Evaluation of the workload of nurses caring for patients with congenital diaphragmatic hernia in a neonatal intensive care unit, according to the TISS-28 and NEMS scales

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ABSTRACT

Introduction: The term "workload" has been used in the foreign literature. It is defined as a kind of power relations, active in the time of work. Excessive workload has been identified as a significant stressor in different professions. Nurses working in a complex, technology-related environment are exposed to a high workload. Those working in newborn intensive care units are exposed to an extremely high workload, both physically and psychologically. In the research project the measurement and analysis of nurses' workload in the care of patients with congenital diaphragmatic hernia was conducted.

Aim of the study: The purpose of this study was to evaluate nursing workload in the care of patients with congenital diaphragmatic hernia, based on the TISS-28 (Therapeutic Intervention Simplified Scoring System-28) and the NEMS (Nine Equivalent of Nursing Manpower Score) scales.

Material and methods: The research group comprised patients with congenital diaphragmatic hernia admitted to the neonatal intensive care unit (NICU) from January 2017 to December 2017. The applied methods included participatory observation, application of two standardised scales: TISS-28 and NEMS, and documentation analysis.

Results: The average result of the measurement with the TISS-28 scale amounted to 479.5 (± SD = 47.2) points for nurses' workload evaluation during a day of work and 480.1 (± SD = 46.0) points at night. No statistically significant differences of the analysed variables due to time of a day were found ($p = 0.403$). The average results of the measurement with the NEMS scale amounted to 37.9 (± SD = 5.6) points for nurses' workload evaluation during a day of work and 36.8 (± SD = 4.9) points at night. No statistically significant differences of the analysed variables due to time of a day was found ($p = 0.562$). The evaluations of day workload with the TISS-28 scale correlated statistically significantly with the results of night workload using the same scale: $\rho = 0.51$ ($p = 0.034$), as well as with the results of day workload with the NEMS scale: $\rho = 0.91$ ($p < 0.001$). Moreover, the measurements with the NEMS scale correlated with the results for the night workload, measured with the same scale: $\rho = 0.65$ ($p = 0.005$). No statistically significant correlations between the day workload measured with the TISS-28 scale and night workload measured with the NEMS scale were found, nor between the results of night workload measured with the TISS-28 scale and both day and night workload measured with the NEMS scale.

Conclusions: Based on the results of the study, there is a high workload for nurses in the care of patients with congenital diaphragmatic hernia in the intensive care unit. There were no differences in the workload of nurses during day and night duty.

Key words: nursing workload, TISS-28, NEMS, patient with congenital diaphragmatic hernia, newborn intensive care unit (NICU).

INTRODUCTION

The term "workload" has been used in the foreign literature. It is defined as a kind of power relations, active in the time of work. Excessive workload has been identified as a significant stressor in different professions. Nurses working in a complex, technology-related environment, are exposed to high workload. Those working at the newborn intensive care unit are exposed to an extremely high workload, both physically and psychologically [1-5].

Congenital diaphragmatic hernia (CDH) is a congenital abnormality with pulmonary hypoplasia and congenital coloboma diaphragm, with viscera displacement to the chest. Newborns with CDH present symptoms of respiratory and circulatory failure. Bilateral pulmonary hypoplasia is observed, more severely on the abnormality side. Pulmonary hypoplasia and abnormalities of pulmonary vessels result in a morphologically and functionally conditioned tendency for persistent pulmonary hypertension (PPHT). Anoxia, acidosis, and mechanical ventilation, triggering automatic contraction of pulmonary vessels, causes changes in the construction of vascular walls. Congenital diaphragmatic hernias occur at a frequency of one per 2000-5000 live births, with a burden of high mortality. According to the Life Support Organisation Registry, overall survival in newborns with CDH is estimated at approximately 60%. In centres well-experienced in treating patients with CDH, offering optimal pre- and post-natal care and diagnostics, the survival rate amounts to 90% [5].

There are several scales aimed at nurses' workload evaluation in Western countries, like the TISS-28 (Therapeutic Intervention Simplified Scoring System-28) scale or its shortened version: the Nine Equivalents of Nursing Manpower Use Score (NEMS). These scales were standardised on large populations of intensive care patients. They have proven to be useful in estimating nursing workload [6-9].

Implementations of employment standards in Poland were attempted according to the Minister of Health and Social Care regulation from 2012 [10]. Unfortunately, due to difficulties in estimating the time of direct and indirect nursing activities, as well as a lack of objective measurements, the goal has not been achieved so far.

The TISS-28 and NEMS scales were analysed in Polish intensive care units on large patient groups. Verification of the results revealed their applicability in the evaluation of nursing workload [11, 12].

The aim of the research was the evaluation of nursing workload, according to the TISS-28 and NEMS scales. The following hypotheses were developed for this project:

H0: The workload of nurses in caring for patients with congenital diaphragmatic hernia is high.

H1: The workload of nurses in caring for patients with congenital diaphragmatic hernia is not high.

As well as:

H0: The workload of nurses in caring for patients with congenital diaphragmatic hernia on daytime duty is higher than on night duty.

H1: The workload of nurses in caring for patients with congenital diaphragmatic hernia on day and night duty is the same.

MATERIAL AND METHODS

The study included 29 patients with CDH, hospitalised in the III Reference Centre, between January 2017 and the end of December 2017. Twenty-three of them underwent surgery, 14 of whom were supported with ECMO treatment. Observation and analysis of data started on the first day of admission to the ward, and the research was completed in the era of ECMO.

This research involved a non-reactive test and non-probability sampling. Research methods included participatory observation, documentation analysis, and standardised TISS-28 and NEMS scales.

Therapeutic interventions were documented according to the TISS-28 and NEMS scales for each patient during hospitalisation [8]. These interventions were registered by nurses during their two-shift (day and night) services. Participatory observation with the TISS-28 and NEMS scales were applied. The research technique included document analysis (medical documentation, daily observation card, medical examination chart, pain observation chart, central routes observation chart, bladder catheter observation cart, surgical site observation cart, medical orders chart, nursing reports book).

The TISS-28 scale is built from seven therapeutic intervention groups. Therapeutic activities are divided into basic activities related to patient monitoring, respiratory therapy, cardiopulmonary therapy, supportive treatment of renal excretion, monitoring of central nervous system function, treatment of metabolic disorders, and other interventions performed both in the intensive care unit and outside the ward [1]. According to the TISS-28 scale, one point takes the nurse about 10.6 minutes during eight hours of work. This scale assumes that the nurse during one duty should not work more than 46.35 points. This information can be useful for planning the allocation of nursing manpower, to evaluate the efficacy in the use of nursing workload, and to objectively classify ICUs based on the amount of care provided [1, 13].

The NEMS scale was developed on the basis of the TISS-28 scale. It consists of nine therapeutic interventions, including: monitoring of life parameters, respiratory assistance, vasoactive therapy, dialyses, activities specific for a unit, and activities realised outside an intensive care unit. A patient can receive a maximum of 63 points, and maximal nurse workload cannot exceed 46 points [13, 14]. Nurses workloads were estimated with this scale for each patient at the end of day and night shifts.

The number of points obtained with this scale revealed the nurses' workload during particular shifts. The data were analysed with Statistica software. Descriptive statistics were used (average, standard deviation, median, minimal and maximal values), as well as the Mann-Whitney test, to find dependencies among variables.

RESULTS

Average value of evaluation with the TISS-28 scale amounted to 479.5 (± SD = 47.2) points for nurses' day workload and 480.1 (± SD = 46.0) points for nurses' night workload. No statistically significant differences (p = 0.403) of this variable as for time of a day were found (Table 1, Figure 1).

The average value of evaluation with the NEMS scale amounted to 37.9 (± SD = 5.6) points for nurses' day workload and 36.8 (± SD = 4.9) points for nurses' night workload. No statistically significant differences (p = 0.562) of this variable for time of day were found (Table 1, Figure 2).

Day workload evaluation using the TISS-28 scale correlated significantly with evaluation of night workload: ρ = 0.51 (p = 0.034) and with day workload evaluation with the NEMS scale: ρ = 0.91 (p < 0.001). Moreover, day workload evaluation with the NEMS scale correlated with the night workload evaluation according to the same scale: ρ = 0.65 (p = 0.005). No statistically significant correlations of day workload evaluation in the TISS-28 scale and night workload evaluation in the NEMS scale were found, nor between night workload in the TISS-28 scale and both day and night workload evaluation in the NEMS scale (Table 2).

Table 1. Descriptive statistics for the results in TISS-28 (Therapeutic Intervention Simplified Scoring System-28) and NEMS (Nine Equivalent of Nursing Manpower Score) scales (number of points)

Scale	Time of day	Statistical parameter							Level of statistical significance of differences
		M	ME	Q_1–Q_3 (IQR)	SD	SE	95% CI	Min.-max.	
TISS-28	Day	479.5	466	466-503.5 (37.5)	47.2	10.5	457.4-501.6	350-583	p = 0.403
	Night	480.1	466	466-498 (32.0)	46.0	9.6	460.2-500.0	382-615	
NEMS	Day	37.9	34	34-40 (6.0)	5.6	1.4	35.0-40.8	34-52	p = 0.562
	Night	36.8	34	34-40 (6.0)	4.9	1.1	34.5-39.1	27-46	

M – average, Me – median, Q – quartiles (first and third), IQR – interquartile range, CI – confidence interval

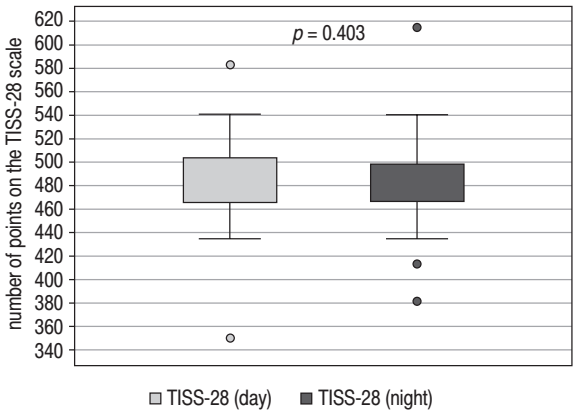

Figure 1. Distribution values of points in TISS-28 (Therapeutic Intervention Simplified Scoring System-28) scale according to time of day

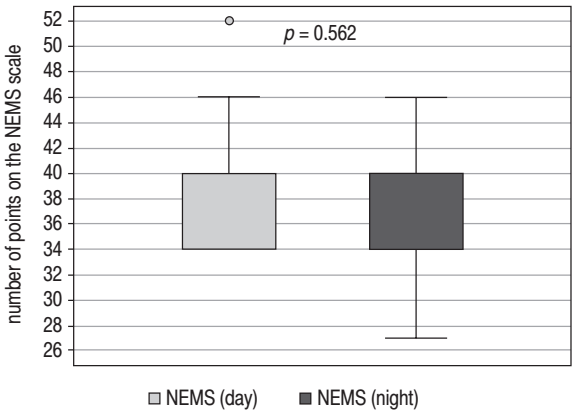

Figure 2. Distribution values of points in NEMS (Nine Equivalent of Nursing Manpower Score) scale according to time of day

Table 2. The coefficients of Spearman rank correlation ρ, together with the p statistical significance of the results in analysis scales according to time of day

Scale	TISS-28 (day)		TISS-28 (night)		NEMS (day)		NEMS (night)	
TISS-28 (day)								
TISS-28 (night)	**ρ = 0.51**	**p = 0.034**						
NEMS (day)	**ρ = 0.91**	**p < 0.001**	ρ = 0.35	p = 0.172				
NEMS (night)	ρ = 0.42	p = 0.093	ρ = 0.33	p = 0.196	**ρ = 0.65**	**p = 0.005**		

TISS-28 – Therapeutic Intervention Simplified Scoring System-28, NEMS – Nine Equivalent of Nursing Manpower Score

DISCUSSION

The results reveal high workload of nurses, proven by the number of points received per patient during each shift.

No differences in day and night workloads were found in analysis of the findings – the number of diagnostic and therapeutic interventions is similar or the same. However, some studies show that nurses' workload (number of interventions during a shift) during a night shift is lower, and others explain such a situation by the generally lower number of interventions at night [7]. As this research proves, the number of diagnostic and therapeutic interventions is the same for both shifts.

The NEMS scale assumes that the nurses' overload cannot exceed 46 points. The results received in this study were high [15].

Based on the NEMS scale score, the so-called "Categorisation of the patient", which defines the need for nursing care, the Swiss Society for Intensive Care developed the following patient categorisation: Category 1A (< 1 nurse : patient) > 30 NEMS points, Category 1B (1 : 1) 21-30 points of the NEMS scale, Category 2 (1 : 2) 13-20 points of the NEMS scale, and Category 3 (1 : 3) 0-12 points of the NEMS scale [16, 17]. The average NEMS measurement results show patient category 1A, which is understood in the same way as high workload of nursing [1].

The impact of nursing workload on the patient and the nurse is well documented: increased workload leads to lower quality of patient care and safety, as well as higher rates of anxiety, stress, burnout, and attrition of nurses [18].

There are many tools to measure workload but the Therapeutic Intervention Scoring System (TISS) is the most widespread and has become the international gold standard for measuring workload [19].

Determining the number of staff and the workload required to provide quality care in the ICU is a challenging task [20]. Nurse managers need to address the workload issues with regard to the real nature of nursing work; the complexity of care has been associated with the need for a higher number of nursing professionals per patient [20, 21].

CONCLUSIONS

Based on the results of the study, it can be concluded that the workload of nurses caring for patients with congenital diaphragmatic hernia on NICU is high. This is confirmed by the values obtained from both scales: TISS-28 and NEMS. There were no differences in the workload of nurses during day and night duty because the number of diagnostic and therapeutic interventions is similar or the same.

Disclosure

The authors declare no conflict of interest.

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