American Journal of Public Health Research, 2023, Vol. 11, No. 3, 117-123
Available online at http://pubs.sciepub.com/ajphr/11/3/5
Published by Science and Education Publishing
DOI:10.12691/ajphr-11-3-5

Intensive Care Nursing Scoring System in Human Resource Allocation for ICU Nurses Systematic Evaluation

He Mengli[1,*], Fu Yingping[1], Duan Baofeng[2]

[1]School of Nursing, Yunnan University of Traditional Chinese Medicine, 650000
[2]Affiliated Hospital of Yunnan University, 650032
*Corresponding author: 2804264508@qq.com

Received April 14, 2023; Revised May 17, 2023; Accepted May 30, 2023

Abstract **Objective:** To systematically evaluate the effectiveness of the critical care nursing scoring system in the human resource allocation of ICU nurses. **METHODS:** A computer search of The Cochrane Library, PubMed, EMbase, Web of Science, CINAHL, China Biomedical Literature Database, China Knowledge Network, Wanfang and Weipu databases for literature on the critical care nursing scoring system in ICU nurse human resource allocation was conducted with a search time frame of build to November 2022.Two researchers screened the literature and extracted data according to inclusion and exclusion criteria, and the Cochrane Risk of Bias Assessment Tool was used for methodological quality assessment and RevMan 5. 3 software was used for statistical analysis. **RESULTS**: Fifteen studies were ultimately included. Meta-analysis results showed that the intensive care scoring system reduced inpatient length of stay [MD: -1.36, 95% CI (-3.44, -2.88)], inpatient healthcare costs [MD: -0.87, 95% CI (-0.94, - 0.81)], reduced the incidence of inpatient complications [OR: 0.33, 95% CI(0.23, 0.46)], improved patient and family satisfaction [OR: 4.89, 95% CI (3.27, 7.30)], and improved nurse job satisfaction [OR:5.65, 95% CI (2.73, 11.70)]. **CONCLUSION:** The included literature the evaluation results were of moderate quality and could be improved in terms of blinding and allocation concealment. The critical care nursing scoring system was able to reduce patient hospital costs, reduce length of stay, reduce the incidence of complications, improve patient and family satisfaction with nursing care, and improve nurse satisfaction with nursing care to some extent, and more high-quality literature should be included for further evaluation in the future.

Keywords: *intensive care scoring system, human resource allocation, ICU, system evaluation, Intensive Care Unit (ICU)*

Cite This Article: He Mengli, Fu Yingping, and Duan Baofeng, "Intensive Care Nursing Scoring System in Human Resource Allocation for ICU Nurses Systematic Evaluation." *American Journal of Public Health Research*, vol. 11, no. 3 (2023): 117-123. doi: 10.12691/ajphr-11-3-5.

1. Introduction

Intensive care unit (ICU) is a rescue colony for critically ill patients [1], with certain special characteristics, the patients admitted are in critical condition, requiring high professional ethics and comprehensive quality of nursing staff, and attaching importance to the effectiveness of human resource allocation [2]. Accurate assessment of nursing workload and rational allocation of nursing human resources becomes a prerequisite and basis for implementing nursing plans and ensuring quality of care [3]. The Intensive Care Nursing Scoring System (ICNSS) was introduced by Finnish nursing scientist Pyykk et al. [4,5] in 2000. This scoring system evaluates nursing interventions and adds up the scores to the total amount of nursing care, which is important for the allocation of nursing resources and has been widely used in Europe and the USA [6]. Studies at [7] have shown that intensive care scoring systems can reduce the length of ICU stay, the cost of care, the incidence of complications during ICU stay and the satisfaction of patients, families and nurses with the care provided. In recent years, there have been many studies at home and abroad on the use of intensive care scoring systems in the allocation of nurses in ICUs, but the results of a single study do not reflect the overall effectiveness of the allocation, and there is no systematic evaluation of the system. The aim of this study is to systematically evaluate the effect of the intensive care nursing scoring system in ICU nurse human resource allocation through systematic evaluation, with a view to providing reference for better ICU nurse human resource allocation.

2. Materials and Methods

2.1. Literature Inclusion and Exclusion Criteria

2.1.1 Study population: ICU patients;

2.1.2 Interventions: test group: intensive care scoring system care; control group: average bed-sharing method;

2.1.3 Study type: randomized controlled trials (RCTs) published in Chinese or English;

2.1.4 Outcome indicators: 1) length of ICU stay; 2) medical costs; 3) incidence of complications during ICU stay; 4) satisfaction of patients and families with nursing care; 5) satisfaction of nurses with nursing care.

2.1.5 Exclusion criteria: (i) duplicate publications or incomplete data; (ii) unavailability of full text;

2.2. Literature Search Strategy

Computer searches of PubMed, Embase, Web of Science, Cochrane Library, CINAHL, China Knowledge Network, China Biomedical Literature Database, Vipshop, and Wanfang databases for studies on the effectiveness of critical care nursing scoring systems in human resource allocation in ICUs were conducted with a search time frame of build to November 2022. English databases were searched using PubMed as an example, using a combination of subject terms and free words: (Critical care nursing scoring system [Title/Abstract]) OR (ICNSS [Title/Abstract])) AND (Allocation of nursing human resources [Title/Abstract]) OR (nursing human resource allocation [Title/Abstract]) OR (nursing human resource distribution [Title/Abstract]) OR (nursing human resource distribution [Title/Abstract]) Title/Abstract])) OR (nursing human resources allocation [Title/Abstract])) OR (nursing human resources disposal [Title/Abstract]); for Chinese databases, take China Knowledge Network as an example. For example, the search formula was (Topic: Intensive care nursing scoring system (exact)) AND (Topic: Nursing human resources allocation (exact) OR (Topic: Nursing human resources management (exact)) OR (Topic: Nursing human resources deployment (exact)).

2.3. Literature Screening and Data Extraction

Literature screening and data extraction was carried out independently by 2 research-trained investigators, and where disagreements were encountered, a third investigator trained in evidence-based care was consulted to assist with judgement through discussion or consultation. The retrieved literature was first imported into the EndnoteX9 literature management tool to exclude duplicates, followed by a primary screening based on inclusion and exclusion criteria, and a final reading of the full text for re-screening. Information was extracted including authors of included literature, study population, study methods and results.

2.4. Quality Assessment

Methodological quality was independently assessed by 2 investigators using the Cochrane Risk of Bias Assessment Tool. The evaluation included: (i) generation of randomized sequences; (ii) allocation concealment; (iii) blinding of subjects and trial personnel; (iv) blinding of outcome assessors; (v) completeness of outcome data; (vi) selective reporting bias; and (vii) other biases, with responses categorized as 'high risk', 'uncertain ", and "low risk" responses. Methodological results are presented in a risk bias evaluation chart in RevMan 5.3 software.

2.5. Statistical Analysis

The extracted data were processed using the RevMan 5.4 software provided through the Cochrane Collaboration Network. Dichotomous variables were described by relative risk (RR), continuous variables by mean difference (MD), and 95% confidence interval (CI) were used to describe the interval estimates of the outcome indicators. [222]Heterogeneity between included studies was analyzed using the $\chi 2$ test (at $\alpha = 0.1$) and was considered statistically significant if $P < 0.1$ and not statistically significant if $P \geq 0.1$. The level of Meta-analysis was set at $\alpha=0.05$. If there was significant clinical heterogeneity, the Meta-analysis was performed by subgroup analysis or sensitivity analysis, or by descriptive analysis only.

3. Results

3.1. Literature Screening Process and Results

The initial check yielded 172 relevant papers. After removing duplicates using EndNoteX9 software, 110 papers were obtained, 74 were excluded after reading the title and abstract, and 21 were excluded after reading the full text Fifteen studies were included, all of which were RCTs with a total of 1520 patients (775 in the trial group and 745 in the control group). The literature screening process is shown in Figure 1.

3.2. Basic Characteristics of the Included Studies

The basic characteristics of the included studies are shown in Table 1.

3.3. Results of the Risk of Bias Evaluation

Of the 15 included studies, all in Chinese, two [7,24] studies proposed a randomization method using a 'random number table', one [19] study proposed a 'stratified randomized grouping' method, one [30] study proposed a computerized randomization method, and 11 [2,16,21,22,23,25,26,27,28,29,31] studies mentioned 'randomization' only. [30] All studies did not mention the use of blinded methods, including investigators and patients and outcome evaluators. All studies reported outcome indicators objectively and completely. See Figure 2.

3.4. Meta-analysis Results

3.4.1 Reduction in hospital length of stay A total of 14 studies comprising 1415 patients were included,

tested for heterogeneity (P = 0.13, I^2 =31%), using a fixed effects model. The results showed a statistically significant reduction in length of stay in the intervention group compared to the control group (MD: -3.16, 95% CI [-3.44,-2.88]), (Z = 22.31, P < 0.000 01), suggesting that the intensive care scoring system could significantly reduce the length of stay of patients. See Figure 3.

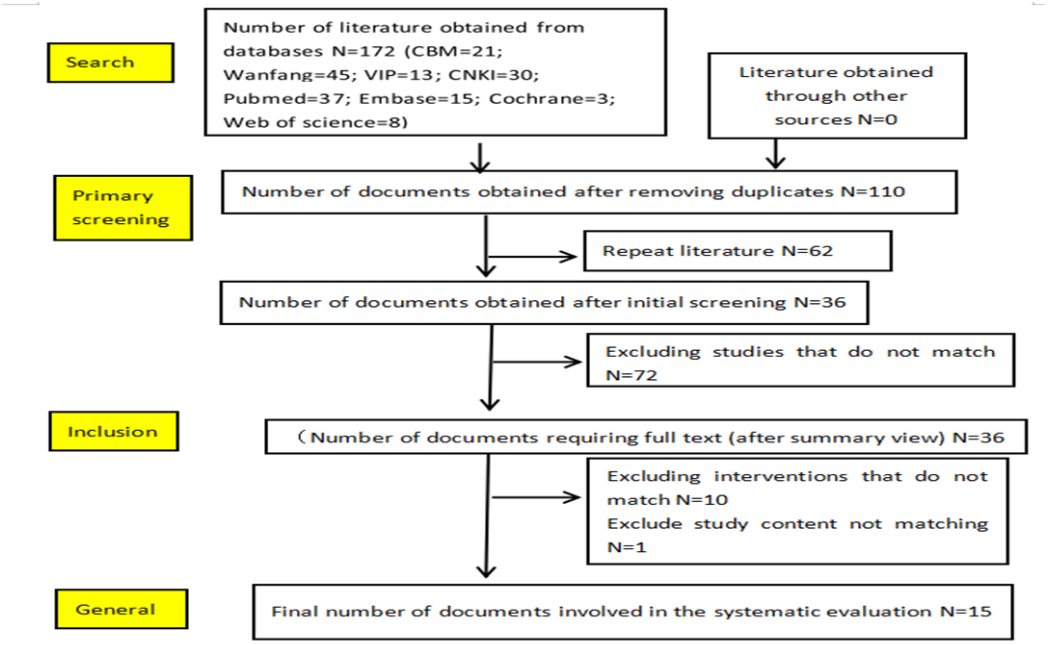

Figure 1. Flow chart of literature screening

Table 1. Basic characteristics of the included literature

Inclusion in *the study*	Study design	Number of cases (T/C)	Interventions		Ending indicators
			T	C	
Wang Yanju 2018	RCT	45/45	ICNSS	Average bed sharing method	(1)(2)(3)(4)
Yao Guizhen 2019	RCT	30/30	ICNSS	Average bed sharing method	(1)(2)(4)
Malan 2015	RCT	40/40	ICNSS	Average bed sharing method	(1)(2)(3)(4)(5)
Xiong Jie 2011	RCT	55/50	ICNSS	Average bed sharing method	(1)(2)(3)(4)(5)
Shin Ai Ai 2017	RCT	55/50	ICNSS	Average bed sharing method	(4)(5)
Wang Chunfeng 2013	RCT	56/51	ICNSS	Average bed sharing method	(1)(2)(3)(4)(5)
Yang Manmei 2014	RCT	60/60	ICNSS	Average bed sharing method	(1)(2)(3)(4)(5)
Yang Shouxiang 2014	RCT	50/50	ICNSS	Average bed sharing method	(1)(2)(3)(4)(5)
Yuan Yan 2016	RCT	122/113	ICNSS	Average bed sharing method	(1)(3)(4)(5)
Xiong Jie 2010	RCT	55/50	ICNSS	Average bed sharing method	(1)(2)(3)(5)
Cui Erping 2018	RCT	50/50	ICNSS	Average bed sharing method	(1)(2)(3)
Wang Fang 2012	RCT	40/40	ICNSS	Average bed sharing method	(1)(2)(3)(4)
Xu Zhengyan2018	RCT	40/40	ICNSS	Average bed sharing method	(1)(2)(3)(4)
Tian Lianying 2015	RCT	34/33	ICNSS	Average averaging method	(1)(2)(3)(4)
Ho Kin Yung 2013	RCT	43/43	ICNSS	Average bed sharing method	(1)(2)(3)

Note: T: experimental group, C: control group; ICNSS: Intensive Care Nursing Scoring System, (1) duration of ICU stay; (2) hospitalization cost; (3) occurrence of complications during ICU stay; (4) satisfaction of patients and family members with nursing care; (5) satisfaction of nurses with nursing care.

Figure 2. Risk of bias assessment results for the included literature

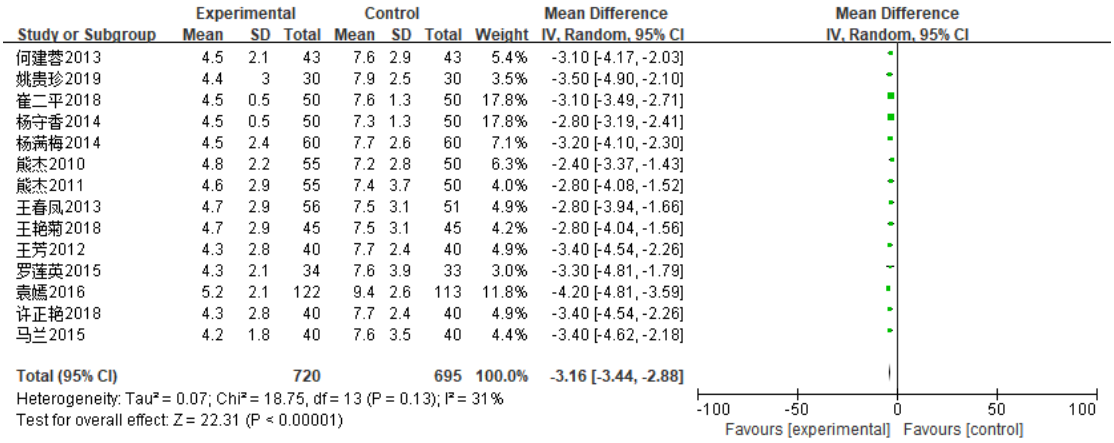

Figure 3. Meta-analysis of reduction in length of stay

3.4.2 Reduction in medical costs A total of 13 studies comprising 1180 patients were included, tested for heterogeneity (P < 0. 000 01, I^2 =0%) and analyzed using a fixed effects model. The results showed that medical costs were significantly lower in the intervention group than in the control group [MD: -0.87, 95% CI (-0.94, -0.81)], with a statistically significant difference (Z = 25.96, P < 0.000 01), suggesting that the intensive care scoring system can significantly The difference was statistically significant (Z = 25.96, P < 0.000 01), suggesting that the intensive care scoring system could significantly reduce patients' healthcare costs. See Figure 4.

3.4.3 Reduction of complications A total of 13 studies comprising 1355 patients were included, tested for heterogeneity (P < 0. 000 01, I^2 =0%) and analyzed using a fixed effects model. The results showed that complications were significantly lower in the intervention group than in the control group [MD: 0.33, 95% CI (0.23, 0.46)], with a statistically significant difference (Z = 6.27, P < 0. 00001), suggesting that the intensive care scoring system could significantly reduce complications in patients. See Figure 5.

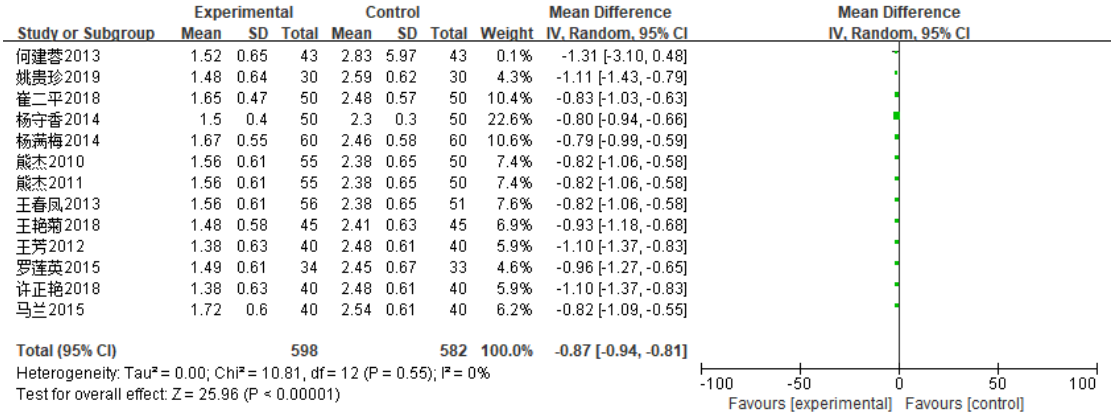

Figure 4. Meta-analysis of health care cost reduction

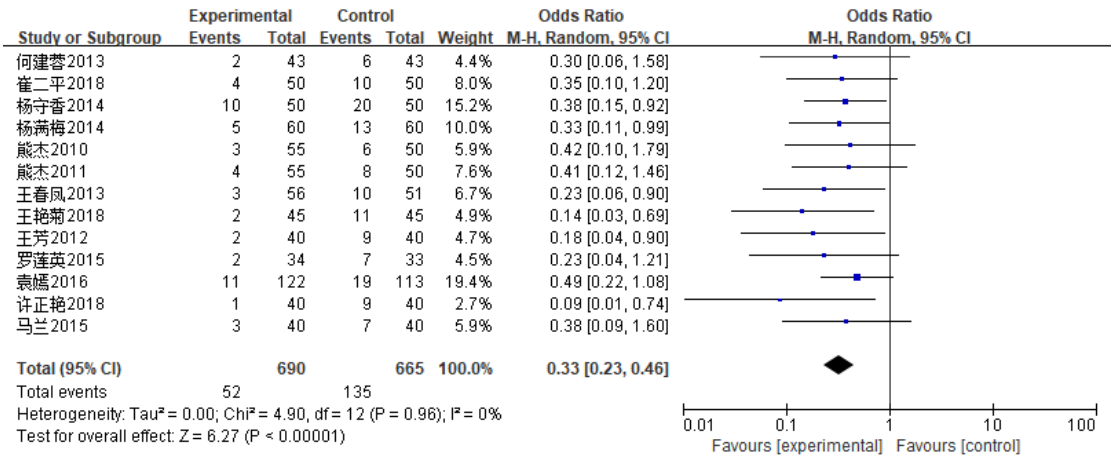

Figure 5. Meta-analysis of complication reduction

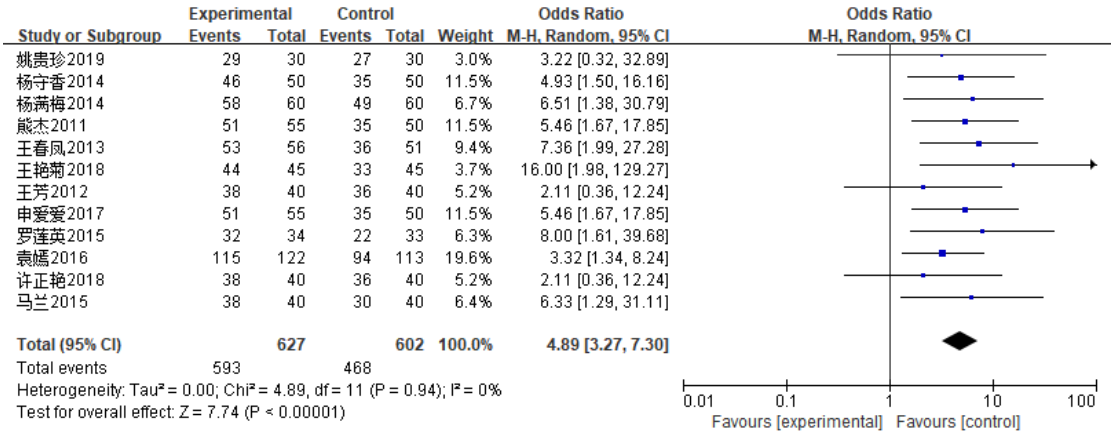

Figure 6. Meta-analysis to improve patient and family satisfaction

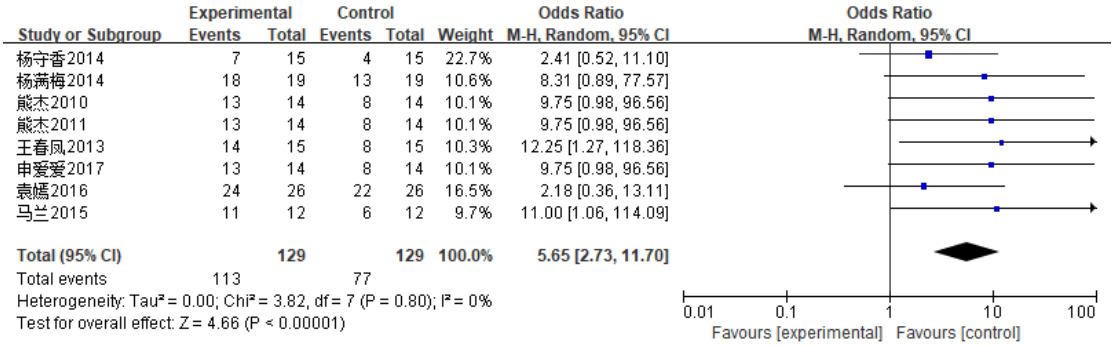

Figure 7. Meta-analysis to improve nurses' satisfaction with nursing care

3.4.4 Increased patient and family satisfaction A total of 12 studies comprising 1229 patients were included, tested for heterogeneity ($P < 0.00001$, $I^2 = 0\%$) and analyzed using a fixed effects model. The results showed that patient and family satisfaction was significantly higher in the intervention group than in the control group [OR: 4.89, 95% CI (3.27, 7.30)], with a statistically significant difference ($Z = 7.74$, $P < 0.00001$), suggesting that the intensive care scoring system can significantly improve patient and family satisfaction. See Figure 6.

3.4.5 Improving nurses' satisfaction with their nursing work A total of eight studies containing 258 nurses were included, tested for heterogeneity ($P < 0.00001$, $I^2 = 0\%$) and analyzed using a fixed effects model. The results showed that nurses' job satisfaction was significantly higher in the intervention group than in the control group [OR: 5.65, 95% CI (2.73, 11.70)], with a statistically significant difference ($Z = 4.66$, $P < 0.00001$), suggesting that the intensive care scoring system can significantly improve nurses' job satisfaction. See Figure 7.

4. Discussion

4.1. Effect of Intensive Care Scoring System on Patients' Length of Stay

The results of this study showed that the intensive care scoring system reduced the length of stay of inpatients. Length of stay is an important indicator for evaluating the capacity of healthcare services and the use of healthcare resources [8] and prolonged length of stay not only increases the risk of in-hospital acquired complications or death after discharge [9,10], but also increases the financial burden on patients and the pressure on healthcare resources [8]. However, the results of this indicator study are from only 13 studies and further validation of the findings is needed.

4.2. Impact of the Intensive Care Scoring System on Patients' Healthcare Costs

The results of this study showed that the intensive care scoring system reduced the healthcare costs of hospitalized patients. Patients admitted to the intensive care unit are acutely and critically ill and incur high medical costs as more emergency treatment and vital sign maintenance measures are used [11]. The current health care system in China is still inadequate, some patients' medical expenses are paid out of pocket and most family members have low income [12], the high medical costs can place a heavy financial burden on the patient's family [13].

4.3. Impact of the Intensive Care Scoring System on Patient Complications

The results of this study showed that the intensive care scoring system reduced the incidence of complications in hospitalized patients. The nature of the intensive care unit setting and the severity of the patient's illness, which requires a variety of therapies that prevent the patient from moving and resting in bed, determines that patients in the intensive care unit have a much higher incidence of

complications than in the general ward. [14] The occurrence of complications can exacerbate patient distress on the one hand and affect clinical outcomes on the other. [15] The adoption of an intensive care scoring system for the allocation of nursing resources in the ICU will allow for a more targeted approach, especially for critically ill patients in the ICU, to ensure a high level of quality of care and thus reduce the incidence of complications. [16] However, the results of this indicator study are only from 13 studies and further validation of the findings is needed.

4.4. Impact of the Critical Care Scoring System on Patient and Family Satisfaction

The results of this study show that the critical care scoring system can improve the satisfaction of patients and their families. Patient and family satisfaction is an important indicator of the quality of medical services, which can objectively reflect the strengths and weaknesses of medical services, reflect the fairness and scientific nature of medical and health care, and directly affect social stability, equity and harmony. [17] Improving the satisfaction of residents with medical services is an important goal of the supply-side reform of medical services, and is also the key to promoting the health China strategy. [18] The allocation of nursing resources according to ICNSS is highly flexible, and for patients in critical conditions and with a large nursing workload, the allocation of manpower can be increased and strong integrated nursing measures can be taken to ensure that patients are saved.

The treatment is in place to effectively control further progression of the disease, while for patients with relatively mild conditions and less extensive care, manpower allocation and unnecessary monitoring and care measures can be appropriately reduced, which can improve the quality of care and reduce the financial burden on patients [19], thereby increasing patient and family satisfaction. However, the results of this indicator study are only from 12 studies and the findings need further validation.

4.5. Impact of the Critical Care Scoring System on Nurses' Job Satisfaction

The results of this study show that the critical care scoring system improves nursing satisfaction with their jobs. Nurses' satisfaction with their jobs affects practice attitudes and work efficiency, which will have a direct impact on patient experience, and poor patient experience is detrimental to the development of quality nursing care [20]. The allocation of nursing human resources according to the ICNSS scale can motivate nursing staff and effectively improve their job satisfaction, and nursing staff feel that their workload is moderate. [21] For example, for patients with IC N SS 16-22, the nurse-patient ratio is 0.5:1; for IC N SS 23-32, the nurse-patient ratio is adjusted to 1:1; when the IC N SS reaches 33-40, the nurse-patient ratio is 1.5:1; for patients with IC N SS-40, the nurse-patient ratio is increased to 2:1, which not only relieves the nurses' excessive fatigue and tension, but also ensures that they have sufficient energy to go to work in a timely manner. This not only relieved the nurses' excessive fatigue and stress, but also ensured that they had sufficient energy to complete all nursing tasks in a timely manner, with quality and quantity, and also ensured that the nurses' working hours were flexible, with the opportunity to have a weekend off every month, truly reflecting the humanization of ICU management. [7] However, the results of this indicator study are only from eight studies and the findings need further validation.

4.6. Limitations

Limitations: (i) no foreign language literature was included, which affects the extrapolation of results; (ii) some of the included studies were not explicitly reported or did not implement allocation concealment, blinding and the presence of dropouts/missed visits, which may lead to selection, implementation and measurement bias; (iii) only published literature was searched during the literature search, and some negative outcome studies that had not been published were not considered, which may lead to bias.

In summary, the current evidence suggests that intensive care scoring systems can reduce patient length of stay, hospital costs, complication rates during hospitalisation, patient and family satisfaction and nurse satisfaction with nursing care, but more high-quality studies are needed to validate these findings due to the number and quality of included studies.

References

[1] Wang Lizhu, Shang Dandan, Wang Yuwei, et al. Research progress on factors influencing early activity in ICU patients [J]. Nursing and Rehabilitation, 2021, 20(10): 41-44.

[2] Wang Yanju. The application of critical care scoring system in ICU nursing human resource allocation [J]. Nursing Research, 2013, 26: 99.

[3] Li Xueqiu, Li Ming, Huang Hongyou, et al. Survey of nursing human resources in ICU and management countermeasures [J]. China Nursing Management, 2004, 4(2): 22-24.

[4] Pyykko AK, Laurila JJ , Ala-Kokko TI, et al. Intensive care nursing scoring system. Part 1:classification of nursing diagnose [J]. Intensive Crit Care Nurs, 2000, 16(6): 345-356.

[5] Pyykkerenolamine AK, Laurila JJ, Ala-Kokko TI, et al. Validation of the new intensive care nursing scoring system (ICNSS) [J]. Crit Care Med, 2004, 30(2): 254-259.

[6] Yang Manmei. Application and effect evaluation of ICU nursing scoring system in nursing human resource allocation [J]. Journal of Taishan Medical College, 2014, 35(7): 636-637.

[7] Xiong J, Huang Sufang, Liu Weiquan, et al. Application of critical care nursing scoring system in ICU nursing human resource allocation [J]. Journal of Liberation Army Nursing, 2011, 28(1B): 21-23.

[8] Zhu L, Liu L, Zhang JM, Yang XH, Wei Q, Du CHP. Effect of frailty and nutritional risk on length of stay in hip replacement patients [J]. Modern preventive medicine, 2021, 48(14): 2669-2672.

[9] Hoang V. Tran et al. Trends in Length of Hospital Stay and the Impact on Prognosis of Early Discharge After a First Uncomplicated Acute Myocardial Infarction [J]. The American Journal of Cardiology, 2018, 121(4): 397-402.

[10] Rasu Rafia S. et al. Shorter length of hospital stay for hip fracture in those with dementia and without a known diagnosis of osteoporosis in the USA [J]. BMC Geriatrics, 2020, 20(1): 523-523.

[11] Yan Zhaohong, Zhang Yong, Zhu Qipeng, Qin Ningning, Gao Qianqian. Trend analysis of inpatient cost changes of ICU patients in the perspective of structural change degree [J]. China Medical Case, 2019, 20(10): 49-52.

[12] Han Lulu. Clinical study on the current situation of psychological needs of family members of ICU inpatients and the factors influencing them [D]. Lanzhou University, 2021.

[13] Huang Xiaojun, Liang Jinyan, Xiang Jie. Systematic evaluation of a qualitative study on factors influencing the choice of life-saving treatment for terminally ill patients in a domestic intensive care unit[J]. Nursing Practice Research, 2021, 18(07): 999-1002.

[14] Wang N,Cai S-X,Liu Z. Research progress of early activity in intensive care unit patients [J]. Journal of Nursing Continuing Education, 2018, 33(12): 1082-1086.

[15] Chen Meixue. Application of evidence-based nursing in the prevention of complications in ICU patients [J]. Nursing Practice and Research, 2017, 14(12): 44-46.

[16] He Jianrong, Application of intensive care nursing scoring system in ICU nursing human resource allocation [J]. Medical Information, 2013, 26(4): 296-297.

[17] Zhang Jianjie, Li Jinlin, Cao Xueli. An empirical analysis of factors influencing patients' satisfaction with medical care [J]. Journal of Beijing University of Technology (Social Science Edition), 2018, 20(01): 102-109.

[18] Lei Xian Sheng. A study on residents' satisfaction with medical services in China--an empirical analysis based on China General Social Survey (CGSS) 2015 data [J]. China Health Policy Research, 2019, 12(03): 1-7.

[19] Xiong J, Huang SF, Liu WQ, et al. Application of ICU nursing scoring system in nursing human resource allocation and evaluation of its effectiveness [J]. Chinese Journal of Nursing, 2010, 45(7): 581-584.

[20] Guo Yanhong,Yu Xiaochu, Wang Shengyou, Li Lei, Zhang Lixin, Wang Zhisheng, Meng Li, Wang Manli, Wu Xinjuan, Cao Jing, Chen Xiaohong. Survey and analysis of third-party satisfaction with quality nursing services in 112 hospitals [J]. China Nursing Management, 2013, 13(05): 1-4.

[21] Wang Chunfeng. Application of intensive care nursing scoring system to evaluate nursing human resource allocation in ICU [J]. Nursing Practice and Research, 2013, 10(1): 79-80.

[22] Cui Erping, Analysis of the effect of allocating nursing human resources in ICU with intensive care nursing scoring system [J] Capital Food and Medicine, 2018,1 (on) 64-65.

[23] Luo Lianying, Analysis of the application of intensive care nursing scoring system in the management of nursing human resources in ICU, [J] Modern Diagnosis and Therapy, 2015,26(18): 4319-4320.

[24] Ma Lan, Analysis of the effect of allocating nursing human resources in ICU with intensive care nursing scoring system, [J] Contemporary Medicine Series, 2015,13(12) 106-107.

[25] Shen Ai-ai, Application of intensive care nursing scoring system in ICU nursing human resource allocation, [J] Health Frontiers, 2017, 9(26): 79.

[26] Wang F, Application of critical care nursing scoring system in ICU nursing human resource allocation, [J] General Practice Nursing, 2012, 10(5): 1195.

[27] Xu Zhengyan, Observation on the application effect of intensive care nursing scoring system in ICU nursing human resource allocation, [J] China Rural Health, 2018, 5(10): 61-62.

[28] Yang Manmei, Application of ICU nursing scoring system in nursing human resource allocation and evaluation of its effect, [J] Journal of Taishan Medical College, 2014, 35(7): 636-637.

[29] Yang Shouxiang, Application of ICU nursing scoring system in nursing human resource allocation Effectiveness analysis, [J] Modern Nursing, 2014,16(a) 164-165.

[30] Yao Guizhen, Application of intensive care nursing scoring system in ICU nursing human resource allocation, [J] Mother and Child World, 2019, 3(6): 241.

[31] Yuan Yan, Application of critical care nursing scoring system in ICU nursing, [J] Journal of Practical Clinical Nursing, 2016, 5(1): 64-66.