




ORIGINAL ARTICLE

## PRACTICE ENVIRONMENT AND PATIENT SAFETY IN THE OPERATING ROOM: PREDICTIVE DIMENSIONS

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### ABSTRACT

**Objectives:** to identify the practice environment perceived by perioperative nurses and determine the dimensions of the practice environment that predict patient safety. **Method:** descriptive and explanatory study, in a sample of 1,001 nurses from 24 Portuguese hospitals (January to October 2018), using the Patient Safety in the Operating Room questionnaire and the Portuguese version of the Practice Environment Scale - Work Nursing Index. Use of descriptive analysis, Cronbach's alpha and stepwise method in the analysis of the linear regression model. **Results:** the global average (M=2.49) of the practice environment indicates its classification as unfavorable. Regression models reveal that all dimensions of the environment are predictors of patient safety in the operating room, highlighting the dimension "Nursing fundamentals for quality of care". **Conclusion:** this study highlighted the influence of the practice environment on patient safety in the perioperative context and the need to introduce improvements.

**DESCRIPTORS:** Working Environment; Patient safety; Operating Rooms, Perioperative Nursing; Perioperative Care.

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## INTRODUCTION

The concern with nursing practice environments is not recent, it began with Florence Nightingale, who recognized that the conditions and circumstances in which the practice is developed are decisive for the patient's outcome. Other nursing theorists emphasize in their conceptual models the constant interaction between humans and their environments, such as Myra Estrin Levine, Barbara Artinian, Imogene King, Callista Roy or Jean Watson<sup>(1)</sup>. In turn, the specific conceptual model of the perioperative context, adopted by the Association of periOperative Registered Nurses (AORN), the Perioperative Patient Focused Model, recognizes as one of the four central domains for the provision of care, the domain of the health system, which refers to the practice environment, assuming its influence on perioperative care<sup>(2)</sup>. The environment is a central nursing concept, integrating one of the four metaparadigm concepts (person, health, environment and nursing)<sup>(1)</sup>.

In the early 1980s, the marked turnover and shortage of nurses in the United States of America determined the need to understand the distinctive factors and organizational characteristics that allowed some hospitals, identified as Magnet hospitals, to be able to recruit and retain nurses<sup>(3)</sup>. These hospitals had specific organizational characteristics: the decentralization of decision-making at nursing level; strong and effective nursing leadership; the recognition of professional nursing autonomy, accountability and responsibility for the quality of customer care; adequacy of human resources and flexible schedules<sup>(3)</sup>. It is in this context that the notion arises that the growing shortage of nurses could not be reversed without work environments that support nursing practice. The practice environment is defined as the organizational characteristics that facilitate or restrict professional nursing practice<sup>(3)</sup>.

Em 2004, com a publicação do relatório "Keeping patients safe: Transforming the work environment of nurses" pelo Institute of Medicine (IOM), o ambiente de prática de enfermagem é assumido como um fator crítico na segurança do doente (SD), reconhecendo-se a necessidade da sua transformação para melhorar a SD<sup>(4)</sup>. Desde então, tem sido produzida evidência crescente indicando que o desenvolvimento de ambientes favoráveis à prática de enfermagem influencia os resultados clínicos dos doentes, nomeadamente no que se refere à redução da mortalidade, erros de medicação, infecções associadas aos cuidados de saúde, úlceras de pressão, e ocorrência de quedas<sup>(5-8)</sup>.

A study involving 535 American hospitals, 53699 nurses and 805811 patients, which analyzed the evolution of the nurses' practice environment between 2005 and 2016<sup>(9)</sup>, revealed that seven out of 10 hospitals did not record improvements in the practice environment and that about 10% registered a deterioration of environments, indicating the existence of weaknesses and little investment in practice environments. The authors warn for the consequences of failure to improve practice environments, arguing that inadequate work environments can hinder progress in PS and hinder adherence to evidence-based safety interventions, enhancing the gap between knowledge and practice in prevention damage to the patient<sup>(9)</sup>.

The operating room (OR) is one of the most complex places for providing care and where the greatest number of adverse events occur<sup>(10)</sup>. The implementation of safety projects in this context, namely the "Safe Surgery, Saves Lives" project, has been faced with implementation difficulties at national and international level, which may compromise the PS<sup>(10-11)</sup>. Assuming that the optimization of nursing practice environments has the potential to contribute positively to PS and recognizing the gap in the literature regarding the characterization of practice environments in the perioperative context, the objectives of this study are to identify the practice environment perceived by perioperative nurses and determine the dimensions of the practice environment that predict PS.

## METHOD

Descriptive and explanatory study, inserted in an initial investigation<sup>(12-13)</sup> using the same sample and ethical-legal procedures. The target population consists of 2,975 perioperative nurses working in OR (adult patients) of hospitals belonging to the Portuguese National Health Service.

A cluster sampling was performed, and hospitals were selected from the different benchmarking groups of the Central Health Services Administration (ACSS) and Regional Health Administrations (RHA)<sup>(10,14)</sup>. Twenty-four hospitals were part of the sample, with a percentage per benchmarking group between 50% (groups B and E) and 66.7% (group F) and by RHA between 42.86% (Lisbon and Vale do Tejo) and 100% (Algarve), corresponding to a total of 46 OR.

It was defined as an inclusion criteria to have more than six months of professional experience and as exclusion criteria: to work as a nurse manager and to be temporarily absent from the service during the period of data collection by sick leave, vacation or otherwise. Data collection took place between January and October 2018. 1,798 questionnaires were delivered, covering all perioperative nurses who met the inclusion criteria. 1,001 nurses responded to the questionnaire, corresponding to a answer rate of 55.70%.

The sample, consisting of 1,001 participants, has an estimated sampling error of 2,6%, with a 95% confidence interval. The majority are female, corresponding to 852 individuals (84,90%). Respondents have an average age of 42,74 years (SD=0,27) and an average age of professional exercise of 19.76 years (SD=0.27). These nurses have an experience time at OR and in the current service, respectively, of 13.52 years (SD=0,28) and 11,56 years (SD=0,27). Regarding the academic degree, 866 are graduated (79,10%), 122 (18,50%) has masters, eight (1.90%) are bachelor's and five (0,50%) doctorated. Only 180 respondents (17.90%) have the title of clinical specialist. 711 of the respondents work in central OR (76,9%), 156 (15,60%) in ambulatory surgery OR and 74 (7,40%) in peripheral OR. 599 (59,7%) participants work in accredited/certified OR.

As a data collection instrument, we used the OR Patient Safety Questionnaire (ORPS)<sup>(12)</sup> and the Portuguese version of the PES-NWI<sup>(15)</sup>. The ORPS questionnaire consists of 79 items, scored on a Likert-type scale from one (never) to five (always), which allow the assessment of 19 dimensions of PS, evaluating the implementation of good practices and audits within the scope of nine areas of PS.

The practice environment was assessed using the Portuguese version of the PES-NWI<sup>(15)</sup>, consisting of 31 items grouped into five subscales of the original version of the instrument<sup>(3)</sup>. We have eliminated item 30 "The attribution of care to patients promotes continuity of care, that is, the same nurse can take care of the same patient overnight" from the dimension "Nursing fundamentals for the quality of care", since this item does not apply to the context of OR, where the present investigation was carried out. The instrument is in the form of a Likert scale, graduated in four levels, scored from one (completely agree) to four (completely disagree). The answers were inverted so that the highest values on the scale indicate agreement. The cutoff point of the scale, to consider a favorable nursing practice environment, is 2,5<sup>(3)</sup>.

Data were analyzed using the IBM SPSS Statistics software, version 25.0. In the descriptive analysis of the data, we calculated the frequencies (absolute and percentage), measures of central tendency (mean, maximum and minimum) and dispersion measures (standard deviation). In assessing reliability, we calculated the internal consistency of each dimension using Cronbach's alpha coefficient ( $\alpha$ ). We analyzed the multiple linear regression model using the stepwise method.

An opinion was requested from the Ethics Committee of the Nursing Health Sciences Research Unit of the Nursing School of Coimbra and requests for authorization to collect

information were made to the Board of Directors (BD) from the hospitals involved in the study. A positive opinion (P 458-09-2017) was obtained from the aforementioned Ethics Committee and from the BD of the 24 hospitals. Questionnaires were delivered in open envelopes, with explicit objectives and request for informed consent. They were later returned in a sealed envelope and informed consent was collected separately.

## RESULTS

The dimensions of the calculated practice environment<sup>(3,15)</sup> presented  $\alpha$  values ranging between 0,74 ("Adequacy of human and material resources") and 0,86 ("Participation in hospital policies"), as can be seen in Table 1, indicating adequate internal consistency. The overall internal consistency of the scale proved to be very good, with an  $\alpha$  value of 0,93.

Table 1 - Descriptive analysis and Cronbach's alpha of the dimensions of the Portuguese version of the PES-NWI: items, minimum, maximum, mean and standard deviation (n=1.001). Coimbra, Portugal, 2021

Dimentions	Itens	n	$\alpha$	Mín	Máx	M	SD
Participation in hospital policies (PHP)	5; 6; 17; 11, 15; 21; 23; 27; 28	987	0,86	1	4	2,21	0,54
Nursing fundamentals for quality of care (NFQC)	4; 14; 18; 19, 22; 25; 26; 29; 31	983	0,81	1	4	2,66	0,49
Management, leadership and support capacity of nurses (MLSCN)	3; 7; 10; 13; 20	986	0,82	1	4	2,43	0,62
Adequacy of human and material resources (AHMR)	1; 8; 9; 12	987	0,74	1	4	2,38	0,65
Collegiate relationship between doctors and nurses (CRDN)	2; 16; 24	996	0,77	1	4	2,79	0,51
PES-NWI global			0,93			2,49	

n = Sample; A = alfa de Cronbach Mín = Minimum; Max = Maximum; M = Mean; SP = Standard deviation.  
Source: Authors (2021).

There was a heterogeneity of responses obtained, with responses at all points of the scale in all items. Only two dimensions had values above the midpoint of the scale ( $M \geq 2.5$ ): "Colegial relationship between doctors and nurses" ( $M=2,79$ ;  $SD=0,51$ ) and "Nursing fundamentals for quality of care" ( $M=2,66$ ;  $SD=0,49$ ). The dimension "Participation in hospital policies" gathered a less favorable appreciation from nurses ( $M=2,21$ ;  $SD=0,54$ ), followed by "Adequacy of human and material resources" ( $M=2,38$ ;  $SD=0,65$ ) and "Nurses' management, leadership and support capacity" ( $M=2,43$ ;  $SD=0,62$ ). The global mean of nurses' agreement with the practice environment was also calculated ( $M=2,49$ ), which did not reach the midpoint of the scale, corroborating the existence of weaknesses in the practice environment.

In order to analyze the explanatory power of the practice environment in PS in the OR, we used the multiple linear regression technique. We considered the 19 dimensions of the ORPS questionnaire as dependent variables and the five dimensions of the practice environment as predictor variables<sup>(3,15)</sup>. In Table 2, we can see that all dimensions of the practice environment are predictors of PS in OR. The models have greater explanatory

power in the dimensions "Prevention and control of infection and resistance to antimicrobials - training and epidemiological surveillance" (30%), "Culture of safety in the internal environment" (26%), "Surgical safety - audits" (26%), "Communication security - audits" (26%) and "Incident analysis and prevention" (25%). On the contrary, they show less explanatory power in the dimensions "Safety in the use of medication - prescription" (7%), "Prevention of pressure ulcers - good practices" (10%), "Unequivocal identification - good practices" (11%), " Incident Notification" (12%), "Pressure Ulcer Prevention – Audits" (12%), and "Pressure Ulcer Prevention – Resources" (13%).

Table 2 - Practice Environment Dimensions that enter into the predictive models of PS dimensions in OR: adjusted Beta regression weights, t-tests, and explanatory percentage of each model (n=1,001). Coimbra, Portugal, 2021 (continues)

<b>Dimentions of Patient Safety in the Operating Room</b>	<b>Practice environment (Predictive Dimensions)</b>	<b>Beta-adjusted regression weights</b>	<b>T</b>	<b>P</b>	<b>% explained</b>
Safety Culture	NFQC	0,35	-9,57	0	26
	NMLSC	0,21	-5,58	0	
Communication security - good practices	NFQC	0,44	14,99	0	19
Communication security - audits	PHP	0,2	4,01	0	26
	NFQC	0,24	5,65	0	
	NMLSC	0,19	4,16	0	
	AHMR	-0,09	-2,66	0,01	
Surgical safety – good practices	NMLSC	0,25	6,17	0	16
	NFQC	0,19	4,84	0	
Surgical safety – audits	NFQC	0,28	6,54	0	26
	NMLSC	0,18	4,11	0	
	PHP	0,11	2,19	0,03	
Safety in medication use - good practices	NFQC	0,24	5,42	0	16
	NMLSC	0,01	2,13	0,03	
	PHP	0,11	2,12	0,03	
Safety in medication use - audits	PHP	0,2	3,88	0	21
	NFQC	0,18	4,07	0	
	NMLSC	0,18	3,97	0	
	AHMR (-)	-0,09	-2,37	0,02	
Safety in medication use – prescription	PHP	0,16	3,39	0	7
	NFQC	0,14	3,08	0	
Unambiguous identification - good practices	NFQC	0,3	8,56	0	11
	CRDN	0,07	2,1	0	
Unambiguous identification – audits	PHP	0,27	6,02	0	14
	NFQC	0,13	2,98	0	

Fall prevention - good practices	NFQC	0,34	7,83	0	20
	NMLSC	0,25	5,42	0	
	PHP (-)	-0,12	-2,36	0	
Fall prevention – audits	PHP	0,17	3,29	0	16
	NFQC	0,17	3,73	0	
	NMLSC	0,11	2,33	0,02	
Prevention of pressure ulcers - good practices	NFQC	0,22	5,32	0	10
	NMLSC	0,13	3,13	0	
Prevention of pressure ulcers – audits	PHP	0,25	4,62	0	12
	AHMR	-0,13	-3,24	0	
	NFQC	0,1	2,24	0,03	
	NMLSC	0,11	2,18	0,03	
Prevention of pressure ulcers – resources	NMLSC	0,14	3,37	0	13
	AHMR	0,16	4,26	0	
	NFQC	0,13	3,12	0	
Incident notification	NFQC	0,21	4,61	0	12
	PHP	0,17	3,79	0	
Incident analysis and prevention	NFQC	0,36	9,62	0	25
	NMLSC	0,18	4,85	0	
Infection prevention and control and antimicrobial resistance - good practices	NFQC	0,32	7,78	0	19
	NMLSC	0,11	2,75	0,01	
	CRDN	0,07	2,07	0,04	
Infection prevention and control and antimicrobial resistance – training and epidemiological surveillance	NFQC	0,37	9	0	30
	NMLSC	0,14	3,3	0	
	PHP	0,1	2,14	0,03	

(-)=inverse relationship; T=t tests; \*Significant two-tailed correlation for  $p \leq 0.05$ ; NFQC=Nursing fundamentals for the quality of care; NMLSC=Nurses' management, leadership and support capacity; PHP=Participation in hospital policies; AHMR=Adequacy of human and material resources; CRDN=College relationship between doctors and nurses

Source: Authors (2021).

The predictive power of the dimension "Nursing fundamentals for the quality of care" is highlighted, which is included in all predictive models with high Beta values, and of the dimensions "Management capacity, leadership and support of nurses" and "Participation hospital policies", which also fit into most models. In turn, the dimensions "Colegial relationship between doctors and nurses" and "Adequacy of human and material resources" reveal a lower predictive power (Table 2).

## DISCUSSION

The scale used in the assessment of the practice environment (PES-NWI) proved to be a reliable instrument in the perioperative context, having obtained a values, both globally



and in different dimensions, higher than those found by the authors of the validation of the scale for the Portuguese population<sup>(15)</sup> and by the author of the original version<sup>(3)</sup>.

According to the classification proposed by Lake<sup>(3)</sup>, the practice environment perceived by Portuguese perioperative nurses is considered unfavorable, with an overall mean value of less than 2.5, highlighting the need to improve the management of the environment in this context. These results are in line with a study that involved a sample of 2,235 nurses from Portuguese medical-surgical services ( $M=2,44$ )<sup>(16)</sup>, and with the results obtained by the authors of the validation of the scale for the Portuguese context ( $n=365$ ;  $M=2.57$ )<sup>(17)</sup>, which show weaknesses in the nursing practice environment in different clinical contexts. At an international level, a literature review<sup>(18)</sup> reveals that there has been little investment in practice environments, considering that in the analyzed studies, global mean values of the PES-NWI between 2,30 and 3,07 were observed. The results of a study involving 535 American hospitals, from 2005 to 2016<sup>(9)</sup>, showed that there was no improvement in the practice environment in most of the hospitals studied, and about 10% showed a deterioration.

The results of this investigation reveal that only two dimensions were rated positively: "Colegial relationship between doctors and nurses" and "Nursing fundamentals for quality of care", in line with other investigations<sup>(16,19)</sup>.

With regard to the dimension "Colegial relationship between doctors and nurses" ( $M=2,79$ ), the moderately positive values perceived by Portuguese perioperative nurses allow for the identification of good relationships, collaboration and teamwork between nurses and doctors, and are in agreement with the results obtained in other studies analyzed<sup>(16-17,19)</sup>. The best results observed in the perioperative context, superior to those identified in other care contexts, may be associated with the fact that work in OR requires great cooperative effort from the team and constant interaction between different professional groups, who recognize the importance of good relationships and interdisciplinary work in complex contexts, such as the OR. National studies that assess the culture of safety also identify "Teamwork" as the dimension with the best results, both in different care contexts<sup>(20)</sup> and at the level of OR services<sup>(21)</sup>, corroborating the investment of professionals in this domain.

The dimension "Nursing fundamentals for quality of care" ( $M=2,66$ ) shows that Portuguese perioperative nurses have a positive, albeit moderate, perspective on the contribution of nursing to improving the quality of their organization. The results highlight the need for greater follow-up and supervision of professionals newly admitted to organizations, as well as a greater focus on the consistent and systematic implementation of care plans that promote the quality and continuity of care.

We highlight the negative results observed in the dimension "Participation in hospital policies" ( $M=2,21$ ), similarly to the results observed in other studies<sup>(16-17,19)</sup>. The results point to the development of intrinsic and extrinsic motivation strategies that promote greater involvement of nurses in decision-making processes, ensuring the integration of their perspective and, consequently, greater adherence to complying with the internal policies.

The average value observed in the dimension "Adequacy of human and material resources" ( $M=2,38$ ), although slightly higher than those observed in other studies<sup>(16-17,19)</sup>, indicates the precariousness in the adequacy of human and material resources in the OR, although less pronounced than in other hospital settings. At the international level, as the literature review by Swiger<sup>(18)</sup> reveals, the low values systematically observed in this dimension point to a critical area of the practice environment. The national results of the evaluation of the safety culture also reveal that the dimension "Allocation of Human Resources" is among the most critical, both at the hospital level<sup>(20)</sup> and in the specific context of OR<sup>(21)</sup>, corroborating the need for organizations ensure safe staffing in different care settings, including the perioperative setting.

Perioperative nurses also perceive weaknesses in the "nurses' management, leadership and support capacity" ( $M=2,43$ ), showing ample space for improvement, as

identified by other investigations<sup>(16,19)</sup>, which should be taken into account by the middle and top management of hospital organizations. In this dimension, important opportunities for improvement in care supervision are highlighted.

We identified the predictive models of patient safety in the OR and verified that all dimensions of the practice environment are predictors of the implementation of PS practices in the OR, with emphasis on the dimensions "Nursing fundamentals for the quality of care", "Ability to management, leadership and support of nurses" and "Participation in hospital policies". These results reinforce the importance of a nursing model and philosophy, nursing leadership, and the involvement of nurses in internal policy decisions, as a way to promote PS in the perioperative context. Our results are supported by studies in which the optimization of nursing practice environments is associated with a more positive perception of safety indicators by professionals<sup>(6,9)</sup> and presents a significant inverse relationship with the number of adverse events, medication errors, pressure ulcers and falls<sup>(5,7)</sup>.

We consider as a limitation of the present study that we did not include, in addition to the professionals' perception about the implementation of good PS practices, the evaluation of PS outcome indicators.

## CONCLUSION

The practice environment, from the perspective of Portuguese perioperative nurses, has weaknesses, highlighting the need for significant investment in different dimensions. Nurses positively consider, despite the lack of expression, the working relationships with the medical professional group and their involvement in improving the quality of their organization, as well as identifying few opportunities for professional development and participation in hospital issues, stress the precariousness in the adequacy of human and material resources and alert to opportunities for improvement in the management and leadership of nurses.

The regression models reveal the positive influence of the dimensions of the PS practice environment in the OR, with emphasis on the dimensions "Nursing fundamentals for the quality of care" and "Nurses' management, leadership and support capacity", being essential to introduce improvements in this scope to improve PS in the perioperative context.

The results obtained in this investigation allow, in a pioneering way, to describe the nursing practice environment in the Portuguese perioperative context, highlight the influence of the PS practice environment in this context, and alert to the need to improve several dimensions of the practice environment when it intends to improve the implementation of strategies that promote PS, thus contributing to a better understanding of this reality. These results provide relevant information for nursing practice, for the middle and top management of hospital organizations, challenging nursing leaders to escort a positive transformation of nursing practice environments, based on the diagnostic assessment performed.

Having demonstrated the impact of the practice environment on the different dimensions of PS in the perioperative context, it is hoped that this study design can be replicated in other professional nursing contexts. It is equally important to investigate the impact of practice environment improvement projects on PS outcome indicators.

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