

# A Study on Quality Management System in Medical Intensive Care Unit in Tertiary Care Hospital

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## Abstract

**Background:** Quality indicators provide insight in the structure and process aspects of care that are related to outcome that serve as instruments to improve health care. Thus, it is important to identify ways of more efficiently managing Intensive Care Units (ICUs) and reducing the variation in patient outcomes.

**Objectives:** To study the quality management in medical ICU (MICU) with respect to structure, process and outcome.

**Methodology:** The study is a descriptive study. Data were collected from doctors and nurses in MICU through informal interview and personal observation. A questionnaire was given to the patients/patient parties to assess their satisfaction. Secondary data were collected by studying relevant records in MICU.

**Results:** The study shows that the structure indicators when assessed showed poor results. Process indicators such as length of ICU stay was found to be 2.4 days, duration of mechanical ventilation 1.9 days and proportion of days with all ICU beds occupied to be 6 days in a month. The outcome indicators showed good results, i.e., mortality rate was 15.1% for 2012, incidence of decubitus was six cases per 1000 admissions. Proportion of glucose measurement exceeding 8.0 mmol/L or lower than 2.2 mmol/L and number of unplanned extubation was not collected due to unavailability of the data.

**Conclusion:** A significant share of health care resources is spent in ICUs and quality improvement is a vital activity for all members of the interdisciplinary critical care team. Hence, it is important to identify the quality indicators which can be executed and monitored in ICU to improve the standard of care.

**Keywords:** Data collection/methods, Humans, Intensive care units/standards, Outcome and process assessment (health care)/methods, Quality indicators health care

## INTRODUCTION

Significant shares of health care resources are spent in Intensive Care Units (ICU). Technological, demographic, and social aspects are likely to lead to an increased number of intensive care in the future. Hence, it is necessary to identify ways of more competently managing ICUs and reducing the variation in patient outcomes.

ICUs differ considerably with each hospital with respect to structure, services provided, employees and their level of expertise, and organizational features. These variations are based on economic and political factors exclusive to each hospital's internal dynamics and external environment. Accordingly, the characteristics of an ICU may depend on the population catered the services provided by the hospital and nearby hospitals and the subspecialties of physicians on the hospital's staff.

Mainz<sup>1</sup> says evaluating the quality of care has become important to providers, regulators, and purchasers of care. In recent years, providers have begun to be fascinated in evidence-based medicine and purchasers have begun to concentrate on the cost-effectiveness of health care in producing health outcomes. Clinical indicators consider particular health structures, processes, and outcomes. They

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can be rate or mean-based, providing a measurable basis for quality improvement or lookout recognizing incidents of care that trigger further investigation. They can evaluate aspects of the structure, process, or outcome of health care. Furthermore, indicators can be common measures that are applicable for most patients or disease-specific, expressing the quality of care for patients with specific diagnoses.

Quality improvement is an important activity for all members of the interdisciplinary critical care team. Although an increasing number of resources are available to guide clinicians, quality improvement activities can be overwhelming. Therefore, there is a need for a study which focuses on critical care, summarizes key concepts, and outlines a practical approach to development, implementation, evaluation, and maintenance of an interdisciplinary quality improvement system in the ICU.<sup>2</sup>

Quality management is crucial in ICUs, and quality indicators can be used as a tool to assist quality improvement. Morbidity and mortality rates in ICUs vary widely among hospitals.<sup>3</sup>

Rundgren<sup>4</sup> has defined quality management system as “a system by which an organization aims to reduce and eventually eliminate non-conformance to specifications, standards, and customer expectations in the most cost effective and efficient manner.”

A study conducted by de Vos *et al.*<sup>5</sup> classified the quality indicators in ICUs into structure, process and outcome. After the feasibility study, 11 indicators were eventually selected. The following structure indicators were selected: Availability of intensivist (hours/day), patient-to-nurse ratio, strategy to prevent medication errors, measurement of patient/family satisfaction. Four process indicators were selected: Length of ICU stay, duration of mechanical ventilation, proportion of days with all ICU beds occupied and proportion of glucose measurement exceeding 8.0 mmol/L or lower than 2.2 mmol/L. The selected outcome indicators were as follows: Standardized mortality (acute physiology and chronic health evaluation II [APACHE II]), incidence of decubitus, and the number of unplanned extubation.

To quantify the desired (positive) and undesired (negative) consequences of activities in health care, measurement of outcome is essential. Indicators may provide insight in the structure and process aspects of care that are related to outcome.

### Objectives

Quality management in medical ICU (MICU) of tertiary care hospital with respect to:

- a) Structure
- b) Process
- c) Outcome.

## METHODOLOGY

The study is a descriptive study. The study was carried in MICU of tertiary care hospital. Ethical Clearance as obtained from the concern authorities. The sources of data are doctors, nurses, patients and relevant records maintained in MICU. Data were collected from doctors and nurses in MICU through informal interview and personal observation. A questionnaire was given to the patients/patient parties to assess their satisfaction. Secondary data were collected by studying relevant records in MICU.

The collected data will be analyzed by mean, standard deviation, frequency and percentage.

## RESULTS

### Structure Indicators

#### *Availability of intensivist (hours/day)*

There is no qualified intensivist available in MICU. A resident doctor is present instead of intensivist and the doctors are available on-call.

#### *Patient-to-nurse ratio*

The total number of beds available is 20. The staff nurses work on a rotation basis, and there are six nurses per shift. Thus, the patient:nurse ratio maintained is 4:1 for non-ventilated patients and 1:1 for ventilated patients.

#### *Strategy to prevent medication errors*

There is a manual with documented procedures to prevent medication errors.

#### *Measurement of patient/family satisfaction*

Likert's five point rating scale was used to assess the level of satisfaction.

Majority of the respondents (62%) were between 25 and 50 years of age. 54% of the respondents were females, and 46% of the respondents were males. Majority of the respondents (56%) were spouse. 45 out of 50 respondents were literate (Table 1).

### Family Satisfaction with ICU Experience

#### *Care of family*

94-100% of the respondents were satisfied with the care of the patients given by the staff in MICU. Among these respondents, 10% were fully satisfied with the consideration of needs by the staff (Table 2).

**Care of patient**

Majority of the respondents (78%) were satisfied, and 20% of the respondents were fully satisfied with the care given to the patients. Majority of the respondents were satisfied with the pain management (66%), breathlessness management (24%) and agitation management (32%) in MICU (Table 3).

**Professional care**

80-84% of the respondents were satisfied with professional care of whom the respondents were satisfied with nursing skill and competence (96%), nursing communication (98%) and social work (84%).

All the respondents were satisfied with physician skill and competence as well as communication of which 26% of the respondents were fully satisfied with it (Table 4).

**ICU environment**

88% of the respondents were satisfied with the atmosphere of the ICU. 60% of the respondents were satisfied with the atmosphere of the waiting room. It is important to note that 26% of the respondents are dissatisfied with the atmosphere

**Table 1: Socio-demographic details**

Parameters	n	Frequency (%)
Age		
>50	14	28
25-50	31	62
<25	5	10
Gender of the respondents		
Females	27	54
Males	23	46
Relationship with the patient		
Spouse	28	56
Blood relative	22	44
Level of education		
Literate	45	90
Illiterate	5	10

**Table 2: Response regarding care of family**

Parameters	Satisfied (n)	Proportion (%)
Consideration of needs	50	100
Emotional support	49	98
Spiritual support	47	94
Coordination of care	48	96
Concern and caring for the family	50	100

**Table 3: Response regarding care of patient in the MICU**

Parameters	Satisfied (n)	Proportion (%)
Care given to patients	49	98
Pain management	39	78
Breathlessness management	16	32
Agitation management	18	36

MICU: Medical intensive care unit

of the waiting room due to poor hygiene in the waiting area. The overall satisfaction was found to be 84% (Table 5).

**Satisfying information needs**

Majority of the respondents (94%) were satisfied regarding the information provided by the staffs (Table 6).

**Process Indicators**

**Length of ICU stay**

The length of stay was calculated using the formula:

$$\text{Length of stay} = \frac{\text{Total occupied bed days}}{\text{Number of patients in a given time frame (weekly, monthly / yearly)}}$$

The mean value of length of stay was found to be 2.4 days (2 days approximately) per patient based on the records for the month of November 2012.

**Duration of mechanical ventilation**

63.64% were on mechanical ventilation for <2 days and 36.36% were on ventilator for more than 2 days. Hence, from the collected data, the aggregate mean duration of mechanical ventilation was found to be 1.9 days (Table 7).

**Table 4: Response regarding professional care provided**

Parameters	Satisfied (n)	Proportion (%)
Nursing skill and competence	48	96
Nursing communication	49	98
Social work	42	84
Physician skill and competence	50	100
Physician communication	50	100

**Table 5: Response regarding ICU environment**

Parameters	Satisfied (n)	Proportion (%)
Atmosphere of ICU	49	98
Atmosphere of waiting room	31	62
Overall satisfaction	43	86

ICU: Intensive care unit

**Table 6: Response regarding satisfying information needs**

Parameters	Satisfied (n)	Proportion (%)
Ease of getting information	49	98
Understanding of information	49	98
Completeness of information	48	96
Honesty	48	96
Level/amount of care	49	98
Consistency	41	82
Overall	47	94

**Proportion of days with all ICU beds occupied**

Based on the collected data, the proportion of days with all ICU beds occupied is found to be 6 days/month based on the records for the month of November 2012.

**Outcome Indicators**

**Standardized mortality (APACHE II)**

It was observed that not all the patients were categorized based on APACHE II scoring system. Hence, the mortality rate was calculated based on the formula:

$$\text{Mortality rate} = \frac{\text{Total number of hospital deaths during the given period}}{\text{Total discharges (including deaths during the same period)}} \times 100$$

Total discharges = Transfer out + Discharges + Deaths

The mortality rate shows an upward trend from 2010 (15.1%) to 2011 (16.6%) and is gradually declining in 2012 (16.4%) (Table 8).

**Incidence of decubitus**

The incidence of decubitus was calculated using the formula:

$$\text{Incidence of decubitus} = \frac{\text{Number of pressure ulcers}}{\text{Number of cases}} \times 1000$$

It is observed that the number of cases of decubitus ulcers is decreasing that is six cases per 1000 admissions in 2010, three cases per 1000 admissions in the year 2011 and 2012 (Table 9).

**Table 7: Duration of mechanical ventilation**

Duration of mechanical ventilation	n	Frequency (%)
<2 days	7	63.6
More than 2 days	4	36.4

Mean duration of mechanical ventilation was 1.9 days

**Table 8: Standardized mortality (APACHE II)**

Year	Mortality rate (%)
2010	15.1
2011	16.6
2012	16.4

APACHE: Acute physiology and chronic health evaluation II

**Table 9: Incidence of decubitus**

Year	Number of cases per 1000 admissions
2010	6
2011	3
2012	3

**DISCUSSION**

**Structure Indicators**

**Availability of intensivist (number of hours/day)**

Based on the data collected through informal interview and observation, there is a full time resident doctor present who attends to the needs and the various specialists are informed on call but there is no full time intensivist present in MICU in the hospital.

A study from the University of Pittsburgh, published in the New England Journal of Medicine, found that using night-time intensivist physician staffing in ICUs with a low-intensity daytime staffing model reduces mortality. However, researchers found that intensivist improve patient outcomes only in some circumstances. Also, ICUs with night-time intensivist coverage were similar to ICUs without night-time staffing. The same relationship between night-time staffing, daytime staffing and mortality was observed in all subgroup analyses.<sup>6</sup>

Thus, it is important to have a night time intensivist so that the mortality is reduced, and the quality of care improves.

**Patient to nurse ratio**

The patient: nurse ratio maintained is 4:1 for non-ventilated patients and 1:1 for ventilated patients. The study conducted by Kane et al.<sup>7</sup> showed, higher registered nurse staffing was associated with less hospital-related mortality, failure to rescue, cardiac arrest, hospital acquired pneumonia and other adverse events. More overtime hours were associated with an increase in hospital related mortality, nosocomial infections, shock, and bloodstream infections.

This stressed on the importance of the right patient to nurse ratio to minimize the infections in critical care units and to prevent burnout that reduces the efficiency of the nurses.

**Strategy to prevent medication errors**

A documented procedure regarding administration of medication is the only available documented strategy. However, approximately two-thirds of infusions prepared by nurses are outside industry-accepted standards, and 6% contain a greater than two-fold concentration error. Transcription errors are usually attributed to handwriting, abbreviation use, unit misinterpretation (“mg” for “mcg”), and mistakes in reading.<sup>8</sup>

Thus, an effective strategy needs to be planned and implemented in order to prevent medication errors and adverse drug reactions.

**Measurement of family/patient satisfaction**

There is no format to collect the feedback from the patient or patient party regarding their satisfaction.

The investigator conducted a study in order to assess the satisfaction of the patient or patient party regarding ICU. A sample of 50 patients or families was taken, and the using purposive sampling technique and questionnaire were distributed.

Comparing the study conducted in the institution regarding the care of the patients given by the staff in MICU and a satisfaction survey conducted by Ray *et al.*<sup>9</sup> We can infer that the patient or patient party is satisfied regarding the ICU including the infrastructure, the care given and the outcome.

### Process Indicators

#### *Length of ICU stay*

Mean duration of stay according to the study conducted was found to be 2 days, while a study conducted by Ray *et al.*<sup>9</sup> the length of stay in ICU in the tertiary health center was found to be less, signifying better quality of care.

#### *Duration of mechanical ventilation*

In the study conducted from the collected data, the average duration of mechanical ventilation was found to be 1.9 days while according to a study conducted by Seneff *et al.*,<sup>10</sup> average duration of ventilation for the 42 ICUs ranged from 2.6 to 7.9 days. This signifies that the duration of mechanical ventilation is reduced.

#### *Proportion of days with all ICU beds occupied*

From the collected data, the proportion of days with all ICU beds occupied is found to be 6 days/month based on the records for the month of November 2012.

### Outcome Indicators

#### *Standardized mortality (APACHE II)*

The study conducted and that by Pronovost *et al.*<sup>11</sup> indicate that the mortality rates of tertiary care hospital are comparable to the levels of international hospitals.

#### *Incidence of decubitus*

The study conducted shows the number of cases of decubitus ulcers is decreasing over the years with a mean value being 4 per 1000 cases (0.4%) with the incidence of decubitus.

In a study conducted by Eachempati *et al.*<sup>12</sup> the incidence of decubitus ulcers increased significantly over time to 9%. Multivariate analysis revealed that emergent admission, age, days in bed, and days without nutrition were independent predictors of a decubitus ulcer.

Hence, the comparison shows that the incidence of decubitus is less compared to the other hospital proving better quality of care being provided in the tertiary health center.

## CONCLUSION

A descriptive study was conducted to study the quality management in MICU with respect to structure, process and outcome.

The study focuses the need to improve the structure indicators namely availability of intensivist (hours/day), patient-to-nurse ratio and strategy to prevent medication errors. Family satisfaction study conducted shows patient and patient party are satisfied with the care and infrastructure of the ICU.

The data on process indicators such as length of ICU stay, duration of mechanical ventilation, proportion of days with all ICU beds occupied were analyzed and it shows continuous improvement in the quality of care delivered over the past 3 years.

The outcome indicators that is, standardized mortality and incidence of decubitus were assessed which showed the values to be decreasing. This was mainly due to improved nursing care and specialized and improved service to the patients over the years.

As an extension to this project, an intensive study can be conducted at tertiary care hospital to address the quality assurance parameters or indicators which are specifically defined for the department under consideration.

In general, more harmful errors are reported in ICU than non-ICU settings. Thus, it is important to identify ways of more efficiently managing structure and process in ICUs and reducing the variation in patient outcomes.

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