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Nursing care time and quality indicators for adult intensive care: correlation analysis¹

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The objective of this quantitative, correlational and descriptive study was to analyze the time the nursing staff spends to assist patients in Adult Intensive Care Units, as well as to verify its correlation with quality care indicators. The average length of time spent on care and the quality care indicators were identified by consulting management instruments the nursing head of the Unit employs. The average hours of nursing care delivered to patients remained stable, but lower than official Brazilian agencies' indications. The correlation between time of nursing care and the incidence of accidental extubation indicator indicated that it decreases with increasing nursing care delivered by nurses. The results of this investigation showed the influence of nursing care time, provided by nurses, in the outcome of care delivery.

Descriptors: Nursing; Nursing Administration of Human Resources; Workload; Quality Indicators in Health Care.

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Tempo de assistência de enfermagem em unidade de terapia intensiva adulto e indicadores de qualidade assistencial: análise correlacional

Trata-se de estudo de abordagem quantitativa, correlacional e descritivo, elaborado com o objetivo de analisar o tempo utilizado pela equipe de Enfermagem para assistir aos pacientes internados em unidade de terapia intensiva adulto, bem como verificar sua correlação com os indicadores de qualidade assistencial. A identificação do tempo médio de assistência despendido e dos indicadores de qualidade assistencial foi efetivada por meio de consulta aos instrumentos de gestão, utilizados pela chefia de Enfermagem da unidade. O tempo médio de assistência despendido com os pacientes manteve-se equilibrado, porém, inferior aos indicados pelos órgãos oficiais brasileiros. A correlação entre o tempo de assistência de Enfermagem despendido por enfermeiros e o indicador incidência de extubação acidental indicou que a incidência de extubação acidental diminui, à medida que aumenta o tempo de assistência de Enfermagem despendido por enfermeiros. Os resultados desta investigação demonstram a influência do tempo de assistência de Enfermagem, provido por enfermeiros, no resultado do cuidado ministrado.

Descritores: Enfermagem; Administração de Recursos Humanos em Enfermagem; Carga de Trabalho; Indicadores de Qualidade em Assistência à Saúde.

Tiempo de atención de enfermería en la unidad de cuidados intensivos de adultos y los indicadores de atención de calidad: análisis de correlación.

Un estudio de enfoque cuantitativo, de correlación y descriptiva, elaborado con objetivo de analizar el tiempo empleado por equipo de enfermería para asistir pacientes hospitalizados en Unidad de Cuidados Intensivos de Adultos y verificar su correlación con indicadores de calidad de la atención. La identificación del promedio de tiempo de cuidados y de indicadores de calidad asistencial fue realizada por medio de consulta a las herramientas de gestión utilizadas por el jefe de enfermería de la Unidad. El promedio de tiempo de cuidado ministrado a los pacientes se mantuvo equilibrado, pero inferior a los indicados por organismos oficiales en Brasil. La correlación entre tiempo de cuidados de enfermería e indicador de incidencia extubación accidental indicó que esta disminuye con aumento de tiempo de atención de enfermería utilizado por enfermeras. Los resultados de esta investigación demuestran la influencia del tiempo de atención de enfermería por las enfermeras, en los resultados de la atención prestada.

Descriptorios: Enfermería; Gestión de Recursos Humanos en la Carga de Trabajo de Enfermería; Los Indicadores de Calidad en la Atención de la Salud.

Introduction

In the global context, the challenge of improving the safety and quality of patient care delivery in health services is not new.

According to the campaign launched by the World Health Organization⁽¹⁾, we are in the "Age of Safety" and, since 2002, the organization has addressed this theme as a priority issue. The program was strengthened in 2004, through the creation of the Global Patient Safety

Alliance, with a view to promoting and developing patient safety health practices and policies at global level⁽²⁾.

A document the International Council of Nurses published also considers that the improvement of nursing practice can guarantee patient safety and constitutes a global priority goal⁽³⁾.

The same document⁽³⁾ highlights that organizational culture and management directly influence the results

reached in health institutions. Quality in the nursing work environment, in turn, interferes in the quality and safety of patient care and is influenced by the size of the nursing staff, the number of professionals according to professional category and the nursing/patient rate.

In that context, it is verified that issues related to the nursing staff dimensioning process gain relevance and are under investigation to produce technical and scientific evidence to enhance awareness of the meaning of health staff that sees not only to patients and health institutions' needs, but also to patients and nursing team professionals' safety.

A systematic literature review⁽⁴⁾ appoints that concerns with patient safety and care quality are determining the accomplishment of research on clinical practice and the cost-effectiveness relation of health interventions are care, including the distribution of human resources. This is particularly important in intensive care, where a large part of hospitals' financial resources are consumed and the nursing staff represents the main cost item.

Another literature review⁽⁵⁾ indicates that research done in recent decades shows an association between the nursing staff and patient care outcomes. Most of these studies were developed at intensive care units and picture the direct relation between nursing staff and increased infection rates, postoperative complications, mortality and accidental extubation, also described as unplanned extubation.

The author of that research⁽⁵⁾ concluded that the analysis of nursing staff needs at intensive care units is important, mainly for the managers of these units, to the extent that they have the power to make decisions and distribute resources.

Thus, the challenge for intensive care nurses is to develop and quantify evidence to demonstrate that a larger proportion of nurses positively influences the outcomes of care delivery to patients and their families, through studies that relate staff number with quality care indicators⁽⁶⁾.

In this perspective, the use of quality care indicators represents a powerful management instrument for nurses, as it permits showing the relevance of quantitative and qualitative staff dimensioning with a view to the promotion of excellent care delivery to health service users.

The use of clinical or quality indicators to assess the care offered represents an important approach to document attendance. In addition, when the indicators are validated and tested with transparency and scientific

rigor, they permit comparative analyses among health services, with a view to planning quality improvements in care delivery to patients/service users⁽⁷⁾.

The analysis of Brazilian literature, however, shows a lack of studies that demonstrate the relation between nursing staff conformity and care indicators. In that sense, the aim of this study is to analyze the time the nursing team uses to see to patients/clients hospitalized at the Adult Intensive Care Unit (AICU) of the University of São Paulo Teaching Hospital (HU-USP), as well as to check its correlation quality care indicators.

Method

A quantitative and descriptive correlation study was developed at the AICU of the HU-USP.

The AICU offers 12 beds. Four of these are structured and preferably reserved for the hospitalization of patients who need isolation. It should be highlighted that the Unit elaborates monthly reports, as a management instrument, which are forwarded to the Nursing Department (ND), informing on the number of care hours delivered to hospitalized patients during the period, with a view to supporting human resource management decisions, so as to maintain quality care.

The nursing time spent is calculated with the help of an electronic worksheet called "Worksheet to calculate the mean nursing care time spent"⁽⁸⁾.

Another characteristic of the Unit where the research was accomplished is the use of care quality indicators. The selected indicators, according to the Institution's Group of Quality Indicators, are: Incidence of nasogastric tube loss for nutrition; Incidence of central venous catheter loss; Incidence of accidental extubation; Incidence of pressure ulcer; Incidence of fall; Incidence of medication error.

These indicators represent care practice at the Institution and are validated and recommended in Brazilian⁽⁹⁾ and international literature⁽¹⁰⁾. One exception is the central venous catheter loss indicator, which was developed according to the need evidenced at HU-USP. In addition, these indicators are frequently used in the Brazilian hospital network, permitting intra and extra-institutional comparability.

Data collection procedures

Data were collected monthly from the management instruments the Unit nursing head uses: "Worksheet to calculate the mean nursing care time spent", and "Worksheet to obtain nursing quality indicators, AICU

Unit", with the approval of the HU-USP Research Ethics Committee (CEP) (registration CEP-HU/USP: 982/10 – Registration SISNEP – CAAE: 0009.0.198.196-10).

Identification of the mean care time spent on patients hospitalized at the AICU of the HU-USP

The "Worksheets to calculate the mean nursing care time spent", which are part the Unit head nurse's monthly reports, were consulted to identify the mean monthly care time spent on patients hospitalized at the Adult ICU of the HU-USP, between 01/01/2008 and 12/31/2009.

The mean nursing care time was calculated electronically, using the worksheet developed in Microsoft Excel®, with the help of equation (1)⁽¹¹⁾:

$$(1) \quad h_k = \frac{q_k \cdot p_k \cdot t_k}{n}$$

Where: h_k = mean nursing care time per patient, spend by workers from professional category k ;

k = professional category;

q_k = mean number of nursing staff members in professional category k ;

p_k = mean productivity of professional category k (85%);

t_k = work journey of professional category k (six hours);

n = mean daily number of patients attended.

Survey of quality care indicators at the AICU of the HU-USP

The choice of the quality indicators used in this research was based on the criteria recommended in literature⁽⁷⁾ and on data accessibility at the Unit.

Among the indicators assessed at the HU-USP, the decision was made to use those inherent in the intensive care context: incidence of nasogastric tube loss for nutrition; incidence of central venous catheter loss, incidence of accidental extubation and incidence of pressure ulcer.

Thus, the quality care indicators were collected monthly from the "Worksheet to obtain nursing quality indicator data, AICU Unit", which the Unit nursing head uses to make calculations according to the equations indicated in the Manual of Nursing Indicators⁽⁹⁾. One exception is the central venous loss indicator, whose equation the institution developed by itself.

$$\text{Incidence of central venous catheter loss} = \frac{\text{No. of central venous catheter losses}}{\text{No. of patients with central venous catheter/day}} \times 100$$

Data treatment and analysis

The results were presented through tables with central trend and variability measures. To correlate the mean care time spent on AICU patients with the quality care indicators, initially, the Kolmogorov-Smirnov test was applied to assess the normality distribution. It was ascertained that the central venous catheter loss indicator showed no normal distribution. Thus, for this variable, correlation analysis was developed using

Spearman's correlation coefficient, while Pearson's correlation coefficient was used for the other quality indicators.

Results

Table 1, presented next, demonstrates the mean care time spent on patients hospitalized at the Adult ICU of the HU-USP between 01/01/2008 and 12/31/2009.

Table 1 – Mean Nursing Care Time spend on AICU patients at HU-USP, between Jan/2008 and Dec/2009. São Paulo, SP, Brazil, 2011

Variables	Mean Time (2008)						Mean Time (2009)					
	Total		Nurses		Nursing Technician		Total		Nurses		Nursing Technician	
	(h)	(%)	(h)	(%)	(h)	(%)	(h)	(%)	(h)	(%)	(h)	(%)
January	14.5	100	4.2	28.9	10.4	71.1	13.5	100	4.2	31.1	9.3	68.9
February	13.8	100	3.9	28.2	9.8	71.8	15.1	100	4.7	31.1	10.4	68.9
March	13.5	100	3.9	28.8	9.6	71.2	14.7	100	4.6	31.3	10.1	68.7
April	13.3	100	4.1	30.8	9.2	69.2	13.1	100	4.1	31.3	9.1	68.7
May	13.3	100	3.7	27.8	9.5	72.2	13.4	100	4.2	31.3	9.3	68.7

(continue...)

Table 1 - (continuation)

Variables	Mean Time (2008)						Mean Time (2009)					
	Total		Nurses		Nursing Technician		Total		Nurses		Nursing Technician	
	(h)	(%)	(h)	(%)	(h)	(%)	(h)	(%)	(h)	(%)	(h)	(%)
June	14.0	100	4.4	31.4	9.6	68.6	13.3	100	4.3	32.3	9.0	67.7
July	13.3	100	4.1	30.8	9.2	69.2	13.9	100	4.5	32.4	9.4	67.6
August	14.5	100	4.6	31.7	9.9	68.3	15.4	100	4.8	31.1	10.6	68.9
September	13.8	100	4.4	31.8	9.3	68.2	14.0	100	4.3	30.7	9.7	69.3
October	13.6	100	4.6	33.8	9.0	66.2	14.0	100	4.3	30.7	9.7	69.3
November	14.6	100	4.9	33.5	9.6	66.5	14.7	100	4.7	32.0	10.0	68.0
December	14.1	100	4.4	31.2	9.7	68.8	13.7	100	4.6	33.5	9.2	66.5
Mean	13.9	100	4.3	30.9	9.6	69.1	14.1	100	4.4	31.2	9.6	68.9
sd	0.48		0.35		0.36		0.73		0.24		0.53	
VAR. C.(%)	3.49		8.13		3.79		5.22		5.44		5.50	

Slight variations were observed in the time spent during the study period (minimum 13.3 hours and maximum 14.6 hours in 2008 and minimum 13.1 hours and maximum 15.4 hours in 2009). The mean number of nursing care hours spent on the patients during the two years studied is practically equivalent (13.9 h/patient/day in 2008 and 14.1 h/patient/day in 2009), with a difference of only 0.2 hours, i.e. 12 minutes.

As for the distribution of nursing care time between professional categories, the mean care hours both nurses and nursing technicians spent remained the same in 2008 and 2009 (4.3 and 4.4 hours, respectively, for nurses and 9.6 for technicians). On average, the proportion of nurses' care time corresponded to 31% and that of nursing technicians to 69%.

Table 2 – Mean scores of Nursing quality care indicators at AICU of HU-USP between Jan/2008 and Dec/2009. São Paulo, SP, Brazil, 2011

Variables	2008				2009			
	Incidence of Accidental Extubation	Incidence of NGT loss	Incidence of CVC loss	Incidence of PU	Incidence of Accidental Extubation	Incidence of NGT loss	Incidence of CVC loss	Incidence of PU
January	1.14	0.00	0.00	18.60	0.00	4.69	0.00	3.85
February	1.26	1.51	1.08	10.20	0.00	4.61	1.65	5.77
March	0.62	4.05	0.00	5.26	0.43	1.79	0.00	14.58
April	0.74	1.88	1.37	6.25	0.53	3.13	0.00	6.67
May	0.48	2.78	1.20	12.82	1.18	1.06	0.00	2.38
June	0.72	1.44	0.00	7.27	0.00	1.72	0.00	7.50
July	1.88	3.32	0.00	16.67	0.00	1.03	0.00	6.56
August	1.09	0.87	1.17	10.71	0.00	2.97	0.00	0.00
September	0.00	4.48	0.79	12.50	1.75	6.19	0.00	5.56
October	0.00	0.87	0.39	3.85	0.97	0.83	0.37	7.94
November	0.00	4.52	0.00	0.00	0.60	1.06	0.43	2.22
December	0.83	2.25	0.50	12.50	0.00	1.32	0.00	17.65
Mean	0.73	2.33	0.54	9.72	0.46	2.53	0.20	6.72
sd	0.57	1.51	0.55	5.40	0.58	1.79	0.48	5.03
VAR. C.(%)	0.33	2.27	0.31	29.12	0.34	3.19	0.23	25.28

Table 2 shows the performance of nursing quality care indicators used at the AICU of the HU-USP during the study period. The CVC loss incidence indicator showed the smallest variation coefficient (0.31% in 2008 and 0.23% in 2009), while the PU incidence indicator showed the highest coefficient (29.12% in 2008 and 25.28% in 2009).

Data in Table 3 demonstrate that the nursing care time nurses spent and the quality indicator incidence of accidental extubation showed a Pearson's correlation coefficient of ($r = -0.454$), with $p=0.026$. For the other variables, no statistically significant correlations were found.

Table 3 - Correlation between mean care time spent, according to professional category, and quality care indicators at the Adult ICU of HU-USP, between January 1st 2008 and December 31st 2009. HU-USP, São Paulo, Brazil, 2011

Variables	Incidence of NGT loss		Incidence of CVC loss*		Incidence of accidental extubation		Incidence of PU	
	Pearson's correlation	p	Spearman's Correlation	p	Pearson's correlation	p	Pearson's correlation	p
Time spent	-0.015	0.944	0.033	0.878	-0.174	0.416	-0.162	0.450
Time spent, nurses	-0.003	0.987	-0.013	0.953	-0.454	0.026 [†]	-0.306	0.146
Time spent, tech./aux.	-0.019	0.931	0.208	0.330	0.067	0.756	-0.017	0.939

* The CVC loss incidence variable shows no normal distribution, so that Spearman's non-parametric correlation was used.

[†] Significance level for p < 0.05.

Discussion

The mean care time spent on patients hospitalized at the AICU of the HU-USP between 01/01/2008 and 12/31/2009 corresponded to approximately 14 hours. Based on the comparison between the present research results and those of a study⁽¹²⁾ that identified the mean nursing care hours at the AICU of the HU-USP between 2001 and 2005, it was ascertained that less nursing care hours were spent on AICU patients in 2008 and 2009 than in the years the author analyzed (mean 15.4 hours), although the percentage distribution the same researcher found did correspond (30% for nurses and 70% for nursing technicians)⁽¹²⁾.

Concerning the times established by the Federal Nursing Council⁽¹³⁾ (COFEN) (17.9 h) and the National Health Surveillance Agency⁽¹⁴⁾ (ANVISA) (15 h), the mean nursing care hours spent on patients hospitalized at the AICU of HU-USP, except in February and August 2009, remained below these entities' indications.

This result suggests the possibility that the nursing team is overburdened and evidences the need to revise the Unit's existing staff. Nevertheless, the workload patients demand should also be assessed through the application of specific instruments⁽¹⁵⁻¹⁶⁾, as the care time patients demand can differ from official entities' indications and their use in putting in practice dimensioning methods could cause an over or under-dimensioning of nursing staff.

As for the percentage distribution of care time between the professional categories who are part of the nursing team, it is observed that the proportion of time AICU nurses spent remains below the minimum percentage recommended in COFEN Resolution⁽¹³⁾ 293/2004 (52%).

An exploratory and descriptive study⁽¹⁷⁾ developed in fourteen hospitalization units of seven hospitals in São Paulo City, aimed at assessing the parameters recommended in COFEN Resolution⁽¹³⁾ 293/04, as

an official reference for nursing staff dimensioning at hospital institutions, found that, at the six ICUs studies, the proportion of hours attributed to the nurses was smaller than that attributed to nursing technicians and auxiliaries, remaining far below COFEN recommendations⁽¹³⁾.

The percentage of nursing care time AICU nurses spent, however, is higher than that identified in RDC⁽¹⁴⁾ No. 7, proposed by the Joint Board of ANVISA⁽¹⁴⁾ (20%).

In that sense, studies available in international literature demonstrate an inverse relation between the number of nurses and the occurrence of adverse events in patients, correlating the number of care hours these professionals spend with the quality of care delivery, concluding that a larger number of care hours delivered by nurses is associated with a drop in mortality and adverse event rates (urinary tract infection, pressure ulcer, hospital pneumonia, wound infections, central venous access complications, shock, thrombosis, medication errors, postoperative complications), as well as with a decrease in mortality rates deriving from these events⁽¹⁸⁻²⁰⁾.

This scenario evidences that improving the percentage distribution of care hours attributed to nurses represents not only a perspective for the AICU at HU-USP, but also a challenge for Brazilian nursing.

The analysis of AICU indicators suggests improved care quality at the Unit in 2009, when compared with 2008, as the mean incidence levels of accidental extubation, CVC loss and PU dropped. Due to the absence of Brazilian research and the lack of international studies, however, which used the same indicators and method as adopted in the present research, AICU/HU-USP data could not be confronted with those of other services.

Concerning the analysis of the correlation between nursing care time spent by nurses and the incidence of accidental extubation quality indicator, it can be inferred that the incidence of accidental extubation decreases as the nursing care time spent by nurses increases. No

studies were found with similar methods to the present study. Some studies describe the influence of the nursing staff variable on the incidence of unplanned extubation and support the results found.

A study⁽²¹⁾ that assessed the association between the nursing workload and the probability of unplanned extubations at a Pediatric Intensive Care Unit appointed that the logistic regression model revealed positive associations between unplanned extubations and the patient/nurse ratio. In the same study, it was concluded that the number of unplanned extubations may increase in situations when the patient/nurse ratio is higher.

A research⁽²²⁾ aimed at exploring the effects of nursing care on the occurrence and consequences of unplanned tracheal extubation at adult Intensive Care Units reported that self-extubations were more frequent at night and under routine care of nurses with less professional experience. Those authors concluded that an adequate patient/nurse ratio can generate better work and safety conditions during nursing procedures.

A study developed to identify high-risk patients for unplanned extubation and determine professionals' beliefs on perceived unplanned extubation risks revealed that 60% of the interviewed professionals believe that the nursing staff or the patient/nurse ratio are closely related with accidental extubation cases⁽²³⁾.

A recent publication⁽²⁴⁾ aimed at assessing risk factors and outcomes after unplanned extubation at ICU indicated that non-accidental extubation is a frequent event during mechanical ventilation in critically ill patients and can be associated with increased morbidity and mortality. In the same study, the incidence of extubation was considered relatively low (2.1% for patients under mechanical ventilation and 0.4% per ventilation day), due to the high nurse/patient ratio in the units where the field research was accomplished.

Thus, the present research results demonstrate the influence of nursing care time, provided by nurses, on the outcomes of care delivered to patients attended at AICU.

Conclusion

As a result of this study, the mean nursing care time spent on patients hospitalized at the AICU of the HU-USP could be identified and analyzed, between 01/01/2008 and 12/31/2009, and its correlation with quality care indicators used at the Unit could be ascertained.

The nursing care hours spent on AICU patients at the HU-USP between January 1st 2008 and December

31st 2009 remained below COFEN and ANVISA recommendations.

The nursing care time spent by nurses and the incidence of accidental extubation quality indicator showed a negative Pearson's correlation coefficient, indicating that the incidence of accidental extubation drops as the number of nursing care hours spent by nurses increases. Concerning the other quality indicators assessed in this study, i.e. the incidence of nasogastric tube loss for feeding, incidence of central venous catheter loss and incidence of pressure ulcer, no statistically significant correlations were found.

The limitations of the present research, i.e. the fact that it was accomplished at a single unit of a single institution, put constraints on its generalization. It does offer support and equips nurses though, through the presentation of a systematic method and the indicator time series, with a view to reproducing the study in different contexts, contributing to the validation of this finding and to comparability among health services, as no studies have been published that correlate these variables in the Brazilian context.

The accomplishment of this study also contributes to understand the importance and impact of the nursing staff on care outcomes and patient safety, supporting nurses' administrative and political decisions, as well as staff negotiations with hospital managers, with a view to the excellence of care offered to these services' users.

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