# Utilizing Patients' Acuity Scores in Nurses' Allocation and its effect on the Care Quality for Mechanically Ventilated Patients

Mahmoud Ali Aboelmagd[1], Zeinab Hussein Ali[2]

(1)  *Andalusia Group Regional Nursing Director,*

(2)  *Professor of Medical Surgical Nursing Department and Vice Dean for Community Service and Environmental Development, Faculty of Nursing / Helwan University.*

## Abstract

**Background:** Applying acuity scores is an important basis for standardized assignment which allows nurses to perform the care of mechanically ventilated patients correctly. **Aim** : the study aimed to explore the Effect of applying acuity score on the quality of care of mechanically ventilated patients. **Setting :** the study was conducted at the critical areas of a JCI accredited hospital in Egypt. **Subjects**: The study subjects included two groups. Firstly, a convenience sample of staff nurses working in critical areas at the time of the study and having at least one year of work experience in ICU. Secondly, Convenience sample of ventilated patients who admitted in the ICU during the time of the study. **Design:** A quasi-experimental study design was used in the study. **Data collection tools:** The study tools were 3 tools including; firstly, nurses' demographic characteristics assessment sheet in which the personal interview was used. Secondly, nurses' practice regarding ventilated patient observational checklist which was used to assess the quality of nursing care of mechanically ventilated patients. Thirdly, patients' outcome assessment sheet which was used to measure ventilated patients' outcome. **Results**: It calcifies that applying patients' acuity score had positive large effect size on total nursing practice regarding care of mechanically ventilated patients during pre, post & three months follow up. **Conclusion**: There is a significant relation between applying the acuity score and the quality of care of mechanically ventilated patients and thus patients' outcomes. **Recommendations**: The acuity score should be used in the critical care units.

**Key words:** Care Quality, Mechanically Ventilated Patients, Nurses' Allocation, Patients' Acuity Scores

## Introduction

Nurses are the backbone of quality care in hospitals. Their mental and physical well-being directly affects how well they perform their duties *(Kim et al, 2019).* Despite their dedication to providing excellent care, various challenges hinder their ability to deliver optimal service. These challenges often involve heavy workloads and demanding patient assignments, which are believed to ultimately compromise the quality of care patients receive *(Racy et al, 2021).*

Figuring out how to assign nurses to patients in a busy hospital is a complex task. The usual way of doing this involves setting a specific number of patients per nurse, aiming to deliver the best possible care *(Mitai, & Mosenifar, 2020)*. However, this method has limitations. It's hard to predict exactly how many patients a single nurse can handle because patients' conditions can change unexpectedly *(Choi & Miller, 2018)*.

Assigning nurses to patients is no easy feat. Patients' health can fluctuate rapidly, and their care needs constantly evolve. To ensure a fair workload and optimal care, several factors are considered when making these assignments. This includes matching nurses with patients based on their individual skills and the specific needs of each patient *(Marzouk & Kamoun, 2020).* One key factor is patient acuity, which is a way of measuring how much nursing care a patient requires. Patients with higher acuity scores need more intensive care compared to those in better health *(Juvé-Udina et al, 2020).*

The patient acuity score (PAS) is a helpful system for classifying patients based on their specific care needs *(Al-Dweik & Ahmad, 2019).* This evidence-based approach uses real-world patient data and workload

indicators to assign a numerical score. This score reflects the level of complexity and intensity of care each patient requires from nurses.

Matching nurse assignments to patient acuity scores ensures the right number of nurses are caring for the right patients, not just filling quotas *(Dalton et al, 2018).* Needs can vary greatly. For instance, patients in a surgical ward might require basic care, while those on ventilators in critical care need complex, specialized attention. By understanding each patient's specific needs through acuity scores, nurses can prioritize and deliver personalized care, ultimately leading to higher quality outcomes *(Zaga, Berney, & Vogel, 2019).*

Deciding who cares for whom is a crucial part of delivering good healthcare. This process, called nurse-patient assignment, involves matching nurses with patients based on their skills and the specific needs of each patient. It has a big impact on three key areas: patient safety, the overall quality of care, and how satisfied nurses are with their jobs *(Al-Dweik & Ahmad, 2019).*

Effective nurse leaders rely on data and real-world results (evidence-based practices) to understand how well their assignment strategies are working. This allows them to adjust assignments based on the specific needs of each unit *(Hickman et al, 2018)*. It's also important to consider the skills and experience of the nurses themselves. By involving them in the assignment process, leaders can create a more positive work environment and gain buy-in from the staff. Ultimately, balanced assignments lead to better patient outcomes and a fairer workload for nurses.

Not all hospital patients are the same. They each have individual needs based on their medical condition and personal situation. To ensure everyone

gets the right level of care, hospitals now commonly categorize patients based on these needs *(An et al, 2021)*. This classification system helps make sure each patient receives the most appropriate care possible.

Nurse-to-patient assignment is crucial as it affects daily nurse workload and patient flow, allowing nurses to assess the level of patient safety risks. Assigning several critical cases to a single nurse can have negative impacts on professional practice and healthcare services, including increased patient waiting times, overtime, unfair distribution of assignments, nurse dissatisfaction, retention issues, nurse burnout, and patient safety problems *(Driscoll et al, 2018)* Maintaining a balance between the supply of qualified providers and patient care demands is crucial for ensuring quality care in hospitals. This requires continuous efforts to improve quality and achieve a balance between

supply and demand *(Tamata, Mohammadnezhad, & Tamani, 2021)*.

The nursing care of mechanically ventilated patients presents various challenges, including the need for highly technical skills, expertise in invasive monitoring, and the implementation of interventions. Each critically ill patient brings unique complexities associated with their illness and the rationale for mechanical ventilation *(Dalton et al, 2018)*.

The nursing care and management of critically ill mechanically ventilated patients require therapeutic interventions and come with potential complications. Equitable patient-nurse assignments are crucial for these patients. Evidence-based nursing care plays a pivotal role in achieving quality health outcomes for mechanically ventilated patients *(Mitai & Mosenifar, 2020)*.

Patients in critical care units are vulnerable and require increased nursing care due to the complexity of their care, patient acuity, and co-morbidities. Inconsistent, subjective, and unquantifiable nurse assignments can result in nurse dissatisfaction, which poses barriers to adaptation and threatens patient care outcomes, which are crucial for quality care *(Khalil, Mohamed, & Sharkawy, 2018).*

Patient acuity is a fundamental concept in critical care units as it can impact outcomes and safety for mechanically ventilated patients, including issues such as pressure ulcers, mortality rate, length of stay, falls, medication errors, nosocomial infections, and pain management. Nursing workload acuity affects nurses' ability to assess patient status and promote excellent patient outcomes, as patient outcomes are significantly influenced by nurse staffing ratios. When assignments are not equitable, nurses may feel disappointed and frustrated, hindering their ability to perform their work effectively for the well-being of patients *(Guilhermino, Inder, & Sundin, 2018).*

The old way of assigning patients (by room or equal numbers) can have downsides. It might cluster patients who need a lot of care together, leaving some nurses overloaded. This can make it hard for nurses to notice small changes in their patients' conditions or provide all the care they need.

When nurse-patient ratios decreased and patient acuity increased, nurse workload increases and care quality deteriorated and vice versa *(Qureshi, Purdy, & Neumann, 2021).*

The study hypothesized that Applying patients' acuity scoring to assign nurses to patients has an effective role in promoting level of

nursing care of ventilated patients and thus patients' outcome.

It is assumed that there are 10 JCI accredited hospitals in Egypt which is the first-class hospitals. All of them don't apply the patient acuity score-based nurse-patient assignment and indeed the lower-level hospitals.

Research, including this study, highlights the importance of using patient acuity scores to fairly distribute workload among nurses. This method could significantly improve overall nursing care, particularly for critically ill patients who require mechanical ventilation *(Alsharari et al., 2020).*

The significance placed on that healthcare organizations need applying patient acuity score and able to lead change positively in the way to perform assigned duties perfectly to keep up with updates and development which inspired by satisfaction of nurses toward high quality of patient care. So, this study was done to assess

the effect of applying patients' acuity scoring on the level of care of mechanically ventilated patients in the selected setting.

This study aimed to assess the effect of applying patients' Acuity scoring on the level of care of mechanically ventilated patients through; assessing the quality of care of ventilated patient before applying the patients' acuity scoring, applying developed acuity scoring in the chosen critical area, assessing quality of care of ventilated patient after applying the patients' acuity scoring, and evaluating effects of applying the patients' acuity scoring on the quality of care of ventilated patients.

## Materials and methods

This study was conducted in the critical areas of one of the JCI accredited hospitals in Cairo, Egypt. The study tools were used with two samples (n=336) divided into 84 nurses and 252 patients. The study

tools were 3 tools including; firstly, nurses' demographic characteristics assessment sheet in which the personal interview was used. Secondly, nurses' practice regarding ventilated patient care observational checklist which was used to assess the quality of nursing care provided by nurses to mechanically ventilated patients. Thirdly, patients' outcome assessment sheet which was used to measure ventilated patients' outcome in critical care units.

Three tools were tested by five experts specialized in medical surgical and critical care nursing from different universities (Helwan University – Cairo University – MTI University) for their face and content validity through an opinionnaire sheet. Accordingly, the necessary modifications were done.

Two tools were tested for their reliability. The stability aspect of reliability (internal consistency of

results over time) composing the two tools was assessed using Cronbach's Alpha coefficient. Test of reliability for two tools yielded (0.851) for the observational checklist.

## Results

**Table (1):** Number and percentage of distribution of demographic characteristics among the studied nursing staff (n=84)

| Items | | No. | % |
|---|---|---|---|
| Age (year) | • 20-≤30 | 31 | 36.9 |
| | • 31-≤40 | 49 | 58.3 |
| | • 41-≤50 | 4 | 4.8 |
| | • **Mean± SD** | **31.86 + 3.78** | |
| Gender | • Male | 56 | 66.7 |
| | • Female | 28 | 33.3 |
| | • **Male to female ratio** | **2:1** | |
| Educational level | • Bachelor nursing degree | 79 | 94.0 |
| | • Master's degree | 5 | 6.0 |
| Years of experience | • 1 -≤ 5 Yrs. | 11 | 13.1 |
| | • 6 -≤ 10 Yrs. | 50 | 59.5 |
| | • 11 -≤ 15 Yrs. | 16 | 19.0 |
| | • > 15 Yrs. | 7 | 8.3 |
| | • **Mean± SD** | **9.25 + 3.92** | |

**Table (1):** shows demographic characteristics among the studied nursing staff, it shows that about two thirds (58.3%) of the age range of the studied nursing staff was ranged from

31-≤ 40 years old, with a mean age of 31.86 ± 3.78. considering gender, more than two thirds (66.7%) of them were male with a male to female ratio is 2:1. In relation to educational level, more than three thirds (94.0%) of them holding bachelor nursing degree. Considering years of experience, about two thirds (59.5%) of them had an experience lasting for 6 -≤ 10 Yrs. with a mean age of 9.25 ± 3.92.

**Table (2):** shows demographic characteristics among the studied mechanically ventilated patients, it 1.3:1 respectively during pre, post & three months follow up test.

shows that more than half of the age range of the studied mechanically ventilated patients was more than 60 years old years old, with the percentages (52.4%, 53.6% and 53.6%) respectively during pre, post & three months follow up test with a mean age of 59.7 ±15.9, 62.0± 3.6 & 60.3±12.6 respectively. considering gender, more than half of them were male with the percentages (59.5%, 54.8% and 57.1%) respectively with Male to Female Ratio is 1.5:1, 1.2:1 &

**Table (2):** Number and percentage of distribution of demographic characteristics during pre, post & three months follow up among the studied mechanically ventilated patients (n=252)

| Items | | Pre-test n=84 | | Post-test n=84 | | Follow up - test n=84 | | χ2 | P Value |
|---|---|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % | | |
| ▪ Age | 20-≤30 years old | 4 | 4.8 | 2 | 2.4 | 2 | 2.4 | 6.81 | 0.557 |
| | 21-≤40 years old | 10 | 11.9 | 3 | 3.6 | 5 | 6.0 | | |
| | 41-≤50 years old | 8 | 9.5 | 11 | 13.1 | 12 | 14.3 | | |
| | 51-≤60 years old | 18 | 21.4 | 23 | 27.4 | 20 | 23.8 | | |
| | > 60 years old | 44 | 52.4 | 45 | 53.6 | 45 | 53.6 | | |
| | **Mean ± SD** | 59.7 ±15.9 | | 62.0± 3.6 | | 60.3±12.6 | | | |
| ▪ Gender | Male | 50 | 59.5 | 46 | 54.8 | 48 | 57.1 | 0.389 | 0.823 |
| | Female | 34 | 40.5 | 38 | 45.2 | 36 | 42.9 | | |
| | Male to Female Ratio | 1.5:1 | | 1.2:1 | | 1.3:1 | | | |

**Table (2):** shows demographic characteristics among the studied mechanically ventilated patients, it shows that more than half of the age range of the studied mechanically ventilated patients was more than 60 years old years old, with the percentages (52.4%, 53.6% and 53.6%) respectively during pre, post & three months follow up test with a mean age of 59.7 ±15.9, 62.0± 3.6 & 60.3±12.6 respectively. considering gender, more than half of them were male with the percentages (59.5%, 54.8% and 57.1%) respectively with Male to Female Ratio is 1.5:1, 1.2:1 & 1.3:1 respectively during pre, post & three months follow up test.

**Table (3):** Effect size and η2 of applying patients' acuity score on total practice regarding care of mechanically ventilated patients during pre, post & three months follow up among the studied nursing staff (n=84)

| Variables | Interval | Mean | SD | F Test | P value | η | η2 | Effect size |
|---|---|---|---|---|---|---|---|---|
| ▪ Primary assessment | Pre-test | 16.0 | 4.10 | 135.4 | 0.000*** | 0.722 | 0.521 *** | Large effect |
| | Post-test | 22.9 | 1.56 | | | | | |
| | Follow up | 22.3 | 2.85 | | | | | |
| ▪ Secondary assessment | Pre-test | 21.2 | 4.79 | 224.7 | 0.000*** | 0.802 | 0.643 *** | Large effect |
| | Post-test | 31.5 | 1.99 | | | | | |
| | Follow up | 31.0 | 3.35 | | | | | |
| ▪ Intervention phase | Pre-test | 24.0 | 4.36 | 114.2 | 0.000*** | 0.692 | 0.479 *** | Large effect |
| | Post-test | 31.1 | 2.13 | | | | | |
| | Follow up | 30.6 | 3.30 | | | | | |
| ▪ VAB bundle | Pre-test | 9.85 | 1.20 | 62.4 | 0.000*** | 0.578 | 0.334 *** | Large effect |
| | Post-test | 11.4 | 0.828 | | | | | |
| | Follow up | 11.3 | 1.02 | | | | | |
| ▪ CLABSI bundle | Pre-test | 6.83 | 1.37 | 216.9 | 0.000*** | 0.797 | 0.635 *** | Large effect |
| | Post-test | 9.89 | 0.581 | | | | | |
| | Follow up | 9.70 | 1.08 | | | | | |
| ▪ CAUTI Bundle | Pre-test | 7.81 | 1.18 | 87.8 | 0.000*** | 0.643 | 0.414 *** | Large effect |
| | Post-test | 9.51 | 0.668 | | | | | |
| | Follow up | 9.38 | 0.849 | | | | | |
| **Total** | **Pre-test** | **85.74** | **16.35** | **158.9** | **0.000***** | **0.749** | **0.561 *** | **Large effect** |
| | **Post-test** | **116.48** | **7.29** | | | | | |
| | **Follow up** | **114.43** | **12.14** | | | | | |

*Significant p ≤ 0.05        **Highly significant p ≤ 0.01        F: ANOVA Test

*Small effect size (0.01 to < 0.06)        **Medium effect size (0.06 to < 0.14)        ***Large effect size ≥ (0.14)

**Table (3):** clarifies Effect size and η2 of applying patients' acuity score on *during pre, post & three months follow up among the studied nursing staff. It* total practice regarding care of mechanically ventilated patients during pre, post & three months follow total practice regarding care of mechanically ventilated patients *calcifies that applying patients' acuity score had positive large effect size on* up among the studied nursing staff as **η2= 0.561.** When Eta-square value = 0.01 to < 0.06, the effect is considered

weak, when it = 0.06 to < 0.14, the effect is considered medium and when it ≥ 0.14 the effect is large. Therefore, this provides enough evidence to support research hypothesis. Moreover, there was a highly statistically significant difference between the total mean score of practice regarding the care of mechanically ventilated patients during pre, post, and three-month follow up among the studied nurses at F = **158.9** &P = 0.000.

**Table (4):** Number and percentage distribution of outcomes during pre, post & three months follow up among the studied mechanically ventilate patients (n=252)

| Items | | Pre-test n=84 | | Post-test n=84 | | Follow up - test n=84 | | $\chi^2$ | P Value |
|---|---|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % | | |
| ▪ Length of Stay | 1≥ 2 days | 26 | 31.0 | 29 | 34.5 | 26 | 31.0 | 5.19 | 0.519 |
| | 3 ≥ 5 days | 29 | 34.5 | 33 | 39.3 | 31 | 36.9 | | |
| | 6 ≥ 7 days | 12 | 14.3 | 14 | 16.7 | 17 | 20.2 | | |
| | > 7 days | 17 | 20.2 | 8 | 9.5 | 10 | 11.9 | | |
| | $\overline{x} \pm$ SD | 5.61± 4.25 | | 4.37 ± 2.42 | | 4.58 ± 2.41 | | | |
| ▪ Ventilator Days | 1≥ 2 days | 41 | 48.8 | 47 | 56.0 | 42 | 50.0 | 12.3 | 0.05* |
| | 3 ≥ 5 days | 26 | 31.0 | 28 | 33.3 | 31 | 36.9 | | |
| | 6 ≥ 7 days | 6 | 7.1 | 7 | 8.3 | 9 | 10.7 | | |
| | > 7 days | 11 | 13.1 | 2 | 2.4 | 2 | 2.4 | | |
| | $\overline{x} \pm$ SD | 3.93± 3.52 | | 2.92± 2.17 | | 3.12 ±2.17 | | | |
| ▪ Acquire pressure injury | Yes | | | | | | | | |
| | No | | | | | | | | |
| ▪ Acquire VAP | Yes | 3 | 3.6 | 0 | 0.0 | 0 | 0.0 | 6.16 | 0.04* |
| | No | 81 | 96.4 | 84 | 100.0 | 84 | 100.0 | | |
| ▪ Acquire CLABSI | Yes | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | NC | |
| | No | 84 | 100.0 | 84 | 100.0 | 84 | 100.0 | | |
| ▪ Acquire CAUTI | Yes | 1 | 1.2 | 0 | 0.0 | 0 | 0.0 | 2.0 | 0.366 |
| | No | 83 | 98.8 | 84 | 100.0 | 84 | 100.0 | | |
| ▪ Mortality | Died | 13 | 15.5 | 12 | 14.3 | 12 | 14.3 | 0.06 | 0.969 |
| | Discharged alive | 71 | 84.5 | 72 | 85.7 | 72 | 85.7 | | |

*Significant p ≤ 0.05                    **Highly significant p ≤ 0.01

NS:  > 0.05                    N.C.: NOT Computed as variable is constant

**Table (4) summarizes** outcomes during pre, post & three months follow up among the studied mechanically ventilate patients. **In relation to length of hospital stay,** it denotes that, during the post-test phase, the studied mechanically ventilated patient gained a lower mean of length of hospital stay ($\overline{x} \pm SD = 4.37 \pm 2.42$) followed by the phase of follow-up test ($\overline{x} \pm SD = 4.58 \pm 2.41$) as compared with the phase of pre-test ($\overline{x} \pm SD = 5.61 \pm 4.25$) during pre, post, and three-month follow up. In addition to, there isn't difference between observed and expected values at $\chi2 = 5.19$ & P Value= 0.519.

**In relation to ventilator days,** it denotes that, during the post-test phase, the studied mechanically ventilated patient gained a lower mean of ventilator days ($\overline{x} \pm SD = 2.92 \pm 2.17$) followed by the phase of follow-up test ($\overline{x} \pm SD = 3.12 \pm 2.17$) as compared with the phase of pre-test ($\overline{x} \pm SD = 3.93 \pm 3.52$) during pre, post, and three-month

follow up. In addition to presence of difference between observed and expected values with a significant statistical difference at $\chi2=12.3$, **P=0.05.**

**Concerning acquire CAUTI and mortality**, there isn't difference between observed and expected values at P Value= 0.366 & 0.969 respectively. While, regarding to **acquire VAB**, there is a difference between observed and expected values with a significant statistical difference at **P=0.04.**

**Figure (1):** Percentage distribution of cumulative total practice regarding the care of mechanically ventilated patients during pre, post & three months follow up among the studied nursing staff (n=84)
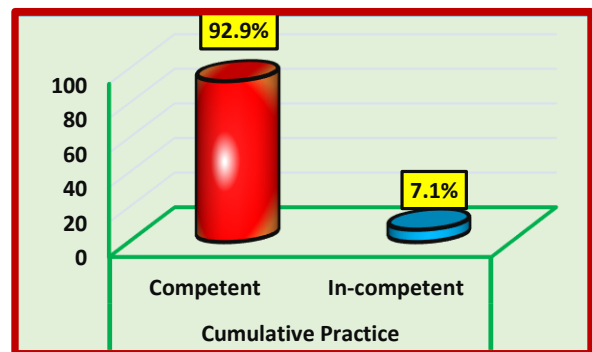
**Figure (1):** clarifies cumulative total practice regarding the care of mechanically ventilated patients among the studied nursing staff. It denotes that more than three quarters **(92.9%)** of the studied nursing staff had a competent level of practice regarding the care of mechanically ventilated patients with a total mean score of practice= $316.64 \pm 29.91$. In addition to presence of difference between observed and expected values with a significant statistical difference at $\chi 2 = 61.71$ P=0.000. moreover, competent to in competent ratio is 13:1.

**Discussion**

The current study discussed that the majority of the nursing staff (about two thirds) were aged between 30 to 40 years old, with a mean age of $31.86 + 3.78$. These findings were in line with the hospital's recruitment policy, which aims to select knowledgeable and skilled staff.

The gender distribution of the nurses was predominantly male (more than two thirds), which was attributed to the physically demanding nature of the work in the intensive care department.

With regards to education, more than three thirds of the nurses held a bachelor's degree in nursing, while the remaining nurses had a master's degree, which reflects the hospital's emphasis on highly educated staff, particularly for ICU nurses.

In terms of experience, approximately two thirds of the nurses had six to ten years of experience. It is worth noting that the hospital was accredited by the Joint Commission International (JCI), and as part of the standardized recruitment process, highly qualified staff nurses were selected to work in the ICU.

On the one hand these results were supported by *(Ageiz & Abd El-Mageed, 2020)* who explained that the

highest percentage of studied nurses aged between 30-40 years old, had a bachelor degree in nursing, and regarding their years of experience the highest percentage were ranged between five to ten years. On the other hand, the previous study was contradicted in regards to the gender as it illustrates that the majority of studied nurses were females.

Concerning the demographic characteristics among the studied mechanically ventilated patients, it shows that more than half of the age range of the studied mechanically ventilated patients was more than sixty years old. Considering gender, more than half of them were male. The results associated with old age could be explained as normal physiological changes of aging which makes the human body more susceptible to many complications that could lead to mechanical ventilation. This finding is supported by *(Cho & Stout-Delgado 2020)* who reported in a study titled "Aging and Lung Disease" that Natural lung aging is associated with molecular and physiological changes that cause alterations in lung function, diminished pulmonary remodeling and regenerative capacity, and increased susceptibility to acute and chronic lung diseases. Also, *(Murtha et al, 2019)* stated in a study titled "The role of aging in cardiac and pulmonary fibrosis" that Aging promotes a range of degenerative pathologies characterized by progressive losses of tissue and/or cellular function. Fibrosis is the hardening, overgrowth and scarring of various tissues characterized by the accumulation of extracellular matrix components. Aging is an important predisposing factor common for fibrotic respiratory disease.

Concerning effect size and η2 of applying patients' acuity score on total practice regarding care of

mechanically ventilated patients during pre, post & three months follow up among the studied nursing staff. It calcifies that applying patients' acuity score had positive large effect size on total practice regarding care of mechanically ventilated patients during pre, post & three months follow up among the studied nursing staff. Therefore, this provides enough evidence to support research hypothesis. Furthermore, Applying the acuity score is the basis for controlling nurse to patient ratio specially with the complicated cases such as the mechanically ventilated patients. That will provide the critical care nurse with the ability to apply the guidelines of caring the mechanically ventilated patients.

Moreover, there was a highly statistically significant difference between the total mean score of practice regarding the care of mechanically ventilated patients

during pre, post, and three-month follow up among the studied nurses

These findings are supported by *(Cho et al, 2019)* in a study titled "Nurse staffing, nurses' prioritization, missed care, quality of nursing care, and nurse outcomes" which stated that inappropriate assignment is associated with increased missed care and vice versa. Also *(Qureshi et al 2019)* in a study titled "Predicting the effect of nurse–patient ratio on nurse workload and care quality using discrete event simulation" which explained that as nurse to patient ratio increases, care quality deteriorated, missed care, and nursing workload increased.

Regarding patient outcomes during pre, post & three months follow up among the studied mechanically ventilated patients. **In relation to length of hospital stay,** it denotes that, during the post-test phase, the studied mechanically ventilated patient gained a lower mean of length of hospital stay

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followed by the phase of follow-up test as compared with the phase of pre-test during pre, post, and three-month follow up. In addition, there is no difference between observed and expected values.

**In relation to ventilator days,** it denotes that, during the post-test phase, the studied mechanically ventilated patient gained a lower mean of ventilator days followed by the phase of follow-up test as compared with the phase of pre-test during pre, post, and three-month follow up. In addition to presence of difference between observed and expected values with a significant statistical difference.

**Concerning acquired CAUTI and mortality**, there is no difference between observed and expected values. While, regarding to **acquired VAB**, there is difference between observed and expected values with a significant statistical difference.

These results are in concordance with *(McHugh et al, 2021)* in the study

titled "Effects of nurse-to-patient ratio legislation on nurse staffing and patient mortality, readmissions, and length of stay: a prospective study in a panel of hospitals" which found that the length of stay were significantly decreased after controlling the nurse-to-patient ratio and assignment. But the same study found that the mortality rates were significantly decreased after intervention which oppose the results of the current study.

In addition, *(Aloush, 2018)* in the study titled "Nurses' implementation of ventilator-associated pneumonia prevention guidelines: an observational study in Jordan" found that Nurses' compliance with ventilator-associated pneumonia prevention guidelines which directly affect the average ventilator days was insufficient, and this knowledge can be used by health professionals to guide clinical practice and improve the quality of care, especially in units with

a 1:2 nurse to patient ratio and higher beds' capacity.

Moreover, *(Matthew et al, 2019)* stated that controlling the assignment and nurse-to-patient ratio leads to more adherence for sepsis bundles and as a result the rate of infection decreased in the study titled "Evaluation of hospital nurse-to-patient staffing ratios and sepsis bundles on patient outcomes".

Concerning cumulative total practice regarding the care of mechanically ventilated patients among the studied nursing staff. It denotes that more than three quarters of the studied nursing staff had a competent level of practice regarding the care of mechanically ventilated patients with a total mean score of practice. In addition to presence of difference between observed and expected values with a significant statistical difference.

These results are in concordance with *(Alsharari et al, 2020)* in the study titled "Critical Care Nurses' Perception of Care Coordination Competency for Management of Mechanically Ventilated Patients" who stated that There was a high overall score and subscale scores of nurses' care coordination competence for mechanically ventilated patients for the majority of critical care nurses, but few gaps were identified in some of the items.

Moreover *(Ali & Ahmed 2023)* in the study titled "Effectiveness of In-Service Training Module on Intensive Care Nurses' Performance Regarding Mechanical Ventilator Patients' Skillful Handling" proved that the majority of studied nurses get promoting the achievement of level of practice after intervention during pre, post & three months follow-up phases.

## Conclusion

Applying the acuity score during assigning nurses to patients has significant effect on the quality of care of mechanically ventilated patients and thus patients' outcomes. The researcher recommends that the acuity score should be applied in all hospitals to assign nurses to patients. Further researches need to be carried out to explore the effects of the administrative variables on the direct nursing care of different cases.

## Recommendations

The study recommended that hospitals should develop comprehensive training programs to educate nurses on the specific patient acuity scoring system being implemented. In addition, nursing managers should develop and apply a standardized acuity scoring system to assess the severity of patients' conditions accurately.

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**Ethical Committee:** The ethical considerations of the research included the following; The research approval was obtained from the ethical committee before starting the study. The researcher assured anonymity and confidentiality of the subjects' data. Nurses were informed that they are allowed to choose to participate or not in the study and that they had the right to withdraw from the study at any time. Ethics, values, culture and beliefs were

respected. Study subjects were informed about research purposes.

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