



# Care actions and nursing diagnoses for patients with extracorporeal membrane oxygenation: knowledge translation

*Ações de cuidado e diagnósticos de enfermagem ao paciente com oxigenação por membrana extracorpórea: translação do conhecimento*

*Acciones de cuidado y diagnósticos de enfermería para pacientes con oxigenación por membrana extracorpórea: traslación del conocimiento*

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## ABSTRACT

**Objective:** to map diagnoses and nursing actions for the care of adult patients with extracorporeal oxygenation membrane, considering a protocol and a computerized prescription system and the inclusion of new care actions, in a process of translating knowledge to clinical practice. **Methods:** descriptive and exploratory study, with cross-mapping between a care protocol and a computerized system of a university hospital, from 2014 to 2018. Two meetings were held with the nursing manager and members of the extracorporeal oxygenation membrane team to validate the actions. **Results:** most common diagnoses used in the 45 medical records of patients with extracorporeal membrane oxygenation were: Risk of infection (100%); Impaired spontaneous ventilation (93.33%); Self-care deficit syndrome (93.33%). **Conclusion and implications for practice:** The mapping included 25 new actions, associated with 14 nursing diagnoses in the computerized system, aiming to disseminate knowledge and its application in real care for patients with extracorporeal oxygenation membrane.

**Keywords:** Nursing Care; Nursing Diagnosis; Evidence-Based Nursing; Extracorporeal Membrane Oxygenation; Standardized Terminology.

## RESUMO

**Objetivo:** mapear diagnósticos e ações de enfermagem para o cuidado ao paciente adulto com oxigenação por membrana extracorpórea, considerando um protocolo e um sistema informatizado de prescrição e a inclusão de novas ações de cuidados, em um processo de translação do conhecimento à prática clínica. **Métodos:** estudo descritivo e exploratório, com mapeamento cruzado entre um protocolo assistencial e sistema informatizado de um hospital universitário, no período de 2014 a 2018. Foram realizados dois encontros com a chefia de enfermagem e membros do time de oxigenação por membrana extracorpórea para validar as ações. **Resultados:** diagnósticos mais comuns utilizados nos 45 prontuários dos pacientes com oxigenação por membrana extracorpórea foram: Risco de infecção (100%); Ventilação espontânea prejudicada (93,33%); Síndrome do déficit de autocuidado (93,33%). **Conclusão e implicações para a prática:** o mapeamento incluiu 25 novas ações associadas a 14 diagnósticos de enfermagem no sistema informatizado, visando a disseminação do conhecimento e sua aplicação em cuidados reais a pacientes com oxigenação por membrana extracorpórea.

**Palavras-chave:** Cuidados de Enfermagem; Diagnóstico de Enfermagem; Enfermagem Baseada em Evidências; Oxigenação por Membrana Extracorpórea; Terminologia Padronizada.

## RESUMEN

**Objetivo:** mapear diagnósticos y acciones de enfermería para el cuidado de pacientes adultos con oxigenación por membrana extracorpórea, considerando un protocolo y un sistema de prescripción computarizado y la inclusión de nuevas acciones de cuidado, en un proceso de traslación del conocimiento a la práctica clínica. **Métodos:** estudio descriptivo, exploratorio, con mapeo cruzado entre un protocolo de atención y un sistema informatizado en un hospital universitario, de 2014 a 2018. Posteriormente se realizaron dos reuniones con la gerente de enfermería y miembros del equipo de oxigenación por membrana extracorpórea para validar acciones. **Resultados:** los diagnósticos más frecuentes utilizados en los 45 prontuarios de pacientes con oxigenación por membrana extracorpórea fueron: Riesgo de infección (100%); Deterioro de la ventilación espontánea (93,33%); Síndrome de déficit de autocuidado (93,33%). **Conclusión e implicaciones para la práctica:** el mapeo incluyó 25 nuevas acciones asociadas a 14 diagnósticos de enfermería en el sistema informatizado, con el objetivo de difundir el conocimiento y su aplicación en la atención real al paciente con oxigenación por membrana extracorpórea.

**Palabras clave:** Atención de Enfermería; Diagnóstico de enfermería; Enfermería Basada en Evidencia; Oxigenación por Membrana Extracorpórea; Terminología estandarizada.

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## INTRODUCTION

Extracorporeal membrane oxygenation (ECMO) is currently the only emergency treatment capable of supporting temporary cardiorespiratory failure. The basic principle of ECMO is to provide mechanical support to a patient whose heart and/or lungs are not providing adequate gas exchange.<sup>1</sup> Deoxygenated blood is removed from the venous circulation, pumped through an oxygenator out of the body - which removes CO<sub>2</sub> and replenishes O<sub>2</sub> - to return to the venous or arterial circulation.<sup>1,2</sup> There are two types of ECMO: veno-arterial (VA), typically used when native cardiac function is minimal, to mitigate the increased cardiac work associated with pumping the retrograde flow provided by the aortic cannula; and veno-venous (VV), used when only pulmonary support is required and both drainage and blood infusion are carried out exclusively in the venous system.

The complexity of the therapy and management of patients with ECMO in an intensive care unit requires adequate preparation and competence on the part of nursing professionals. The dynamic nature and monitoring of the information that determines and alters the proposed therapy requires excellence in the care provided in order to achieve better patient outcomes. In this sense, hospital institutions that offer this type of therapy have, among their objectives, to increasingly qualify their care processes, since the use of a circulatory assistance device for critically ill patients involves differentiated care and strategies in terms of preparation and staffing, requiring an exclusive nurse at the patient's bedside 24 hours a day.

In this context, the implementation of the nursing process (NP), a tool for developing, organizing and executing care, is an important strategy for organizing care with safety and quality, as well as documenting clinical practice.<sup>3</sup> Nursing diagnoses (ND), one of the stages of the NP, are the basis for listing nursing care for the patient in order to achieve the expected results. Their use, based on a standardized language system such as NANDA-I<sup>4</sup> (version 2018-2020), favors the computerization of this and other stages of the NP, such as the prescription of nursing care. It should be emphasized that critically ill patients, such as those using ECMO, require specific care, based on reliable evidence and associated with research, providing a solid basis for its implementation, in order to achieve effective treatment.<sup>5,6</sup>

However, the use of ECMO in Brazil is relatively recent, and nursing has been seeking to build knowledge about the care needs related to the use of this device in intensive care. Recently, a group of nurses developed a care protocol based on the available literature associated with clinical practice for adult patients using ECMO,<sup>5</sup> in which 106 care actions are contemplated and related to 15 nursing diagnoses, both for patients on VA ECMO and VV ECMO, based on NANDA-I (version 2018-2020), which is a standardized terminology for nursing diagnoses.<sup>5</sup>

It is important to mention that during the COVID-19 pandemic there was a significant increase in the use of this device in critically

ill patients in intensive care units (ICU). Thus, the care of these patients based on scientific evidence has become increasingly important.<sup>6,7</sup> In addition, there are few studies that deepen knowledge about nursing diagnoses and associated care for these patients with ECMO. For these reasons, and highlighting the importance of knowledge translation, which focuses on co-creation with stakeholders and the sharing of this knowledge to ensure the use of research results to facilitate changes in policy, practice and the provision of health services,<sup>8</sup> current research on the subject is important.

Thus, considering the ND and care actions presented in the care protocol for adult patients using ECMO,<sup>5</sup> as well as the application of the NP, with the stage of computerized nursing diagnosis and prescription in a university hospital of reference for the care of critically ill patients, associated with its constant need for updating and qualification, this study was developed.

The aim was to map nursing diagnoses and actions for the care of adult patients with extracorporeal membrane oxygenation, considering a care protocol and a computerized nursing prescription system, as well as the inclusion of new care actions, in a process of translating knowledge into clinical practice.

## METHOD

This is an exploratory, descriptive study with cross-mapping,<sup>9</sup> which consists of a process of explaining or expressing something through the use of words with similar meanings, used to deepen knowledge of the taxonomies of the elements of nursing practice.

The collection of data was retrospective of patients who used ECMO during hospitalization at a university hospital in southern Brazil, from January 2014 to December 2018. Data from a care protocol<sup>5</sup> and nursing prescriptions recorded in patients' electronic medical records were included.

The study was carried out in two stages: the first was to identify the most prevalent ND in the electronic medical records of the 45 patients who used ECMO during the collection period in order to subsequently identify the nursing care available in the computerized system for these ND, and no patients/records were excluded; it was identified at this stage that some of the care, even available in the computerized system, was not always prescribed for the 45 patients in the sample. In the second stage, cross-mapping<sup>9</sup> was carried out between this care and the actions described in a care protocol for patients with ECMO.<sup>5</sup> It should also be noted that the site of this study is a reference hospital both in the application of the NP and in the use of ECMO.<sup>10</sup>

The medical records of patients who had used VA or VV ECMO over a five-year period were identified. The inclusion criteria were: adult patients over the age of 18, who during hospitalization used ECMO (VA or VV) with at least one ND assigned and with a nursing prescription during the period in which the device was used. There were no exclusion criteria.

Data collection was retrospective, using a computerized Query, which initially searched for the ND listed in the medical records of patients using ECMO, which were organized in Microsoft Excel® spreadsheets. Patients' sociodemographic and clinical data was also collected, such as type of ECMO, length of stay, discharge or death in the ICU. After identifying the ND, we searched the institution's computerized system for all the nursing care available for the nursing prescription linked to each of the ND identified.

For the cross-mapping stage,<sup>9</sup> three rules established by the main researcher guided the process: selecting of the care linked to the ND based on their similarity to the actions in the protocol for the care of patients with ECMO;<sup>5</sup> to determine a keyword in the protocol's actions that helped identify the care linked to the ND; and to use, preferably, the verbs found in the protocol's care actions<sup>5</sup> to compare with the care prescribed and linked to the ND.

A total of 106 care actions from the protocol<sup>5</sup> were mapped with 216 nursing care actions registered in the computerized system, linked to the five most prevalent ND listed for these patients in the search for similarities between them, as well as differences and/or needs for inclusion in the prescription system.

Once the cross-mapping had been carried out using the three rules mentioned above, its presentation was made via face-to-face meeting with the head of nursing at the ICU of the hospital studied, two nurses from the VA ECMO team and two nurses from the VV ECMO team, all of whom had experience in caring for this type of patient. At this meeting, a group approach was carried out, based on the results obtained from the cross-mapping, and the proposals for changes to the institution's computerized nursing prescription system were presented for analysis, reiteration or rejection, with all the suggested care actions being accepted by the group of specialists.

The organization of the data referring to the cross-mapping considered the ND and the care linked to them, as well as the domain and class of NANDA-I<sup>4</sup> (version 2018-2020). After the intensive care nurses had analyzed the mapping, they went on to propose ways of qualifying the institution's nursing prescription system in order to translate the knowledge. To this end, the results of the mapping analysis were also presented in a meeting with a group approach to the Nursing Process Committee, which is responsible for implementing and updating the stages of the NP used in clinical practice on a daily basis. This study was approved by the institution's Research Ethics Committee under the number 15503019.7.0000.5327.

## RESULTS

Among the 45 patients who used ECMO in the five-year period at the studied institution, 25 used VA ECMO and 20 VV ECMO, the majority of whom were male (69%), with a mean age of  $43 \pm 16$  years, and a median time of ECMO use of 3 (1 - 68)

days. All patients used an orotracheal tube and mechanical ventilation on ECMO and 58% of them also required renal replacement therapy. The outcome of discharge from the ICU occurred in 42% of the total of patients.

For the total number of patients, 23 different ND were identified, with up to four different related factors for each one. On average, six ND were listed per patient, the most frequent being: risk of infection in 45 (100%) patients; impaired spontaneous ventilation in 42 (93.3%) patients; self-care deficit syndrome in 42 (93.3%) patients; risk of bleeding in 30 (66.6%) patients; and impaired gas exchange in 28 (62.2%) patients.

Cross-mapping revealed that of the 106 nursing care actions included in the protocol,<sup>5</sup> 25 were not included in the institution's nursing prescription system. These 25 care actions were included in the system and linked to 14 ND. The ND that received new registered care are described by domains and classes, according to the NANDA-I taxonomy<sup>4</sup> (version 2018-2020).

Chart 1 shows the ND in the "Elimination and Exchange" domain, in which impaired urinary elimination had one care included, while impaired renal tissue perfusion had three care included, and impaired gas exchange had six care included.

Chart 2 shows the ND for the "Activity and Rest" domain. In it, the ND of decreased cardiac output had 13 care items included, the ND of impaired cardiopulmonary tissue perfusion had nine care items included, one of which was modified. The ND risk of cerebral tissue perfusion had two actions included, the ND self-care deficit had four actions included, and the ND self-care deficit syndrome had another four actions included.

Chart 3 shows the ND of the "Perception and Cognition" domain, in which acute confusion ND had a care action included.

Chart 4 shows the ND in the "Safety and Protection" domain, in which the ND of risk of infection had three care actions included, the ND of impaired skin integrity had two actions included, the ND of impaired tissue integrity had four actions included, the ND of risk of pressure injury had two actions and the ND of risk of bleeding had 16 care actions included in the nursing prescription system.

In addition to the nursing care included in the computerized prescription system, some of them were also included in Standard Operating Procedures (SOP), which had previously been constructed by the hospital's ECMO teams. Thus, the actions "Implement ECMO circuit care" and "Implement ECMO cannulas fixation care" were included in the ECMO circuit care SOP; and the actions "Request team support for bathing the ECMO patient", "Perform body hygiene on the ECMO patient with the support of at least four team members" and "Reposition the ECMO patient in bed with at least three team members" were included in the ECMO patient bathing SOP.

**Chart 1.** Nursing care actions associated with the ND of the “Elimination and Exchange” domain of NANDA-I (version 2018-2020) and included in the computerized nursing prescription system of a university hospital. Porto Alegre, RS, Brazil, 2020.

Domain	Class	Nursing diagnosis	Related factor	Care actions included in the nursing prescription system
Elimination and exchange	Urinary function	Impaired urinary elimination	Neuromuscular/musculoskeletal impairment	Perform bladder ultrasound to observe urinary retention and/or residue
		Alteration in tissue perfusion: Renal	Impaired oxygen transport through the capillary and/or alveolar membrane	Guide patient/family on how to:
				Perform bladder ultrasound to observe urinary retention and/or residue
	Respiratory function	Impaired gas exchange	Change in alveolar capillary membrane	Monitor renal replacement therapy coupled with ECMO
				Perform sweep maneuver on ECMO (10L gas flow for 10 seconds)
				Monitor and record ECMO blood flow and revolutions per minute
				Monitor and record ECMO gas flow and oxygen flow
				Inspect ECMO arterial line, venous line, centrifugal pump and oxygenating membrane with flashlight for clots and fibrin
				Monitor operation, temperature, water level of ECMO console heating device
				Check the presence of clamps, flashlight and emergency box in the ECMO patient box

Source: The authors.

**Chart 2.** Nursing care actions associated with ND in the “Activity and Rest” domain of NANDA-I (version 2018-2020) and included in a computerized nursing prescription system. Porto Alegre, RS, Brazil, 2020.

Domain	Class	Nursing diagnosis	Related factor	Care actions proposed for inclusion
Activity /Rest	Cardiovascular/pulmonary responses	Decreased cardiac output	Cardiac pump failure	Guide patient/family on how to:
				Perform SWEEP maneuver on ECMO (10L gas flow for 10 seconds)
				Monitor and record ECMO blood flow and revolutions per minute
				Monitor and record ECMO gas flow and O <sub>2</sub> F
				Inspect ECMO arterial line, venous line, centrifugal pump and oxygenating membrane with flashlight for clots
				Implement care with arterial/venous puncture of large vessels
				Implement care with large vessel venipuncture
				Check cannulas for kinks or disconnections
				Monitor operation, temperature, water level of the ECMO console heating device
				Check the presence of clamps, flashlight and emergency box in the ECMO patient’s box
		Altered contractility	Guide patient/family on how to:	
		Altered blood volume	Guide patient/family on how to:	
		Septic shock	Guide patient/family on how to:	
		Ineffective tissue perfusion: Cardiopulmonary	Impaired blood flow	Guide patient/family on how to:
	Perform SWEEP maneuver on ECMO (10L gas flow for 10 seconds)			
	Monitor and record ECMO blood flow and revolutions per minute			
	Monitor and record ECMO gas flow and O <sub>2</sub> F			
	Inspect ECMO arterial line, venous line, centrifugal pump and oxygenating membrane with flashlight for clots			
	Implement care with arterial/venous puncture of large vessels			
	Implement care with large vessel venipuncture			
	Check cannulas for kinks or disconnections			
	Monitor operation, temperature, water level of the ECMO console heating device			
	Check the presence of clamps, flashlight and emergency box in the ECMO patient’s box			
Risk of ineffective cerebral tissue perfusion	Vascular alteration	Report change in color and temperature of extremities		
	Side effects of treatment	Report change in color and temperature of extremities		
Self-care	Deficit in self-care: bathing and hygiene	Restrictive therapy	Assess level of sedation	
			Ask the team to accompany the ECMO patient to the bath	
			Check that cannulas and other devices are securely attached to the ECMO patient before beginning body hygiene.	
	Self-care deficit syndrome		Perform body hygiene on the ECMO patient with the support of at least 4 team members	
			Assess level of sedation	
			Ask the team to accompany the ECMO patient to the bath	
		Check that cannulas and other devices are securely attached to the ECMO patient before beginning body hygiene.		
		Perform body hygiene on the ECMO patient with the support of at least 4 team members		

ECMO: Extracorporeal Membrane Oxygenation; O<sub>2</sub>F: Oxygen Flow. Source: The authors.

**Chart 3.** Nursing care actions associated with the ND of the “Perception/Cognition” domain of NANDA-I (version 2018-2020) and included in a computerized nursing prescription system. Porto Alegre, RS, Brazil, 2020

Domain	Class	Nursing diagnosis	Related factor	Care action proposed for inclusion
Perception/ Cognition	Cognition	Acute confusion	Related to side effects of medication	Guide patient/family on how to:

Source: The authors.

**Chart 4.** Nursing care actions associated with ND in the “Safety/Protection” domain of NANDA-I (version 2018-2020) and included in a computerized nursing prescription system. Porto Alegre, RS, Brazil, 2020.

Domain	Class	Nursing diagnosis	Related or risk factor	Care actions proposed for inclusion	
Safety/Security	Infection	Risk of infection	Invasive procedure	Change ECMO cannulas dressings	
				Implement ECMO circuit care	
				Inspect ECMO cannulas insertion site	
	Physical Injury	Risk of impaired skin integrity	Immobility	Protect skin adjacent to ECMO cannula/circuit	
				Reposition ECMO patient in bed with at least 3 team members	
		Impaired tissue integrity	Impaired mobility	Guide patient/family on how to:	
				Report changes in color and temperature of extremities	
				Compare the ECMO patient’s warmth and peripheral pulses	
		Risk of pressure injury	Impaired mobility	Observe changes in skin color	
				Protect skin adjacent to ECMO cannula/circuit	
				Reposition ECMO patient in bed with at least 3 team members	
		Risk of bleeding		Adverse effects of therapy	Guide patient/family on how to:
					Implement care when changing central venous catheter dressings
					Checking ACT / APTT in patients on ECMO
					Change dressings on ECMO cannulas insertions
	Implement ECMO cannulas fixation care				
	Implement ECMO circuit care				
	Hematological disorders			Inspect ECMO cannulas insertion sites	
				Guide patient/family on how to:	
				Implement care when changing central venous catheter dressings	
Checking ACT / APTT in patients on ECMO					
Change dressings on ECMO cannulas insertions					
Implement ECMO cannulas fixation care					
Mechanical trauma	Vascular alteration	Implement ECMO circuit care			
		Inspect ECMO cannulas insertion sites			
			Guide patient/family on how to:		
			Guide patient/family on how to:		

ECMO: Extracorporeal Membrane Oxygenation; ACT: Activated Coagulation Time; APTT: Activated Partial Thromboplastin Time. Source: The authors.

## DISCUSSION

This study provided an opportunity to transfer knowledge of evidence-based care to patients using a circulatory assistance device called ECMO, by identifying the most prevalent ND and the care actions needed to achieve better health outcomes, qualifying the nursing prescription stage in clinical practice.

Fourteen ND were identified for patients using ECMO, the most prevalent being the risk of infection; spontaneous ventilation; self-care deficit syndrome; risk of bleeding; and impaired gas exchange. After cross-mapping, we identified the

need to include 25 new nursing care items to be linked to these ND, with a focus on patients using ECMO.

Based on the most prevalent ND, all the care actions associated with each one were identified, allowing cross-mapping with the actions of a care protocol.<sup>5</sup> It should be noted that the actions in the protocol were grouped by domains (patient and circuit) and subdomains, unlike how the actions are organized in the prescription module of the institution’s computerized system, which are associated with the related factors of the ND, according to the NANDA-I taxonomy (version 2018-2020).

Some of the 25 new nursing actions proposed for inclusion in the computerized system were already carried out in practice, although they didn't appear in the nursing prescription, because as the indication of ECMO became more frequent, the day-to-day care of this type of patient required specific care actions. One example is "perform bladder ultrasound", which is a routine intervention for nurses in the ICU, carried out at the bedside when urinary retention or residue is suspected. This action prevents the risk of urinary infection.<sup>11</sup>

Similarly, the use of renal replacement therapy in ECMO patients is mentioned. Research has shown that acute renal failure may be present, for which continuous dialysis therapy is indicated, and if the ECMO circuit is prepared in advance, with an additional pre-pump and pre-membrane input, it becomes possible to couple dialysis therapy to ECMO.<sup>12,13</sup> When this happens, nursing has the responsibility of monitoring renal replacement therapy coupled to ECMO, an intervention that has been included in the system.

Interventions related to maintaining the circuit and monitoring the patient account for 80% of the instituted interventions. These should be carried out by the nurse responsible for the ECMO, in a thorough and protocolized manner, and any changes to the circuit, cannulas and console should be reported to the team.<sup>5,14,15</sup>

In addition to clinical signs related to bleeding or coagulation disorders, during patient monitoring it is necessary to check for pupillary changes, level of consciousness, bleeding at puncture sites, hemoptysis, hematemesis, hematuria, hemolysis, melena and enterorrhagia, which should be observed and reported to the team, since they are the main complications related to anticoagulation, characterized as thrombotic and hemorrhagic events.<sup>13,15</sup>

It is important to mention that the mobilization of patients on ECMO should not be treated as taboo. For this reason, interventions related to repositioning and mobilizing the ECMO patient in bed, and even from bed to armchair, are important and can be carried out safely by the team. Early mobilization and therapeutic exercises reduce delirium and days of mechanical ventilation.<sup>16</sup> However, there are risks during mobilization out of bed and the patient must be monitored to avoid delayed adverse events, such as cannula dislodgement, bleeding and fatigue,<sup>17</sup> risks which are increased in patients with COVID-19.

The interventions related to the care used to prevent pressure injuries are no different from the approach used for other critically ill patients, which is mainly aimed at relieving pressure points, moisturizing the skin, managing humidity, friction and shear.<sup>18</sup> In addition, patients with ECMO need to manage the risk of injury related to medical devices (in this case, cannulas and circuits), and it is the task of nurses to implement preventive measures that minimize the tension applied by the material to the skin.

Interventions related to hygiene and comfort procedures take up a good deal of the nursing team's workload and can be potentially dangerous, causing hemodynamic and ventilatory instability if the patient's clinical conditions are not considered before the procedure.<sup>19</sup> After assessing the patient, planning

the activities that will be carried out becomes important in order to optimize time and reduce the risks related to hygiene and comfort procedures.

Another aspect that deserves attention is the ECMO patient's family. They are affected by the worsening of their clinical condition. For this reason, the intervention of guiding the patient/family about their state of health and its complications, as well as including the family in direct contact with the patient, recruiting the largest support network available, is fundamental to help them cope with these difficult times.<sup>14,20</sup> The welcoming of the family by the care team, through effective communication, converges towards the qualification of care practices, as well as bringing family members closer together.

Some of the actions related to hygiene and mobilization have been included in standard operating procedures, which detail how this action/intervention should be carried out, including information related to the place of execution, expected results, executor, material, activities and references, and which are also in the computerized system.

The use of ECMO makes the patient highly complex, requiring intensive monitoring and systematic care. This monitoring should be carried out by a qualified multi-professional team, with the aim of integrating care.<sup>10</sup> It is therefore recommended that a set of evidence-based care actions for patients with ECMO be put in place as soon as the implantation of the device is indicated, so that there is uniformity in the execution of care.<sup>5,14</sup> In this context, it is important to update ND and related care actions in order to reduce inappropriate variations in care and contribute to the management of a patient in a specific clinical circumstance, based on the best scientific information.

## CONCLUSIONS AND IMPLICATIONS FOR PRACTICE

The cross-mapping of care actions between a care protocol and a computerized nursing prescription system showed the need to include 25 new care actions in this system, associated with 14 nursing diagnoses belonging to five different domains of NANDA-I (version 2018-2020). This favored the translation of knowledge with the updating of the evidence-based nursing prescription system, in line with the needs and specificities of care for patients using extracorporeal membrane oxygenation, strengthening their safety and the likelihood of obtaining better results.

The strategy used to operationalize the translation of knowledge, despite the challenges that include the complexity of care processes and the availability of people to implement it, was made possible in this study through the mobilization and integration of academic and care teams. The main implication for clinical practice is the dissemination of this knowledge and its use in a real care scenario for ECMO patients.

As a limitation of the study, it is mentioned that it was carried out using data from the computerized system of a single institution, which limits its generalization and the use of NANDA-I version 2018-2020. However, the updates in the next edition do not compromise the evidence in this study.

## AUTHORS' CONTRIBUTIONS

Study design. Aline Valli de Leão. Karina de Oliveira Azzolin. Amália de Fátima Lucena. Emiliane Nogueira de Souza.

Data acquisition: Aline Valli de Leão. Karina de Oliveira Azzolin. Amália de Fátima Lucena.

Data analysis and interpretation of results. Aline Valli de Leão. Karina de Oliveira Azzolin. Amália de Fátima Lucena. Emiliane Nogueira de Souza.

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## REFERENCES

- Zakhary B, Shekar K, Diaz R, Badulak J, Johnston L, Roeleveld PP et al. Position paper on global extracorporeal membrane oxygenation education and educational agenda for the future: a statement from the extracorporeal life support organization ECMO taskforce. *Crit Care Med*. 2020;48(3):406-14. <http://dx.doi.org/10.1097/CCM.0000000000004158>. PMID:31833901.
- Mossadegh C, Combes A. *Nursing care and ECMO*. Switzerland: Springer International Publishing; 2017. <http://dx.doi.org/10.1007/978-3-319-20101-6>.
- Resolução COFEN-358/2009 (BR). Dispõe sobre a sistematização da assistência de enfermagem–SAE nas instituições de saúde brasileiras. Diário Oficial da União [periódico na internet], Brasília (DF), 2009 [cited 2020 jun 16]. Available in: [https://files.cercomp.ufg.br/weby/up/194/o/Resolu%C3%A7%C3%A3o\\_n%C2%BA358-2009.pdf](https://files.cercomp.ufg.br/weby/up/194/o/Resolu%C3%A7%C3%A3o_n%C2%BA358-2009.pdf)
- NANDA-I. *Nursing diagnoses: definitions & classification*. 11th ed. Philadelphia: Wiley-Blackwell; 2018.
- Maurer TC, Souza EN. *Protocolo de cuidados para pacientes adultos com ECMO* [Internet]. Porto Alegre: Editora da Universidade Federal de Ciências da Saúde de Porto Alegre; 2020. [cited 2020 jun 16]. 54 p. Available in: [https://www.ufcspa.edu.br/editora\\_log/download.php?cod=021&tipo=pdf](https://www.ufcspa.edu.br/editora_log/download.php?cod=021&tipo=pdf)
- Ramanathan K, Shekar K, Ling RR, Barbaro RP, Wong SN, Tan CS et al. Extracorporeal membrane oxygenation for COVID-19: a systematic review and meta-analysis. *Crit Care*. 2021;25(1):211. <http://dx.doi.org/10.1186/s13054-021-03634-1>. PMID:34127027.
- Arikan H, Cordingley J. Extracorporeal membrane oxygenation for severe acute respiratory distress syndrome associated with COVID-19. *Breathe (Sheff)*. 2021;17(1):200278. <http://dx.doi.org/10.1183/20734735.0278-2020>. PMID:34295394.
- Oelke ND, Lima MADS, Acosta AM. Knowledge translation: translating research into policy and practice. *Rev Gaúcha Enferm*. 2015;36(3):113-7. <http://dx.doi.org/10.1590/1983-1447.2015.03.55036>. PMID:26486908.
- Lucena AF, Barros AL. Mapeamento cruzado: uma alternativa para análise de dados em enfermagem. *Acta Paul Enferm*. 2005;18(1):82-8. <http://dx.doi.org/10.1590/S0103-21002005000100011>.
- Buffon MR, Severo IM, Barcellos RA, Azzolin KO, Lucena AF. Critically ill COVID-19 patients: a sociodemographic and clinical profile and associations between variables and workload. *Rev Bras Enferm*. 2022;75(75, Suppl 1):e20210119. <http://dx.doi.org/10.1590/0034-7167-2021-0119>. PMID:35262599.
- Carnaval BM, Teixeira AM, de Carvalho R. Uso do ultrassom portátil para detecção de retenção urinária por enfermeiros na recuperação anestésica. *Rev SOBECC*. 2019;24(2):91-8. <http://dx.doi.org/10.5327/Z1414-4425201900020007>.
- Chaves RCF, Rabello Fo R, Timenetsky KT, Moreira FT, Vilanova LCDS, Bravim BA et al. Oxigenação por membrana extracorpórea: revisão da literatura. *Rev Bras Ter Intensiva*. 2019;31(3):410-24. <http://dx.doi.org/10.5935/0103-507X.20190063>. PMID:31618362.
- Kashani K, Ostermann M. Otimizando a terapia de substituição renal para pacientes que precisam de oxigenação por membrana extracorpórea: conversa cruzada entre duas máquinas de suporte de órgãos. *BMC Nefrologia*. 2019;20(1):404. <http://dx.doi.org/10.1186/s12882-019-1602-9>. PMID:31718579.
- Barbaro RP, Maclaren G, Boonstra PS, Iwashyna TJ, Slutsky AS, Fan E et al. Extracorporeal life support organization: extracorporeal membrane oxygenation support in COVID-19: an international cohort study of the extracorporeal life support organization registry. *Lancet*. 2020;396(10257):1071-8. [http://dx.doi.org/10.1016/S0140-6736\(20\)32008-0](http://dx.doi.org/10.1016/S0140-6736(20)32008-0). PMID:32987008.
- Chommeloux J, Valentin S, Winiszewski H, Adda M, Pineton CM, Moyon Q et al. One-year mental and physical health assessment in survivors after extracorporeal membrane oxygenation for COVID-19–related acute respiratory distress syndrome. *Am J Respir Crit Care Med*. 2023;207(2):150-9. <http://dx.doi.org/10.1164/rccm.202206-1145OC>. PMID:36150112.
- Aleef MCM, Labib A. Early mobilization and ICU rehabilitation of ECMO patients. *Qatar Med J*. 2017;2017(1):71. <http://dx.doi.org/10.5339/qmj.2017.swacelso.71>.
- Haji JY, Mehra S, Doraiswamy P. Awake ECMO and mobilizing patients on ECMO. *Indian J Thorac Cardiovasc Surg*. 2021;37(Suppl 2):309-18. <http://dx.doi.org/10.1007/s12055-020-01075-z>. PMID:33487891.
- Araujo SM, Sousa P, Dutra I. Clinical decision support systems for pressure ulcer management: systematic review. *JMIR Med Inform*. 2020;8(10):e21621. <http://dx.doi.org/10.2196/21621>. PMID:33064099.
- Puslecki M, Dabrowski M, Baumgart K, Ligowski M, Dabrowska A, Ziemak P et al. Managing patients on extracorporeal membrane oxygenation support during the COVID-19 pandemic - a proposal for a nursing standard operating procedure. *BMC Nurs*. 2021;20(1):214. <http://dx.doi.org/10.1186/s12912-021-00736-7>. PMID:34717602.
- Jia L, Zhang Z, Bai Y, Du Q. VV-ECMO combined with prone position ventilation in the treatment of *Pneumocystis jirovecii* pneumonia: a case report. *Medicine (Baltimore)*. 2022;101(1):e28482. <http://dx.doi.org/10.1097/MD.00000000000028482>. PMID:35029898.