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INTERVENÇÕES INTERDEPENDENTES DE ENFERMAGEM COMO INDICADORES SENSIVEIS DE QUALIDADE - CUIDADOS EM VENTILAÇÃO NÃO INVASIVA

INTERDEPENDENT NURSING INTERVENTIONS AS SENSITIVE INDICATORS OF QUALITY - CARE IN NONINVASIVE MECHANICAL VENTILATION

INTERVENCIONES DE ENFERMERÍA INTERDEPENDIENTES COMO INDICADORES SENSIBLES DE LA CALIDAD - ATENCIÓN EN LA VENTILACIÓN MECÁNICA NO INVASIVA

Andreia Filipa Fidalgo Fernandes[1] *https://orcid.org/0000-0001-6886-847X*
Maria Augusta Romão da Veiga Branco[1] *http://orcid.org/0000-0002-7963-2291*

[1] Instituto Politécnico de Bragança, Bragança, Portugal

Andreia Filipa Fidalgo Fernandes - andreia.f.sapo@sapo.pt| Maria Augusta Romão da Veiga Branco - aubra@ipb.pt

Corresponding Author
Andreia Filipa Fidalgo Fernandes
Rua Monte do Castro nº 5
5300-717 – Bragança – Portugal
andreia.f.sapo@sapo.pt

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RESUMO

Introdução: As Intervenções Interdependentes de Enfermagem (IIE) na Ventilação Mecânica não Invasiva (VMNI) ao doente crítico, são essenciais para a qualidade em saúde, pelo que importa reconhecer os indicadores de processo (IP) que promovem a visibilidade dessas intervenções cuidativas.
Objetivos: Identificar as IIE ao doente crítico com VMNI, que, pela sua consistência executória, se assumem, como Indicadores de Processo, Sensíveis de Qualidade (IPSQ) aos cuidados, e a sua relação com as variáveis profissionais.
Métodos: Estudo exploratório, quantitativo descritivo, a partir da análise às respostas a um questionário elaborado para o efeito, numa amostra de 76 enfermeiros, de urgência e medicina intensiva, maioritariamente, do sexo feminino (82,9%), com idades entre 36 e 45 anos (51,3%).
Resultados: As IIE ao doente crítico com VMNI, que pela sua consistência executória, se assumem, como IPSQ aos cuidados, são: "doente é monitorizado segundo as recomendações" e "(…) é informado e pedida a sua colaboração" e os constrangimentos mais sentidos foram: "presença de secreções excessivas (…)", "a ocorrência de PCR é contraindicação" e "o nível de consciência do doente influencia o sucesso (…)". Foram verificadas relações estatisticamente significativas entre: a IIE "recurso à sedação" e o tempo de serviço, e o constrangimento "nível de consciência" e as varáveis: formação específica e tempo de serviço.
Conclusão: É essencial protocolo de atuação na VMNI, para uniformização de cuidados.

Palavras-chave: intervenções interdependentes; VMNI; constrangimentos; ISPQ; competências

ABSTRACT

Introduction: The Interdependent Nursing Interventions (INI) in Non-Invasive Mechanical Ventilation (NIMV) for the critically ill are essential for quality in health, so it is important to recognize the process indicators (IP) that promote the visibility of these care interventions.
Objectives: To identify the INI for critically ill patients with NIMV, which, due to their enforceable consistency, are assumed to be Process Indicators, Quality Sensitive (IPSQ) to care, and their relationship with professional variables.
Methods: Exploratory, quantitative and descriptive study, based on the analysis of the answers to a questionnaire prepared for this purpose, in a sample of 76 nurses, of urgency and intensive medicine, mostly female (82.9%), aged between 36 and 45 years (51.3%).
Results: The IIEs for critically ill patients with NIMV, which, due to their enforceable consistency, are assumed to be ISQs for care, are: "the patient is monitored according to the recommendations" and "(…) their collaboration is informed and requested" and the most felt constraints were: "presence of excessive secretions (…)", "the occurrence of cardiac arrest is a contraindication" and "the patient's level of consciousness influences success (…)". Statistically significant relationships were found between: the IIE "use of sedation" and length of service, and the constraint "level of consciousness" and the variables: specific training and length of service.
Conclusion: A protocol of action in NIMV is essential for standardization of care.

Keywords: interdependent interventions; NIMV; constraints; ISQ; competencies

RESUMEN

Introducción: Las Intervenciones de Enfermería Interdependientes (IIE) en Ventilación Mecánica No Invasiva (VMNI) para el enfermo crítico son fundamentales para la calidad en salud, por lo que es importante reconocer los indicadores de proceso (PI) que promuevan la visibilidad de estas intervenciones asistenciales.
Objetivos: Identificar los IIE para pacientes críticos con VMNI, que por su consistencia ejecutoria se asumen como Indicadores de Proceso, Sensibles a la Calidad (IPSQ) de la atención, y su relación con variables profesionales.
Métodos: Estudio exploratorio, cuantitativo y descriptivo, basado en el análisis de las respuestas a un cuestionario elaborado al efecto, en una muestra de 76 enfermeras, de urgencias y medicina intensiva, en su mayoría del sexo femenino (82,9%), con edades comprendidas entre 36 y 45 años (51,3 %).
Resultados: Los IIE para pacientes críticos con VMNI, que por su consistencia exigible se asumen como IPSQ para la atención, son: "el paciente es monitoreado de acuerdo a las recomendaciones" y "(…) se informa y solicita su colaboración" y las limitaciones más sentidas fueron: "presencia de secreciones excesivas (…)", "la ocurrencia de paro cardíaco es una contraindicación" y "el nivel de conciencia del paciente influye en el éxito (…)". Se encontraron relaciones estadísticamente significativas entre: el IIE "uso de sedación" y tiempo de servicio, y la restricción "nivel de conciencia" y las variables: formación específica y tiempo de servicio.
Conclusión: Un protocolo de actuación en VMNI es fundamental para la estandarización asistencial.

Palabras Clave: intervenciones interdependientes; VMNI; restricciones; IPSQ; competencias

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INTRODUCTION

The concept of Interdependent Nursing Interventions (INI), considered here as a dependent variable, will be studied in critically ill patients with Non-Invasive Mechanical Ventilation (NIMV). The relevance of the theme emerges from the fact that this condition is the main reason for hospitalization and the third cause of death in Portugal, (Observatório Nacional das Doenças Respiratórias, 2018), with associated difficulties and constraints that require specific actions (Fernandes et al., 2019) on the part of nursing. The INI are legally recognized as a functional complementarity performance (OE/REPE, 2015), whose executive value, when conceived to change the level of quality in health, becomes a promoter of this effect. Thus, the actions with the highest level of enforceable consistency – in accordance with the recommendations for this purpose – will be considered here as nursing sensitive quality indicators (NSQI). We assume what Santos et al., (2020) advocate, that is, that studying IS in nursing care is a challenge and an opportunity to demonstrate the nature of nurses' contribution to the recovery of their patients.

However, from a theoretical and conceptual point of view, for the relationship under study to be operationalized between the INI and the quality indicators, the Donabedian triad is once again assumed (Seiffert & Wolf, 2020), distinguishing them as indicators of structure, process and result. Structure indicators refer to human, architectural, financial and technical resources; process indicators relate to the efficiency of administrative and care procedures, adequate to the patient's needs, and result indicators relate to meeting the patient's expectations at the time they receive care. The indicators under study are the process indicators because the current literature (Migote, 2022) mentions that through the analysis of structure and process indicators it is possible to access in-depth monitoring of health outcomes, which is why the relationship under study is relevant. Thus, when referring to the NSQI nomenclature, it should be assumed that the indicators under study are only those related to the care process.

Therefore, nursing actions will be considered INI when they are performed in a caring manner, as they may or may not be considered sufficiently relevant to be repeated by nurses, which are assumed to be essential Process Indicators, sensitive to the quality of care provided (NSQI).

The fact is that the executing value of the INI integrates theoretical and practical nursing training, based on scientific evidence. Thus, it is theoretically credible that its application promotes the level of quality in health. The actions with the highest level of executing consistency – in accordance with the recommendations for this purpose – will be assumed here as Care Quality Process Indicators.

Thus, and to guide the procedural steps, an investigation question was formulated: Which INI, due to their executing consistency, can be considered NSQI in the care of critically ill patients with NIMV? In order to answer the research question mentioned above, the following general objective of the study was formulated:

Identify the Interdependent Nursing Interventions (INI), which, due to their greater consistency in execution, are assumed as NSQI for the health care of critically ill patients with NIMV.

This general objective comprises the following specific objectives:

1. To know the sociodemographic and professional variables of the sample under study in clinical practice for critically ill patients with NIMV;
2. Identify the Interdependent Nursing Interventions (INI), which, due to their greater consistency in execution, are assumed as NSQI for the health care of critically ill patients with NIMV;
3. Study the statistical relationships between the INI studied and the professional variables in the sample.
4. Identify the difficulties/constraints of NIMV in clinical practice for critically ill patients with NIMV;
5. Study the statistical relationships between the difficulties/constraints identified in clinical practice for critically ill patients with NIMV and the professional variables in the sample;

A quantitative, descriptive, exploratory, and cross-sectional methodology was outlined to fulfil these objectives.

1. THEORETICAL FRAMEWORK

The strategic orientation in health care management starts from the effectiveness and efficiency of care and from the essential need to communicate these results to institutional managers (Vieira and Santos, 2021), which is why indicators are considered as a measure to understand a system, compare it and improve it (Santos et al., 2020). These authors, when referring to the 2008 report of the National Nursing Research Unit on the state of the art in nursing, refer that most of the indicators reported in the literature focus on quantifiable areas, and that there is a lack of indicators that measure the broader impact of nursing care (McCance et al., 2012). For these reasons, the study of professional practice IQ is pertinent, as they believe they can contribute to the renewal and updating of the care provided by nurses. Based on these assumptions, Interdependent Nurse Interventions (INI) are assumed to be actions learned based on scientific evidence, whose application allows providing care based on scientific evidence, so that the selected practices will be those that, in the perception of nurses, assume greater therapeutic and curative relevance. Among the autonomous and interdependent nursing interventions, the latter were selected for the study, as they are assumed to be the interdisciplinary link in the functional complementarity of health professionals in inter transdisciplinarity. They are the type of interventions that can make all care providers united and more competent to achieve a common goal. In other

words, these actions, if constantly applied, assume the status of NSQI and will be considered of greater value because they are more prevalent.

NIMV is applied according to specific clinical criteria and, as D´Orazio et al. (2018) and Costa et al., (2018) argue, its use promotes not only pulmonary gas exchange but also decreases the respiratory rate and respiratory muscle work, avoids endotracheal intubation and the consequent decrease in associated risks (as BTS/ICS in Davidson et al., 2016). However, D`Orazio et al. (2018) assume that the success of the NIMV technique will depend on the care provided, and in the implementation of actions for the critically ill, the role of the nurse becomes paramount (OE, 2016), so the nurse must assess the general state of the person, as well as the ability to cooperate with the procedure (ACI, 2014). The assessment should include the level of consciousness using the Glasgow Coma Scale, the presence of an effective cough, and the ability to maintain the respiratory airway clear, to be able to anticipate potential complications (Ergan et al., 2018).

The application of NIMV implies preparing the person to ensure adherence to treatment: this work requires time to explain the technique and confirm that the information has been understood (D´Orazio et al., 2018). "The nurse must help/collaborate with the physician in setting the ventilator parameters, (…) check its operation", and provide respiratory education for the person to breathe through the nose (Santos et al., 2020). Responsibility for initiating and subsequently optimizing NIMV should be shared between physicians and nurses, with the selection of the appropriate interface and responsibility for NIMV titration. From here, results compatible with the conclusions of the studies by Raurell-Torredà et al. (2017a, 2017b, 2019) and Pinto and Sousa (2017) are expected since they refer in their articles that, although NIMV is started after medical prescription, monitoring the patient, and consequent success of NIMV depend on nursing care, which is why they consider that this prevention of complications is directly related to its success (BTS/ICS, 2016). The studies by Pinto e Sousa (2017) and Fernandes et al. (2019) refer to which complications should be given more attention by nurses, such as patient-ventilator asynchrony, pressure ulcers, dry mucous membranes, gastric distension, non-adaptation to the interface, the feeling of claustrophobia, pain, accumulation of secretions, nasal congestion, aerophagia, and vomiting.

There are some difficulties/constraints associated with NIMV, whose probability of occurrence increases proportionally with its duration, the patient's agitation and the constant need to adjust the interface (BTS/ICS, 2016). The main complications described according to the BTS/ICS (2016) are discomfort, pressure ulcers (mainly in the nasal pyramid), skin rash, feeling of claustrophobia, excessive leaks, nasal congestion, dry mucous membranes, oral and nasal congestion, sinusitis, headaches and otalgia, eye irritation and infections, accumulation of secretions, vomiting, sleep deprivation, confusion, patient-ventilator asynchrony, hypotension, abdominal distension, and pneumothorax, in the most severe cases. In addition, Fernandes et al. (2019) refer to the importance of specific training for their quality and safety since the surveillance of complications is one of the main functions of nurses during NIMV.

Finally, it is important to mention, in some detail, that despite the recommendations issued by entities such as the BTS/ICS, the studies by Raurell-Torredà, et al. (2018), whose objective was to assess the knowledge and skills of nurses and physicians in NIMV, demonstrated the existence of gaps that jeopardize patient safety and the success of NIMV. The authors refer to gaps in the implementation of protocols and guidelines, which reveals non-compliance with international recommendations. For this reason, it is pertinent to collect data related to problems and constraints felt by nurses in the application of NIMV, and to analyse and reflect specifically on them.

2. METHODS

An exploratory, cross-sectional, and descriptive quantitative analysis study was designed to achieve the established objectives.

2.1 Sample

This study is based on an intentional sample composed of 76 nurses out of 90 who work in the emergency and intensive care medicine service in a hospital in the north of Portugal. In the sampling process, the following inclusion criteria were considered: degree in nursing; provision of care to critically ill patients with NIMV in the emergency service (ES) and internal medicine service (IMS); and the acceptance of completing the data collection instrument (DCI) via Google docs.

2.2 Data Collection Instrument

The Data Collection instrument (DCI) developed for this purpose was based on bibliographical research and is entitled "Interdependent nursing interventions for critically ill patients with non-invasive mechanical ventilation" (Fernandes, A.; Garcia, S.; Veiga-Branco, 2022), to recognize the interdependent interventions practiced by nurses to critically ill patients with NIMV. The DCI inserts the dependent and independent variables and consists of two parts: Part I - sociodemographic and professional variables: 7 questions characterizing the sample in relation to age, gender, marital status, academic qualifications, length of professional experience and length of professional experience in EM/IMS. Part II – : dependent variable operationalized through the INI to the critical patient with NIMV, respecting the sense and meaning conferred to in the original documents (Portuguese Regulation of the Nurse's Professional Practice and Statutes of the Portuguese Nurses Association, 2015), and in order to identify

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the care. This Part II also inserts three items: executing components of the dependent variables with answers using a Likert scale, in five chronological levels: from “0=never” to “5=always”, distributed in 3 dimensions. The first dimension is “Knowledge about NIMV” and has 6 statements; the second is “Patient's adaptation to NIMV” and has 25 questions; and the third is “Difficulties/Constraints in NIMV” and has 19 questions. The consistency level of the variable is thus operationalized through a temporal frequency Likert scale between "Never" and "Always". The care marked “Always” or “Very Often” will be considered here as an NSQI for care, and therefore for quality in health.
The DCI was applied online via Google Forms, from the 7th to the 25th of March 2022. All ethical standards were met.

2.3 Statistical Analysis

Statistical treatment was performed using the Statistical Package Social Science (SPSS) 26 program. Descriptive analysis was used using absolute (n) and relative (%) frequency values for sociodemographic and professional variables, as well as the temporal frequency for nursing interventions. To analyze the relationship between the INI and the independent variables "specific training", "knowledge of the guidelines" and "length of service", the Chi-square independence test or Fisher's test was used. The significance level adopted was 5%. The probative value obtained from each test is presented, and if it is less than 5%, the variables are dependent, that is, they are related from a statistical point of view. It was considered a significance level of 10% for the analysis of the possible association between the INI actions and the sociodemographic variables.

3. RESULTS

The sample (Table 1) is mostly consisted of female professionals (n=63; 82.9%), and 13 male professionals (17.1%). The age variable shows that the vast majority are in the range between 36 and 45 years old (n=39; 51.3%); followed by professionals aged 46 or over (n=21; 27.6%), and there are 16 nurses aged up to 35 years (21.1%). The variable "qualifications" presents 34 nurses with a degree, 21 with a specialty training in nursing (27.6%), 18 nurses with a master's degree (23.7%) and 3 with a postgraduate degree (3.9%). To study the relationship between specific training in the areas of specialization in nursing and the INI considered by the Portuguese Nurses Association (Table 1), it was found that 20 nurses have training in the area of medical-surgical nursing (57.1%), 10 in the area of rehabilitation nursing, 4 nurses in community health (11.4%) and only one trained in maternal health and obstetrics (2.9%). About the variable "length of professional experience", it appears that 35 nurses have 11 to 19 years of professional practice (46.1%), 24 have been working for 20 or more years (31.6%) and 17 have been working for up to 10 years (22.4%).
The variable length of professional experience in ES/IMS shows that 31 (40.8%) respondents have worked in the ES/IMS for less than 5 years, 28 have experience in the ES/IMS for more than 10 years (36.8%) and 17 (22.4%) have between 6 and 10 years of professional experience in ES/IMS.

Table 1 - Values of sociodemographic and professional variables related to the sample.

Sociodemographic and professional variables	n	%
Sex (n=76)		
Female	63	82.9
Male	13	17.1
Age range (n=76)		
Up to 35 years	16	21.1
36 to 45 years	39	51.3
More than 50 years	21	27.6
Qualifications (n=76)		
Degree	34	44.7
Postgraduate degree	3	3.9
Speciality	21	27.6
Master	18	23.7
Area of Specialty in Nursing (n=35)		
Medical-surgical nursing	20	57.1
Rehabilitation nursing	10	28.4
Maternal health and obstetrics	1	2.9
Community health	4	11.4
Length of professional experience (n=76)		
Up to 10 years	17	22.4
11 to 19 years	35	46.1
20 ou mais years	24	31.6
Length of professional experience in ES/IMS (n=76)		
Up to 5 years	31	40.8
6 to 10 years	17	22.4
More than 10 years	28	36.8

The most frequently performed NIVM treatment INIs (Table 2), i.e. “Always”, here considered as NSQI to care, were: the patient is monitored according to the recommendations (50%), is informed about the treatment and asked for their collaboration (35.5%). In a second execution perspective, but with the level of consistency of application to be considered NSQI, are the INI identified as executed “many times” by the sample: criteria with scientific evidence to start NIMV are always present (51.3%). The use of sedation for the patient's adaptation to NIMV is considered by 42.1% of the respondents, as the INI practiced "sometimes". The study of this frequency is based on the assumption that nurses practice an action the more they believe that it constitutes a health gain for the patient. This relationship allows us to expect that the most frequently performed actions are those perceived as the most health promoting, and therefore, those that can assume the status of NSQI in health care. The interdependent interventions "the patient is monitored according to the recommendations" and "the patient is informed about the treatment and asked for his collaboration" are always practiced by the sample, assuming the status of NSQI to health care.

Table 2 - Percentage values of variables related to “Interdependent Nursing Interventions for critically ill patients with NIMV”, according to sample responses.

Interdependent Interventions	N	R	S	MT	A
patient is monitored every (…)			14.5%	35.5%	50.0%
is informed about the treatment (…) collaboration		2.6%	28.9%	32.9%	35.5%
criteria with scientific evidence to start NIMV	1.3%	2.6%	31.6%	51.3%	13.2%
use of sedation (...) is considered	10.5%	15.8%	42.1%	26.3%	5.3%

N – Never; R – Rarely; S – Sometimes; MT – Many Times; A – Always

To fulfil the third objective, that is to study the association between sociodemographic and professional variables and the Interdependent Nursing Interventions studied, the chi-square test or Fisher tests was used. A statistically significant relationship was found between the variable “length of service” and the “use of sedation to adapt the patient to NIMV” vp= 0.099 (Table 3), which may assume the status of indicators of quality in health care.

Table 3 - Statistical significance values between the “Interdependent Nursing Interventions” and the professional sample variables.

Interdependent Interventions	Specific Training	Know guidelines	Length of service in ES/ IMS
presence of criteria with scientific evidence	0.138	0.373	0.814
is informed about the treatment (…) collaboration	0.337	0.237	0.903
patient is monitored (…)	0.999	0.452	0.542
use of sedation for adaptation (…)	0.511	0.627	0.099*

Legend: *- significant at 10%.

The fourth objective, "to identify the difficulties/constraints of NIMV felt by the nurses" (Table 4), exposes that the constraints/difficulties always felt by the nurses were: the presence of excessive secretions influences adaptation (53.9%), the occurrence of CA is a contraindication (50%) and the patient's level of consciousness influences success (46.1%). The constraints felt many times were: the postoperative period of upper digestive tract surgery conditions the NIMV (53.9%), the relationship between the level of impairment of the respiratory disease and its success (51.3%), the asynchrony patient/ventilator determines failure (50%), weaning between 48-72h is a predictor of treatment success (48.7%), non-improvement in gas exchanges up to 4h after the start of NIMV is a predictor of failure (47.4 %), adaptation to the interface/minimal leaks is indicative of success (42.1%) and the patient's expressions of discomfort/fatigue or claustrophobia are valued (40.8%).

Table 4 - Values of the variables “Difficulties/Constraints in NIMV” felt by the sample.

	N	R	S	MT	A
presence of secretions (…)		2.6%	6.6%	36.8%	53.9%
occurrence of CA (…)	9.2%	11.8%	9.2%	19.7%	50.0%
patient's level of consciousness influences success?		1.3%	7.9%	44.7%	46.1%
postoperative period (…)	1.3%	6.6%	11.8%	53.9%	26.3%
relationship between the level of (…)		2.6%	11.8%	51.3%	34.2%
asynchrony patient/ventilator (…)		2.6%	9.2%	50.0%	38.2%
weaning between 48-72h is a predictor of treatment success		1.3%	31.6%	48.7%	18.4%
non-improvement in gas exchanges (…) is a predictor of (…)		9.2%	36.8%	47.4%	6.6%
adaptation to the interface/minimal leaks (…)	2.6%	10.5%	15.8%	42.1%	28.9%

N – Never; R – Rarely; S – Sometimes; MT - Many Times; A – Always

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In response to the fifth objective, the relationship between sociodemographic and professional variables and NIMV difficulties/constraints was analysed using the chi-square test or Fisher test. From this analysis, a significant statistical relationship was found between the variable "length of service" and "specific training" with a probative value of 0.068 and 0.019 respectively, with the constraint "the patient's level of consciousness influences the success of NIMV therapy".

Table 5 - Values of the statistical relationship between the Difficulties/Constraints (D/C) variables and the professional variables in the sample.

D/C on the NIMV	Specific Training	Guidelines	PE
hemodynamic instability of the patient dictates treatment failure	0.824	0.309	0.741
occurrence of CA is a contraindication	0.454	0.272	0.414
the presence of excessive secretions influences adaptation	0.700	0.999	0.326
patient's level of consciousness influences success	0.019*	0.496	0.068**
patient's age influences success	0.123	0.842	0.326
relationship between the degree of commitment (...) and success (...)	0.999	0.560	0.434
postoperative period of upper digestive tract surgery conditions NIMV	0.999	0.885	0.533
adaptation to the interface/minimal leaks is indicative of success	0.875	0.377	0.445
patient's expressions of discomfort/fatigue or claustrophobia are valued	0.821	0.137	0.456
presence of facial trauma makes NIMV impossible	0.823	0.732	0.837
the presence of pressure ulcers/skin rash interferes with NIMV	0.592	0.619	0.870
in situations of aerophagia or risk of vomiting, NIMV is contraindicated	0.526	0.738	0.337
patient refusal is considered for initiation/maintenance of NIMV	0.999	0.133	0.914
patient/ventilator asynchrony determines failure	0.438	0.397	0.126
non-improvement in gas exchanges (...) is a predictor of failure	0.352	0.387	0.955
weaning between 48-72h is a predictor of treatment success	0.780	0.545	0.999

Legend: * - significant at 5%; ** - significant at 10%.

The association between "the use of sedation to adapt the patient to NIMV is considered" and the length of service proved to be statistically significant at 10%, as the probational value obtained in Fisher's test was 0.099. It is observed that nurses (Table 6) with more than 10 years of length of service are the ones who show greater differences between the observed and expected frequencies. That is, they resort to other intervention strategies to calm the patient before the NIMV. There is a statistically significant relationship between "does the patient's level of consciousness influence success?" and "length of service ", being greater than 10% with a probative value in the Fisher test of 0.068. Nurses with up to 5 years of service or more than 10 years (Table 6) show greater differences between the observed and expected frequencies. The statistically significant relationship between "the patient's level of consciousness influences success" and specific training, with 5%, with a probative value in the Fisher test of 0.019, reveals that nurses with specific training are the ones who most agree with the statement.

Table 6 - Observed frequencies and expected frequencies in Fisher's test of statistically significant relationships at 5% and 10%.

Length of Service (years)			
Use of sedation/adaptation of the patient to NIMV	Até 5	6 a 10	Mais de 10
	Observed/Expected		
Never/Rarely	7/ 8.2	1/4.5	12 /7.4
Sometimes/	14/13.1	9/7.2	9 /11.8
Many times/Always	10/9.8	7/5.4	7/8.8
Patient's level of consciousness influences success	Observed/Expected		
Never/Rarely	0/0.4	0/0.2	1/0.4
Sometimes/	1/2.4	0/1.3	5/2.2
Many times/Always	30/28.1	17 /15.4	22/25.4
Specific training			
Patient's level of consciousness influences success	Yes	No	
Never/Rarely	1/0.4	0/0.6	
Sometimes/	0/2.5	6/3.5	
Many times/Always	31/29.1	38/39.9	

4. DISCUSSION

The recognition of the INI as NSQI for health care makes this study relevant from the sample of 76 nurses, predominantly female (82.9%) - corroborating data from the universe of the professional class (Statistical Yearbook of the Portuguese Nurses Association, 2021), with a mean age of 40.96 years. Overall, nurses are mostly married, specialists in Medical-Surgical Nursing, and with 11 to 19 years of professional experience, and in ES/IMS up to 5 years.

The Identification of the nursing INI that, due to their character of greater execution consistency, are assumed as NSQI to health care in clinical practice for critically ill patients with NIMV, comply with the recommendations of the BTS/ICS (in Davidson et al., 2016), corroborate the actions mentioned by the ACI, (2014), and by the study by Ergan et al., (2018). The indicators under study are those of process, because the current literature (Migote, 2022) mentions that through the analysis of structure and process indicators it is possible to access the in-depth monitoring of health outcomes and the care process.

The study of the statistical relationships between the INI studied and the professional variables in the sample revealed a statistically significant relationship between the length of service in the time window of more than 10 years of professional experience and the use of sedation to adapt the patient to NIMV (0.099). Thus, it was verified that the most experienced nurses are the ones who resort to intervention strategies other than sedation to calm the patient before NIMV – through the significance of the statistical relationship between professional time and "the use of sedation to adaptation of the patient to NIMV is considered". This result, as no previous studies were found that could serve as a comparison, can be considered innovative and clarifies the context under study. The most frequently identified difficulties and constraints in clinical practice for critically ill patients with NIMV corroborate the conclusions of the studies by Raurell-Torredà et al., (2017a, 2017b and 2019), and by Pinto and Sousa (2017), as well as everything that is advised by D'Orazio et al., (2018) and Santos et al., (2020), as mentioned above.

Statistical relationships between the identified difficulties/constraints and the professional variables in the sample revealed a significant statistical relationship between "length of service" and "specific training" and some constraints: Specific training and experience reinforce the meaning and attention of nurses to surveillance and the "patient's level of consciousness (because) influences the success of NIMV therapy", which in this sample is considered a constraint. That is, nurses with more training (theoretical and empirical) perceive that if the level of consciousness (Glasgow Scale) is low, airway patency is compromised, so they reinforce vigilance. This is one of the reasons why it is the most experienced and well-trained nurses who assume this influence as a constraint in this therapy.

CONCLUSION

The sample has similar characteristics in relation to the nursing professionals. Three INIs were identified, which, due to their greater consistency in execution, are assumed to be NSQIs for health care in clinical practice for critically ill patients with NIMV. The INI "the patient is monitored according to the recommendations", "the patient is informed about the treatment and asked for his collaboration" and the perception that "there are always criteria with scientific evidence to start NIMV" proved to have Sensitive Indicator of Quality-of-Care value. A significant statistical relationship was found between one of the INI studied and a professional variable in the sample. A group of sixteen difficulties or constraints in NIMV were identified, as well as statistical relationships between a difficulty and the professional variables "length of service" and "specific training", differentiating some types of action and attention from nurses in care practices. Starting from the identified difficulties/constraints, nurses still have some insecurity regarding the technical-scientific knowledge of NIMV and which care they are responsible for planning and implementing, which could compromise the patient's safety. Based on this set of analyses, we propose, as some results have already shown, namely in Fernandes et al. (2019) and Raurell-Torredà et al. (2018), that training for the quality and safety of care for patients with NIMV should be promoted.

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REFERENCES

ACI. (2014). *Non-invasive Ventilation Guidelines for Adult Patients with Acute Respiratory*. Agency for Clinical Innovation Failure.https://aci.h ealth.nsw.gov.au/data/assets/pdf_file/0007/239740/ACI14_Man_NIV_1-2.pdf

Alves, J. C. F., Fank, A., Souza, L. P. de, & Lima, M. G. de. (2018). O papel do enfermeiro na oxigenoterapia: Revisão narrativa da literatura. *Journal of Health & Biological Sciences, 6*(2), 176-181. https://dx.doi.org/10.12662/2317-3076jhbs.v6i2.1242.p176-181.2018

Costa, J. C., Machado, J. N., Costa, J., Fortuna, J., Gama, J., & Rodrigues, C. (2018). Ventilação Não Invasiva: Experiência de um Serviço de Medicina Interna. *Medicina Interna, 25,* 18–22. https:// doi.org/10.24950/rspmi/original/78/1/2018

Fernandes, A. F. F., & Veiga-Branco, M. A. R. (2023). Interdependent nursing interventions as sensitive indicators of quality - care in noninvasive mechanical ventilation. *Millenium - Journal of Education, Technologies, and Health, 2*(21), 1-8, e28233.
DOI: https://doi.org/10.29352/mill0220.28233

D'Orazio, A, Dragonetti A, Campagnola G, Garza C, Bert F, Frigerio S. (2018). Patient Compliance to NonInvasive Ventilation in Sub-IntensiveCare Unit: An Observational Study. *Nursing Crit Care 11*(1), 1-4.

http://doi.org/10.5812/ccn.65300

Davidson, A. C., Banham, S., Elliott, M., Kennedy, D., Gelder, C., Glossop, A., Church, A. C., Creagh-Brown, B., Dodd, J. W., Felton, T., Foëx, B., Mansfield, L., McDonnell, L., Parker, R., Patterson, C. M., Sovani, M., Thomas, L., & BTS Standards of Care Committee Member, British Thoracic Society/Intensive Care Society Acute Hypercapnic Respiratory Failure Guideline Development Group, On behalf of the British Thoracic Society Standards of Care Committee (2016). BTS/ICS guideline for the ventilatory management of acute hypercapnic respiratory failure in adults. *Thorax, 71*, ii1–ii35. https://doi.org/10.1136/thoraxjnl-2015-208209

Ergan, B., Nasilowski, J., & Winck, J. (2018). "How should we monitor patients with acute respiratory failure treated with nonivasive ventilation". *European Respiratory Review, 27*(148), 1-17. http://doi.org/ 10.1183/16000617.0101-2017

Fernandes, S., Veiga-Branco, M., & Rodrigues, P. (2019). The critically ill person submitted to non-invasive ventilation in an emergency department. *Revista de Enfermagem Referência*, *4*(22), 13-22. https:// doi.org/10.12707/RIV19027

McCance, T., Telford, L., Wilson, J., Macleod, O., & Dowd, A. (2012). Identifying key performance indicators for nursing and midwifery care using a consensus approach. *Journal of clinical nursing*, *21*(7-8), 1145–1154. https://doi.org/10.1111/j.1365-2702.2011.03820.x

Migoto, M. & Oliveira, R. & Freire, M. (2022). Validação de indicadores para monitoramento da qualidade do pré-natal. *Escola Anna Nery.* 26. https://doi.org/10.1590/2177-9465-EAN-2021-0262

Ministério da Saúde. (2015). Despacho n.º 5613/2015 de 27 de maio: A Estratégia Nacional para a Qualidade e na Saúde 2015-2020. *Diário da República.* 2.ª série, n.º 102. https://dre.pt/application/file/67318639

Ordem dos Enfermeiros. (2015). *Estatuto da Ordem dos Enfermeiros e REPE*, Ordem dos Enfermeiros. https:// www.ordemenfrmeiros.pt/arquivo/publicacoes/Documents/nEstatuto_REPE_29102015_VF_site.pdf

Ordem dos Enfermeiros. (2016). *Classificação Internacional para a Prática de Enfermagem versão 2015*. https://futurosenf.files.wordpress.com/2017/04/cipe_2015.pdf

Ordem dos Enfermeiros. (2021). *Estatística de Enfermeiros*. Ordem Dos Enfermeiros. https://www.ordemenfermeiros.pt/arquivo/bu/estatistica/acumulado/2021_AnuarioEstatisticos_Nacional.xlsx

Pinto, C. J. C. & Sousa, P. M. L. (2017). Ventilação Não Invasiva: desenvolvimento de linhas orientadoras recorrendo à metodologia Delphi. In M. Dixe, P. Sousa & P. Gaspar (Coords.) (2017). Construindo conhecimento em enfermagem à pessoa em situação crítica (pp. 105-123). Leiria, Portugal: *Instituto Politécnico de Leiria*. http://hdl.handle.net/10400.8/2884

Raurell-Torredà, M., Romero-Collado, A., Rodríguez-Palma, M., Farrés-Tarafa, M., Martí, J. D., Hurtado-Pardos, B., Peñarrubia-San Florencio, L., Saez-Paredes, P., & Esquinas, A. M. (2017). Prevention and treatment of skin lesions associated with non-invasive mechanical ventilation. Recommendations of experts. *Enfermeria intensiva*, *28*(1), 31–41. https://doi.org/10.1016/j.enfi.2016.12.001

Raurell-Torredà, M., Argilaga-Molero, E., Colomer-Plana, M., Ródenas-Fransico, A., Ruiz-Garcia, M. T., & Uya Muntaña, J. (2017). Optimising non-invasive mechanical ventilation: Which unit should care for these patients? A cohort study. *Australian critical care : official journal of the Confederation of Australian Critical Care Nurses*, *30*(4), 225–233. https://doi.org/10.1016/j.aucc.2016.08.005

Rochwerg, B., Brochard, L., Elliott, M. W., Hess, D., Hill, N. S., Nava, S., Navalesi, P., Antonelli, M., Brozek, J., Conti, G., Ferrer, M., Guntupalli, K., Jaber, S., Keenan, S., Mancebo, J., Mehta, S., & Raoof, S. (2017). Official ERS/ATS clinical practice guidelines: Noninvasive ventilation for acute respiratory failure. *European Respiratory Journal, 50*(2). https://doi.org/10.1183/13993003.02426-2016

Raurell-Torredà, M., Argilaga-Molero, E., Colomer-Plana, M., Ródenas-Francisco, A., & Garcia-Olm, M. (2019). Nurses' and physicians' knowledge and skills in non-invasive ventilation: Equipment and contextual influences. *Enfermeria intensiva*, *30*(1), 21–32. https://doi.org/10.1016/j.enfie.2018.04.004

Observatório Nacional das Doenças Respiratórias. (2018). *Panorama das doenças respiratórias em Portugal: O estado da saúde em Portugal*. Observatório Nacional das Doenças Respiratórias

Santos, R. K. M. dos, Nepomuceno, F. C. L., & Andrade, F. L. J. P. de. (2020). Uso de ventilação não invasiva em pacientes críticos: *Endema doença pulmonar obstrutiva crônica e edema agudo de pulmão cardiogênico*. Novas edições Acadêmicas.

Seiffert, L. S., Wolf, L. D. G., Silvestre, A. L., Mendonça, T. R., &Cruz, E. D., Ferreira, M. M. F., & Amaral, A. F. S., (2020). Validação de indicadores de efetividade hospitalar na dimensão cuidado centrado no doente. *Revista de Enfermagem Referência, 5(*2), e19098. doi:10.12707/RIV19098

Vieira, J., Santos, M. R., Pires, R., & Pereira, F. (2021). Quality indicators of professional practice of nurses: the caregiver role. *Millenium - Journal of Education, Technologies, and Health, 2*(16), 41-48. DOI: https://doi.org/10.29352/mill0216.24785