute	28	38.4	1	6.20		
	Bachelor	34	46.6	10	62.5		
Experience / years	Less than 5	13	17.8	2	12.5	χ^2 12.6	0.001 (HS)
	5 – 10	25	34.2	13	81.3		
	More than 10	35	48.0	1	6.2.0		
Clinical area	Anesthesia ICU	27	37.0	3	18.7	χ^2 5.07	0.167 (NS)
	ICU	24	32.9	7	43.7		
	Pediatric ICU	10	13.7	5	31.3		
	Medical ICU	12	16.4	1	6.30		

NS: non-significant, HS: High significant, S: significant, FE; Fisher exact test.

Table 5. Number and Percent Distribution of First line managers' Opinion Regarding Implementation of Patient Acuity Tool-based nurses' assignment. (N=33)

Items	**First line managers (N=33)**					
	Disagree		Neutral		Agree	
	No.	%	No.	%	No.	%
1. Completing an acuity assessment tool was easy and quick.	0	0.00	5	15.2	28	84.8
2. The new acuity assessment tool showed marked improvement in equity of nursing shift assignments	0	0.00	3	9.1	30	90.9
3. The score on acuity tool is reflecting the workload required for the patient.	0	0.00	2	6.10	31	93.9
4. Work shift is finished on time, no need staying overtime to chart on patients.	0	0.00	9	27.3	24	72.7
5. Incorporating an acuity assessment tool in distribution of nursing shift assignments is necessary.	0	0.00	3	9.10	30	90.9
6. It is important to continue the practice of acuity assessments using the acuity tool after this training program.	0	0.00	3	9.10	30	90.9
7. The use of the new acuity assessment tool balanced workload.	0	0.00	3	9.10	30	90.9
8. Utilization of the acuity assessment tool enhanced the quality of care provided to patients on the unit.	0	0.0 0	27	81.8	9	18.2
9. The educational in-service on the acuity tool improved the ability to perform patient acuity assessments.	0	0.00	3	9.10	30	90.9
10. There is enough time for caring of patients since the assignments are better balanced.	13	39.4	13	39.4	7	21.2
Total	2	6.1	4	12.1	27	81.8

Table 4 showed relationship between satisfaction of the experimental group post intervention and their personal data. As shown in this table, there was no statistically significant difference between nurses' satisfaction in the experimental group and their personal data except regarding their educational level and years of experience that was highly statistical. Moreover, the highest percentage of satisfied nurses was between the age (30-40) years old, female, had bachelor degree, having more than 10 years of experience, and worked in Anesthesia Intensive Care Unit.

Table 5 presented number and percent distribution of first line managers' opinion regarding implementation of patient acuity tool-based assignment. As illustrated in this table, the highest percentage of first line managers agreed on implementation of the patient acuity tool-based nurses' assignment. However, the majority of first line managers were neutral regarding that the implementation of the acuity tool enhanced the quality of care provided to patients on the unit.

4. Discussion

Nurses' satisfaction with method of assignment based on developing a link between assignment and patient acuity level through accurate measuring of patient care needs thus resulted in equitable nursing assignment and nurses' satisfaction. Balancing workload in between scheduled nurses through nurses' assignments can aid to decrease the chance of assigning excessive workloads to one or more nurses during a shift, which enhances the level of nurses' satisfaction and quality of care [17].

Generally, nurses' satisfaction could be related to many factors but the most common indicator for achieving satisfaction among nurses was workload balance which improved nurses' moral and satisfaction [10]. Thus, the major aim of the current study was introducing an evidence-based tool (patient acuity tool) for basing nurses' assignment and thus balancing nurses' workload and improving nurses' satisfaction with assignment.

Regarding personal data of the study subject's highest percentage of both groups were between 30-40 years old, females, had a bachelor degree in nursing, married. Regarding their years of experience, the highest percentage of studied group worked from five to ten years but in control group the highest percentage worked more than ten years. The highest percentage of studied group (34.8 %) was from general intensive care unit and (32.6%) of control group was from anesthesia care unit There was not significant difference between both groups regarding all demographic characteristics.

The findings of the current study revealed that, there was highly statistically significant difference between both groups regarding satisfaction about criteria and outcome of nurses' assignment. This result provided a clue that nurses in the experimental group who had been included in the training program about application of the acuity tool and utilizing the tool for equitable assignment by first line manager were more satisfied than nurses in the control group who had not included in the program and assigned by traditional method.

Additionally, experimental group had high mean and standard deviation regarding satisfaction of assignment after training on implementation of acuity tool. Also, the majority of nurses in the experimental group are satisfied with the method of assignment post intervention Thus, that result could answer the research question that implementation of acuity tool-based assignment resulted in difference to nurses' satisfaction with assignment.

This result supported by the findings of Vortherms et al. [9] who reported that key elements in acuity-based assignment are clear communication, fairness distribution, and assignment transparency which considered a critical element for increasing nurses' satisfaction. Moreover, the study by Thomasos et al. [18] reported that acuity-based staffing improved workload balance, satisfaction, and employee engagement. This was consistent with a study by Al-Dweik and Ahmad [19] who concluded that establishing and using a patient acuity tool effectively adopt the complexity of the patients and their care, thus it maintains equitable shift assignments among nurses and increases nurses' job satisfaction.

A recent study was in the same line of the previous findings on the association between patient acuity application and nurses' workload by Sir et al. [3] who concluded that the acuity tool achieved a balanced assignment and lower workload in comparison to the traditional assignment. Also, Tomic [7] stated that the implementation of a valid and reliable instrument of patient acuity for determining nursing shift assignments can affect ultimately the nursing workload and hence increase nurses' job satisfaction.

Furthermore, another recent study reported that the patient acuity tool of Perroca is considered an important tool for nursing in the Brazilian healthcare system to sort the care complexity or patient acuity, as the tool enhanced the opportunity for planning care for patients according to their needs, permits adequate staffing in the unit per shift, and controlling workload [20]. The study by Forton and Melissa [21] showed a statistically significant increase in overall nurses' satisfaction following incorporation of patient acuity into nursing assignments

In agreement of supporting impact of acuity tool in promoting fair assignment among nurses that can lead to improving satisfaction of nurses, the report by Health Research and Educational Trust [22] who reported a nursing staff recurring complaint that nurses' assignments were inconsistent and unfair. An average of five registered nurses and one charge nurse were assigned five patients per nurse per shift. The nursing assignment system involved classifying patients in one amongst two categories: "standard patient" or "involved care" patient. As a result of the subjectivity of assignment and lack of evidenced data that reflect patient complexity and care needs nurses were frustrated, which prompted the unit to develop a process improvement project.

Additionally, according to Sobaski [15] results, developing staffing assignments is a complex process to ensure better patient outcomes and nurses' satisfaction. Consequentially, the equitable distribution of patient care workload called for the need to use patient acuity in making assignments.

The current study results were contradicted with Tomic [7] who concluded that there was no statistically

significant difference in nursing job satisfaction pre-and- post evidence-based project implementation about utilizing a patient acuity tool in nursing shift assignment appropriation

Additionally, the findings of Tomic [7] interpreted the previous finding that, since the concept of job satisfaction was very broad and depended on multiple factors, using of the acuity tool figures only just a small piece of a large puzzle that is job satisfaction. Moreover, satisfaction survey used within this project included various components of nurses' job satisfaction. However, in the current study, the researcher skipped this dilemma through developing a new tool for measuring nurses' satisfaction by assigning satisfaction to certain criteria and outcome that should be achieved with proper assignment.

According to relationship between satisfaction of the experimental group post intervention and their personal data. In the current study, there was no statistically significant difference between nurses' satisfaction in the experimental group and their personal data except regarding their educational level and years of experience that was highly statistical.

That finding was in agreement with the findings by Elsherbeny and El-Masry [23] who reported that there was no significant difference between nurses with low job satisfaction compared to those with moderate and high satisfaction as regard socio-demographic characteristics. However, there was significant difference between nurses' satisfaction level regarding work experience. Moreover, findings by Rahnavard et al. [24] revealed no relationship between demographic variables and job satisfaction. Also, *Tarcan et al.* [25] showed that gender, age, education, marital status had no significant effect on any form of satisfaction.

According to the current study findings, the highest percent of satisfied nurses regarding assignment post intervention, were between the age (30-40) years old (i.e. middle-aged nurses), were female, had bachelor degree, having more than 10 years of experience, and worked for Anesthesia care ICU.

Satisfaction level among nurses generally could be related to different factors and could have different rates in different studies due to variation in socio-demographic factors, work characteristics and economic levels in addition to different organizational resources and policies associated with the other studies [26].

On contrary of the previous findings, the results by Mousazadeh et al. [27] who concluded that, as the nurses get older, they have more job satisfaction compared to younger nurses. Also, Tarcan et al. *[25]* showed that most participants, who were satisfied with their jobs, were in the age range of 41 and above. However, the results of a research conducted by Mastaneh et al. [28] showed that job satisfaction among young people was more.

The previous findings could be interpreted by Mousazadeh et al. [27] that when young personnel just joining their career as nurses might be highly satisfied; however, when their needs are not met, most of them will be dissatisfied. On the other hand, when people become older and more experienced, their expectations declined to be more practical and somehow achievable, which can lead to an increase in their job satisfaction.

Additionally, the current study findings agreed with the results by Mousazadeh et al. [27] who showed a significant difference between job satisfaction levels regarding gender: job satisfaction among women is more than men. The previous result could be justified that, females had willingness for accomplishing financial and social independence, so they were highly satisfied. However, males were deemed the breadwinner and fulfilling the financial needs of their families, consequentially, when these financial needs are not completely fulfilled by their jobs, males often have lower job satisfaction regardless the intervention they had.

Satisfaction level among nurses in the current study was high among nurses having bachelor degree compared to other qualification category, as bachelor degree nurses learnt about evidence-based practice so they frequently looking forward to evidence that guide their practice. When applying acuity tool for basing nurses' assignment, they had more enthusiasm for this intervention and were more satisfied with the results. Also nurses in Anesthesia Care Unit had higher satisfaction as they might have different facilities and circumstances that facilitated the implementation of acuity tool for assignment and contributed to their high satisfaction with the method.

Regarding first line managers' opinion about implementation of acuity tool-based nurses' assignment, the current study reported that the highest percentage of first line manager agreed on implementation of the patient acuity tool for nurses' assignment. The current result was in the same line with Al-Dweik and Ahmad [19] who revealed that most of the nurses were satisfied with the application Perroca PAT (Patient Acuity Tool). The simplicity of use revealed a high level of agreement among first line managers. Moreover, nurses were able to recognize changes in the patients' needs, workload, and staff planning. However, the areas of dissatisfaction among nurses regarding Perroca PAT were reported as the tool's inability to measure the quality of nursing care.

Based on the current results, most of first line managers agreed that completing acuity tool was easy and quick which was contradicted with Hustad et al. [29] who concluded that nurses revealed certain dissatisfactions with the time required to complete the tool.

Majority of first line managers in the current study reported that the new acuity assessment tool showed markedly improve in the nursing shift assignments equity, which was supported by Tomic [7] who reported that little over half of registered nurses indicated that the acuity tool showed markedly increase of nursing shift assignments equity.

According to the current findings, the majority of first line managers were neutral regarding that the implementation of the acuity tool enhanced the quality of care provided to patients on the unit which was supported by Thomasos et al. [18] who reported that quality is a complex construct based on many dimensions and nurses are considered only one of its several dimensions. Furthermore, applying patient acuity tool for allocation of nursing staff allowed better utilization of the resources and controlling performance which, theoretically, should enhance the quality of care.

5. Conclusion

In the light of the current study, it can be concluded that implementation of Kidd et al., new patient acuity tool was effective in improving nurses' satisfaction with assignment. Additionally, there was no statistically significant difference between nurses' satisfaction in the experimental group and their personal data except regarding educational level and their years of experience. Moreover, the highest percent of first line managers agreed regarding all statements related to implementation of the patient acuity tool. However, the majority of first line managers were not sure that utilization of the acuity assessment tool enhanced the quality of care provided to patients on the unit. Finally, further gap in education, practice and research included:

I: **- Education: -**

1. Implementation of different acuity tools in undergraduate nursing curricula is important for being more familiar when utilizing such tools in clinical practice.

II: Research: -

2. Further research studies are needed to evaluate quality of patient care in relation to equitable nursing shift assignments to support the practical utilization of a patient acuity tool.
3. Follow up studies are necessary to assess the constant association between nursing satisfaction with assignment and the utilization of the patient acuity tool in the clinical setting.

III: Practice: -

4. Adopting patient acuity tool-based assignment program by Continuing Education Department at the University Hospital to increase nursing staff awareness regarding patient acuity tool-based assignment.
5. Nurse managers should be committed to continuous incorporation and generalization of the patient acuity tool-based assignment through different nursing units.
6. To overcome subjectivity of completing patient acuity tool, incorporation of electronic heath record is recommended for more efficiency, objectivity, and ease when completing patient acuity tool.

Conflict of Interest

None.

Acknowledgments

The authors' thanks and gratitude are submitted first and foremost to ALLAH who gave the strength and the ability to complete this work. The authors would like to acknowledge the hospital's administration and nursing supervisors for their help and support. The authors are really appreciating all nurses who agreed to participate in the current study.

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Appendices

Appendix 1

A new patient-acuity tool kid et al., (2014)

Current acuity tool

The chart below shows the hospital's new acuity tool. Rating options are 1 through 4, with 1 indicating the lowest acuity and 4 indicating the highest acuity. Ratings are based on nursing time needed to complete a task, emotional and physical energy expenditure required, expertise required, frequency of tasks and interventions, and follow-up assessments related to a specific task. Ratings for all five criteria categories are summed up to obtain a total acuity score for each patient, ranging from 1 to 60. Then the total acuity scores are clustered into acuity category scores, which range from 1 to 4, with 1 being the lowest acuity and 4 being the highest

Acuity category	1	2	3	4
Complicated procedures	☐ Pulse ox ☐ Foley ☐ Oral care ☐ Telemetry	☐ > 4 L O_2 nasal cannula ☐ BIPAP/CPAP @ naps/ night ☐ Routine trach care ≤ 2 times/shift ☐ PICC/central line ☐ NG tube ☐ Incontinent ☐ PCA ☐ Rectal tube ☐ Isolation ☐ Fall risk	☐ High-flow O_2/vent ☐ Continuous BIPAP ☐ New trach or frequent suctioning ☐ Trach care ≥ 3 times/ shift ☐ Wound/skin care ☐ Ostomy ☐ Assist w/ ADLs ☐ Vitals or neurochecks q 2 h ☐ Continuous bladder irrigation ☐ Chest tube ☐ Peritoneal dialysis ☐ Opioid/alcohol withdrawal assessment ☐ Unfinished admit	☐ Total care ☐ Restraints ☐ Total feed ☐ Confused, restless, combative ☐ High fall risk/SOMA bed ☐ Post code/rapid response team
Education	☐ Standard (i.e., DM, HF) Prechecked=1	☐ New meds, side effects	☐ Discharge today ☐ Family education ☐ Pre-/postprocedure	☐ New diagnosis ☐ Inability to comprehend ☐ Multiple comorbidities
Psychosocial or therapeutic interventions	☐ ≤ 2 interventions per shift	☐ 3-5 interventions per shift	☐ 6-10 interventions per shift ☐ Diagnosis of delirium ☐ End of life	☐ > 10 interventions per shift
Medications (oral)	1-5	6-10	11-15	≥ 16
Complicated IV drugs & other meds	☐ Glucometer with coverage	☐ 2-5 IV meds	☐ K+ protocol ☐ Heparin protocol ☐ > 5 IV meds ☐ TPN	☐ Blood/blood products ☐ Tube feeding/meds ☐ Cardiac drip (amiodarone, Cardizem, dopamine) ☐ Insulin drip
Total acuity score/ Total category score				

Acuity category scores:
1: 1 to 15 2: 16 to 30 3: 31 to 45 4: > 45 or new admission

Appendix 1I

Unit Acuity Scores & Category

UNIT: Date_____ Shift: _____

Patient name	Bed number	Acuity Score	Acuity category

Appendix 1II

Example of acuity tool-based nurses' assignment sheet

UNIT: Date_____ Shift: _____

Paige CN III		Gigi CN IV		Ashley CN II	
Room #	Acuity	Room #	Acuity	Room #	Acuity
5200	3	5233	4	5201	2
5203	4	5234	4	5204	2
5210	3	5222	2	5206	2
5212	2	5221	3	5224	2
				5226	3
Helen CN IV		**Ellen CN III**		**Betsy CN IV**	
Room #	Acuity	Room #	Acuity	Room #	Acuity
5209	4	5235	2	5224	3
5207	4	5238	3	5228	3
5236	3	5240	3	5229	2
5237	3	5215	3	5230	3
		5212	3	5232	3