

# PREVENÇÃO DAS CONSEQUÊNCIAS DA IMOBILIDADE NA PESSOA EM SITUAÇÃO CRÍTICA

PREVENCIÓN DE LAS CONSECUENCIAS DE LA INMOVILIDAD EN ENFERMO CRÍTICO

PREVENTION OF THE IMOBILITY CONSEQUENCES IN CRITICALLY ILL PATIENTS

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## RESUMO

Este artigo resultou de um projeto de intervenção que teve como objetivo prevenir as consequências da imobilidade na pessoa em situação crítica. A revisão da literatura salienta que programas de reabilitação precoce minimizam as repercussões da imobilidade com grandes benefícios na funcionalidade e qualidade de vida das pessoas. Para estudar e descrever este problema foi utilizada metodologia de estudo de casos.

Participaram quatro pessoas, internadas numa unidade de cuidados intensivos, a quem foi implementado um projeto de intervenção que incluía um conjunto sistematizado de cuidados no âmbito da prevenção de úlceras por pressão e da reabilitação motora e respiratória. A avaliação dos resultados permitiu concluir que as pessoas que integraram o projeto mantiveram ou melhoraram a amplitude do movimento; não desenvolveram úlceras por pressão nem complicações respiratórias. Conclui-se que um planeamento adequado e individualizado de cuidados de enfermagem de reabilitação previne as consequências da imobilidade nos doentes em estado crítico.

Descritores: Enfermagem em Reabilitação; pessoas acamadas; estado crítico

## RESUMEN

Este artículo resultó de un proyecto de intervención cuyo objetivo fue prevenir las consecuencias de la inmovilidad en enfermos críticos. La revisión de la literatura subraya que los programas de rehabilitación precoz minimizan las repercusiones de la inmovilidad con grandes beneficios en la funcionalidad y calidad de vida de las personas. Para estudiar y describir este problema se utilizó la metodología de estudio de casos.

Cuatro personas, hospitalizadas en una unidad de cuidados intensivos, participaron del proyecto de intervención que incluía un conjunto sistematizado de cuidados del ámbito de la prevención de úlceras por presión y de la rehabilitación motora y respiratoria. La evaluación de los resultados permitió concluir que las personas que integraron el proyecto mantuvieron o mejoraron la amplitud del movimiento; no desarrollaron úlceras por presión ni complicaciones respiratorias. Se concluye que una planificación adecuada e individualizada de cuidados de enfermería de rehabilitación previene las consecuencias de la inmovilidad en enfermos críticos.

Palabras Clave: Enfermería en Rehabilitación; personas encamadas; enfermedad crítica

## ABSTRACT

This article resulted from an intervention project that aimed to prevent the immobility consequences in critically ill patients. The literature review emphasizes that early rehabilitation programs minimize the immobility repercussions with great benefits in people's functionality and quality of life. To study and describe this problem was used the case study methodology.

Four hospitalized persons in an intensive care unit participated on an intervention project that included a systematized nursing care in the scope of pressure ulcers prevention and motor and respiratory rehabilitation. The results evaluation allowed to conclude that people who participated in the project maintained or improved the range of motion and did not develop pressure ulcers or respiratory complications. It is concluded that adequate and individualized rehabilitation nursing care planning prevents immobility consequences in critically ill patients.

Keywords: Rehabilitation Nursing; bedridden persons; critical illness

## INTRODUCTION

In the Intensive Care Units (ICU), prolonged bed rest is used as a therapeutic measure necessary for the clinical stabilization of hospitalized patients. However, the deleterious effects of immobility can be more serious than the clinical situation that generates them, transforming a temporary functional capacity reduction into incapacity<sup>(1)</sup> recognizing that immobility compromises people's quality of life<sup>(2)</sup>. Furthermore, there is currently an increase in the number of survivors of critical illness with sequelae of neuromuscular dysfunction and physical disability, related to their hospitalization in the ICU<sup>(3,4)</sup>.

The harmful effects of prolonged immobility in people in critical condition lead to, among others, severe dysfunctions in the osteomyoarticular system<sup>(5)</sup>, such as the development of joint contractures<sup>(6)</sup>. Another study<sup>(7)</sup> stated that generalized muscle weakness is a common consequence in people who are immobilized and particularly in those who need invasive ventilatory support. In these people, muscle weakness associated with the ineffectiveness of the ciliary lining reduces the effectiveness of coughing, which contributes to an increment of secretions and increase risk of respiratory infections<sup>1</sup>. Ventilation and pulmonary perfusion are also affected, which translates into episodes of hypoxemia, reduced ventilatory reserve capacity, increased dyspnea and greater difficulty in the ventilatory weaning process<sup>(8)</sup>. Another problem associated with immobility is the appearance of pressure ulcers, which represent a serious health problem, with repercussions on the person, in terms of mortality and morbidity, and their prevalence values tend to increase in populations at risk, particularly people in a state critical<sup>(1)</sup>.

These are some of the reasons that justify the investment in preventing the consequences of immobility and it is essential to find evidence that address effective nursing interventions in preventing and reducing the problem<sup>(9)</sup>.

In this sense rehabilitation nurses (RNs), who work in the ICU, play a key role in the development and implementation of rehabilitation programs aimed at minimizing the consequences of immobility. The prevention of complications, in order to avoid or minimize disabilities, is one of the key aspects of RNs performance<sup>(10)</sup>, which gains greater importance in the ICU environment, as one of the purposes of providing Rehabilitation Nursing care for people in critical condition is to avoid and reduce complications resulting from immobility in bed<sup>(11)</sup>, namely respiratory, motor and functional complications<sup>(12)</sup>. It is emphasized that one of the essential contributions to prevent the consequences of immobility is the adequate planning of Rehabilitation Nursing care, which includes interventions that promote mobility and subsequent self-care<sup>(1)</sup>. Other authors<sup>(13)</sup> reinforce the importance of rehabilitation and early mobilization programs, aimed at people in critical condition, with an early start, that is, immediately after the stabilization of vital functions, usually in the first two to five days of hospitalization of people in ICU.

In addition, promoting the safety of people is an important objective in the practice of Rehabilitation Nursing<sup>(14)</sup> and the provision of Rehabilitation Nursing care in preventing the consequences of immobility of people in critical situations allows avoiding situations and adverse effects that compromise their safety.

Hospitalization in ICU and the resulting consequences, such as immobility, are events that trigger various transitions in people, more specifically, health/disease and situational transitions<sup>(15)</sup>. As nurses play a leading role in facilitating transitions, this role takes on a particular meaning in the health/disease transition processes and in these, it is essential that nurses adopt a posture of listening and acceptance of the other, education and guidance, promoting the self-care and comfort<sup>16</sup>, and may also intervene in anticipatory periods, preparation for changing roles, preventing the negative effects of the disease on people<sup>17</sup>, as is the case with the consequences of immobility.

Through the literature review, it was found that the studies carried out by nurses in the area of preventing the consequences of immobility in people in critical situations are scarce, compared to studies carried out by other professionals in the field of rehabilitation.

In order to be able to contribute to the prevention of the consequences of immobility, and to describe these contributions, an early intervention project in Rehabilitation Nursing was developed focusing on people in critical situations affected by immobility, hospitalized in ICU, to whom were provided organized and systematized Rehabilitation Nursing care.

The focus is, by definition of the International Classification of Nursing Practice (ICNP®), an area of intervention that is relevant for nursing<sup>(18)</sup> and in the context of this project, the focuses identified as relevant were airway cleaning, ventilation, joint stiffness and pressure ulcers, associated with the respiratory, joint and integumentary system consequences of immobility.

The intervention project has as a general objective, to prevent the consequences of immobility of people hospitalized in ICU and as specific objectives, to carry out an initial assessment of people that includes the assessment of ventilatory function and airway cleaning mechanisms, assessment of skin integrity as well as the risk of compromise and the assessment of joint range, through direct observation and the application of assessment instruments adapted to the Portuguese population; to identify the risk of developing respiratory, integumentary, and musculoskeletal changes and to formulate associated diagnoses; to implement a respiratory and motor rehabilitation nursing intervention program; to describe the contributions of the intervention program through the reassessment of the person, including ventilatory function and airway clearance mechanisms, skin integrity and joint range.

## METHOD

For the elaboration of the intervention project, the methodology of case studies was adopted, since this research strategy is mainly intended to describe, to understand and to explain<sup>(19)</sup>, allowing the study of a phenomenon (in this case the consequences of immobility in people in critical situations) in a holistic perspective and in a real context, with different sources of evidence, obtaining a wealth of descriptive information, also allowing reflection and the search for alternatives to solve the problem<sup>(20)</sup>. Despite presenting as a limitation the impossibility of generalizing the results obtained in nursing, it makes it possible to know in depth the aspects of the phenomenon under study<sup>(21)</sup>.

This project describes the cases of people hospitalized in ICU of a Hospital Center in Lisbon, who presented a potential risk of developing integumentary, musculoskeletal and respiratory alterations, associated with immobility, a selection criterion for participation in the intervention project. It took place from October to November 2018, after approval by the Ethics Committee for Health and authorization by the Board of Directors of the aforementioned Hospital Center.

The importance of nursing as a theoretical-practical science must be sensitive to multiple focuses of interest and intervene in the transition process and this practical intervention will be based on facilitating the transitions of patients and families where health and well-being are perceived as results<sup>(16,17)</sup>. Therefore, the intervention project was based on the methodology of the nursing process.

Based on the four defined nursing focuses and criteria supported by the Documentary Standard of Nursing Care of the Rehabilitation Nursing Specialty<sup>(22)</sup> and others considered relevant and described in the literature, the initial assessment of people included the assessment of vital parameters, monitoring of skin integrity, pulmonary auscultation and assessment of the cough reflex and breathing pattern through direct observation; the assessment of the state of consciousness through the application of the Glasgow Coma Scale (GCS)<sup>(23)</sup>; assessment of the risk of developing pressure ulcers, with the application of the Braden scale<sup>(24)</sup>. The range of motion (ROM) of the joints at the level of the shoulders, elbows, knees and ankles was also evaluated through goniometry. The use of standardized assessment instruments allows for the documentation of specialized care, its continuity and also the development of research projects that can be assumed as good practices and replicated<sup>(25)</sup>.

After identifying the real and potential problems from the data collected in the initial assessment, Rehabilitation Nursing diagnoses related to each nursing focus were elaborated, using the ICNP® language, and interventions based on scientific evidence and explained in the Documentary Pattern were stratified. of Nursing Care of the Rehabilitation Nursing Specialty, within the scope of Functional Motor Reeducation (FMR), prevention of pressure ulcers and Functional Respiratory Reeducation (FRR).

It was defined that the assessment of nursing focuses on airway cleaning and ventilation would be carried out

at the beginning and at the end of each FRR session, since the interventions performed in each session are expected to promote, in principle, an immediate improvement. Regarding the assessment of the nursing focuses of joint stiffness and pressure ulcers, it was defined that it would be carried out in three moments of the intervention plan - initial, intermediate and final - since the visibility of the results occurs over a longer period, in contrast with the previous focuses.

To ensure the integrity of the investigation, all phases of this project are based on ethical principles defended by nursing, respecting and safeguarding confidentiality and anonymity, both of the institution where the project took place, and of the participants, having been represented by letters. All necessary steps were also taken to obtain an informed, expressed and free consent.

## RESULTS

The information obtained was subjected to descriptive analysis procedures, which make it possible to describe the characteristics of the cases studied and the values obtained by measuring the variables<sup>(26)</sup>.

### Description of Cases

The description of each case is carried out, safeguarding that during the FMR sessions it was found that all participants maintained hemodynamic stability, ensuring the safety of the interventions carried out on people. Before each FRR session, the participants' chest X-rays were viewed in order to detect possible changes that could compromise their respiratory function.

#### Case of person A

A 44 year-old male, married who was admitted to ICU with a diagnosis of traumatic brain injury (diffuse cerebral edema with thin layer of right frontal subdural hematoma); fracture of C2 and D9; right pneumothorax; fracture of the metacarpals of the left hand. During hospitalization, patient had several clinical problems, such as deep venous thrombosis of the left lower limb. This problem was still not resolved at the time of the initial assessment, which took place on the 30th day of hospitalization (Table1), so it was decided not to assess the ROM of the left lower limb at that time, due to the risk of worsening the situation.

State of consciousness (GCS score)	11T score (spontaneous eye opening-4; absent verbal response due to the presence of the endotracheal tube (ETT)-1, and obey orders-6)
Skin Integrity	Absent - Stage 3 pressure ulcer in the occipital region, associated with the permanent use of the cervical collar; - Stage 3 pressure ulcer in the sacral region.
Pressure ulcer risk (Braden scale score)	High risk of pressure ulcers (13 points)
Joint movement assessment	- Maintained prolonged bed rest. - ROM was passively evaluated in the upper limbs and right lower limb with reduced joint and muscle movement. - In flexion of the left elbow, he presented pain at the end of the movement.
Ventilation	- Spontaneous ventilation, with T-piece oxygen therapy with an inspired oxygen fraction (FiO <sub>2</sub> ) of 28%. - Regular, superficial breathing pattern, predominantly abdominal (with minimal chest expansion), thoracic symmetry maintained and without the use of accessory muscles. No respiratory effort. - Pulmonary auscultation with adventitious sounds
Airway Cleaning Mechanisms (Cough reflex)	Decreased cough reflex; it mobilizes secretions to the ETT. Aspiration of frequent secretions.

Table 1 - Initial assessment of person A Source: own elaboration.

Following the initial assessment performed, the following nursing diagnoses were established:

- Diagnosis 1 - Risk of joint stiffness;
- Diagnosis 2 - Risk of high-grade pressure ulcer;
- Diagnosis 3 - Ineffective airway clearance;
- Diagnosis 4 - Impaired ventilation.

Throughout the intervention period, the person A maintained the same state of consciousness. There were 7 sessions of FMR, passive mobilizations were performed, with an increase in the number of

repetitions per movement from the 5<sup>th</sup> session. For safety reasons, the passive mobilization exercises of the left lower limb were only introduced in the 4<sup>th</sup> session, when the ROM of the left lower limb was evaluated.

In the first sessions, patient presented pain facies during the external rotation of the left shoulder, flexion of the left elbow and in the supination of the left forearm, so that movements of lesser amplitude were performed. Analgesic therapy was suggested and administered. In the remaining sessions, there was no pain during the mobilizations. It should be noted that, as there was a longer time of contact with person A, three moments of ROM evaluation were performed, while the remaining participants were submitted to two evaluation moments. Thus, the intermediate assessment of the ROM occurred in the 3<sup>rd</sup> session and at the end of the 7<sup>th</sup> session the ROM was reassessed.

Out of the joints evaluated in the three periods, it was found that there was a linear increase in ROM at the level of right shoulder abduction, right elbow flexion and right knee flexion. The ROM of left shoulder abduction and right ankle dorsiflexion increased from the initial to the intermediate assessment and was maintained in the final assessment.

There was a difference in the ROM of the lower limbs, in which the joints of the right lower limb have greater amplitude, which is understandable since the left lower limb was immobilized for longer, however it showed an increase in ROM at the level of knee flexion and ankle dorsiflexion.

In shoulder flexion and right ankle plantar flexion, there was a decrease in ROM from the intermediate to the final evaluation. There was also a decrease in ROM at the level of plantar flexion of the left ankle between the two assessments performed. Left elbow flexion ROM showed a linear decrease since the first assessment. It should be noted that during the first sessions it was one of the movements where person A presented pain.

As for pressure ulcer preventive measures, in addition to the application of moisturizing cream and maintenance of dry skin, the change in decubitus was reinforced, with total help, and the removal of the cervical collar once a day (at least), to inspect and clean the skin; to prevent pressure ulcers on the chin, due to the cervical collar, skin care was performed and a silicone pressure-reducing compress was applied, covering the chin region up to the supraclavicular region.

In the three assessments carried out, person A maintained the same score on the Braden scale, which translates into a high risk of pressure ulcers, however, he did not develop any more pressure ulcers.

Within the scope of the FRR, 6 sessions were held. From the 2<sup>nd</sup> session onwards, the number of repetitions in the lower costal re-education was increased, by decreasing the vesicular murmur at the lung bases, and in the 3<sup>rd</sup> session, the number of repetitions of the remaining breathing exercises was increased.

It should be noted that during the period in which the intervention project took place, person A was extubated endotracheally (one day before the 3<sup>rd</sup> session), however, due to respiratory decompensation, a new endotracheal re-intubation was performed (before the 4<sup>th</sup> session) and in the 6<sup>th</sup> session, the ETT has been removed in the previous shift.

Before and after each session, vital parameters were evaluated. The values of heart rate and mean arterial pressure showed slight variations, verifying that in the 3<sup>rd</sup> session there was an increase in mean arterial pressure after the FRR session, however it did not compromise the person's hemodynamic stability.

In the 3<sup>rd</sup> and 4<sup>th</sup> sessions, an increase in respiratory rate was observed, however its values were limited to the reference interval of the respiratory rate. Furthermore, the increase in respiratory rate was associated with an increase in the amplitude of the respiratory rate waveform, with an improvement in the breathing pattern.

Throughout all the FRR sessions, ventilation and the presence of respiratory effort were evaluated, verifying that person A did not present signs of respiratory effort, with improvement in the amplitude and type of breathing. We emphasize that in session 4 there was a setback in terms of the breathing pattern that may be associated with the period of previous decompensation and which culminated in the person's re-intubation. Despite this, and from that session onwards, the evolution was favorable.

Oxygen saturation (SpO<sub>2</sub>) values increased in the first three sessions, remained constant in the 4<sup>th</sup> and 6<sup>th</sup> session and in the 5<sup>th</sup> session it slightly decreased from 100% to 96%. It is noteworthy that during the sessions the oxygen flow fluctuated, according to the oxygen therapy needs of person A.

Pulmonary auscultation was performed before and after all sessions, verifying that person A did not present adventitious sounds (AS) at the end of the sessions and the vesicular murmur (VM) in the lung bases, despite remaining reduced, became more audible.

Although in the 1<sup>st</sup> session he presented an episode of vigorous coughing, when disconnected from the oxygen source, having been able to expel secretions by ETT, in all the sessions, while patient was endotracheally intubated and presented a decreased cough reflex, mobilizing secretions up to the ETT, requiring the aspiration of secretions.

In the 3<sup>rd</sup> session and in the last session, he was extubated, with a diminished cough reflex; however, after carrying out the planned FRR techniques, he was able to expel the secretions. When encouraged to cough, he became drowsier and had to aspirate secretions.

**Case of person B**

60-year-old divorced man who lives alone and was admitted to ICU due to right cerebellar ischemic stroke.

The initial assessment was carried out on the 7<sup>th</sup> day of hospitalization (Table 2).

State of consciousness (GCS score)	10T score (eye opening to sound-3; verbal response absent due to the presence of ETT -1 and obeying orders- 6)
Skin Integrity	Present
Pressure ulcer risk (Braden scale score)	High risk of pressure ulcers (12 points)
Joint movement assessment	- Maintained bed rest. -ROM passively evaluated in the upper and lower limbs with reduced joint and muscle movement. - Absent pain in joint movement
Ventilation	-Under invasive mechanical ventilation, in controlled pressure ventilation mode. -Superficial respiratory pattern, mixed, with maintained chest symmetry; without their own respiratory cycles, performing those previously set on the ventilator. - Pulmonary auscultation with AS
Airway Cleaning Mechanisms (Cough reflex)	Decreased cough reflex; it does not mobilize secretions up to the ETT. Aspiration of frequent secretions.

*Table 2 – Initial Assessment of Person B, Source: own elaboration.*

According to the initial assessment, the following nursing diagnoses were elaborated:

- Diagnosis 1 - Risk of joint stiffness;
- Diagnosis 2 - Risk of high-stage pressure ulcer;
- Diagnosis 3 - Ineffective airway clearance;
- Diagnosis 4 - Impaired ventilation.

Person B showed an improvement in consciousness throughout the intervention project, with an GCS score of 14 on the last day (spontaneous eye opening, confused speech, following orders).

There were 4 sessions of FMR, with passive mobilizations in a first phase. From the 3<sup>rd</sup> session onwards, the patient was more awake and when

encouraged, started the movement spontaneously, so assisted active mobilization exercises were started.

In the first two sessions, participant presented pain facies at the mobilization of the cervical region, so the mobilization of the same was suspended in the remaining sessions without pain complaints. At the end of the 4<sup>th</sup> session, the ROM was passively reassessed to compare the results obtained with those of the initial assessment.

Overall, ROM was maintained or increased, with a decrease in ROM at the level of right shoulder abduction, right elbow flexion and plantar flexion of both ankles.

During the intervention project, person B maintained cutaneous integrity; however, due to friction (constantly sliding down in bed) patient presented redness in the sacred region. Moisturizing cream was applied and the preferred positions were the semi-dorsal and lateral decubitus. In the shift prior to the last session, Mr. B had carried out the first uprising which was uneventful. In the last session, person B had the skin of the sacred region intact. Despite maintaining a high risk of pressure ulcers, patient increased the Braden Scale score from 12 to 15 points.

There were 5 sessions of FRR. In the 1<sup>st</sup> session, person B was under invasive mechanical ventilation and was extubated at the end of that day. In the remaining sessions, patient remained under spontaneous ventilation, however there was a need to increase oxygen, and remained since the 3<sup>rd</sup> session, including a venturi mask with a FiO<sub>2</sub> of 50%, which coincided with the time when chest X-rays were observed with image suggestive of right pleural effusion.

In order to improve ventilation and to prevent bronchial secretions stasis, the teachings of respiratory control with dissociation of respiratory times and coughing technique were reinforced. Once there was a suspicion of right pleural effusion, the therapeutic positions that would promote drainage of this area were reinforced.

At the beginning and end of each session, vital parameters were evaluated. Person B maintained hemodynamic stability during the FRR sessions.

Overall, respiratory rates decreased after the session, evidencing session N<sup>o</sup>. 3 in which the respiratory rate prior to the session was higher than the maximum reference value of the respiratory rate. As for the values of SpO<sub>2</sub> either remained the same (greater than 90%) or increased.

Ventilation and the presence of respiratory effort at the beginning and at the end of all FRR sessions were evaluated, noting that person B in the 2<sup>nd</sup> session had an altered breathing pattern and in the 3<sup>rd</sup> session respiratory effort to small work and altered breathing pattern with nasal flutter and draft breathing, it was not possible to modify the breathing pattern; however it was possible to reduce the respiratory rate with the implemented interventions. In the 4<sup>th</sup> and 5<sup>th</sup> sessions, there was an improvement in the amplitude and type of breathing, after encouragement of respiratory control with dissociation of breathing times.

It was found that, at the level of pulmonary auscultation, before the sessions, it presented AS, which were absent at the end of the sessions.

During the FRR sessions, person B maintained a decreased cough reflex. From the 2<sup>nd</sup> session onwards, he was endotracheally extubated, with difficulty in expelling secretions. Despite teaching directed cough, he maintained the need for aspiration of secretions, since he presented moderate to large amount of secretions.

#### Case of person C

A 50 year-old male, married, who had arterial hypertension as a personal history and was admitted to Polyvalent ICU (PICU) due to ruptured anterior communicating artery aneurysm. The initial assessment was carried out on the 1st day of hospitalization (Table 2).

State of consciousness (GCS score)	Score of 15
Skin Integrity	Present
Pressure ulcer risk (Braden scale score)	Low risk of pressure ulcers (17 points)
Joint movement assessment	<ul style="list-style-type: none"> <li>- Therapeutic indication to maintain bed rest.</li> <li>-The ROM was actively evaluated in the upper and lower limbs with reduced joint and muscle movement.</li> <li>- Absent pain in joint movement</li> <li>- it does not perform muscle and joint exercise techniques</li> </ul>
Ventilation	<ul style="list-style-type: none"> <li>-Spontaneous ventilation, with oxygen therapy by binasal probe at 3 L/min</li> <li>- Regular, medium-range, mixed, symmetrical breathing pattern, without the use of accessory muscles</li> <li>-Easily tired on moderate exertion, with increased respiratory rate, change in breathing pattern and difficulty in controlling breathing</li> <li>- Pulmonary auscultation with VM present and without AS</li> </ul>

Airway Cleaning Mechanisms (Cough reflex)	No coughing
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Table 3 – Initial assessment of person C, Source: own elaboration.

Based on the initial assessment, the following nursing diagnoses were outlined:

- Diagnosis 1: Risk of joint stiffness;
- Diagnosis 2: Potential to improve ability to perform muscle and joint exercise techniques;
- Diagnosis 3: Potential to improve knowledge about self-control of the breathing pattern;
- Diagnosis 4: Potential to improve knowledge about breathing technique;
- Diagnosis 5: Potential to improve capacity for self-control of breathing pattern;
- Diagnosis 6: Potential to improve ability to use breathing techniques.

Throughout the intervention project, he was aware and guided. During the 4 sessions of FMR, person C did not report pain.

In the 1<sup>st</sup> session, through passive mobilizations, the polysegmental movements that could be performed to maintain or improve ROM were demonstrated. Person C was able to assimilate and execute the techniques demonstrated independently, performing them several times throughout the day. From the 2<sup>nd</sup> session onwards, person C was transferred to a chair, twice a day, with full load, which was uneventful. In the 3<sup>rd</sup> session, active-resisted muscle and joint exercises were introduced at the level of the upper and lower limbs, using elastic bands, with good assimilation by person C, who performed them independently. At the end of the 4<sup>th</sup> session, the ROM was reassessed, with an increase in the ROM previously assessed. It is considered that the fact that person C had a more active role in his rehabilitation process may have contributed to the gains obtained in terms of ROM.

In the context of the FRR (one session held), person C had no knowledge about self-control of the breathing pattern and the breathing techniques used to optimize ventilation (relaxation technique; rest positions; dissociation of breathing times; abdominodiaphragmatic breathing), due to that, teachings have been done regarding them. Person C was receptive to the information provided, being able to describe the importance and advantages of self-control of the breathing pattern and breathing techniques.

Furthermore, after instruction in the technique of self-control of the breathing pattern and other breathing techniques, person C was able to assimilate and perform them independently, namely during exercises. Person C reported that the use of these techniques helped to better tolerate more intense exercises, which required more effort.

Case of person D

A 49 year-old female, married who was admitted to the PICU in the postoperative period of urgent decompressive craniectomy due to cerebral edema with deviation of midline structures, associated with an ischemic infarction in the territory of the left middle cerebral artery. The initial assessment took place on the 3<sup>rd</sup> day of hospitalization (Table 4).

State of consciousness (GCS score)	9T score (eye opening at sound - 3; absent verbal response, due to the presence of ETT -1 and localization of pain -5)
Skin Integrity	Present
Pressure ulcer risk (Braden scale score)	High risk of pressure ulcers (10 points)
Joint movement assessment	- Maintained bed rest. -ADM passively evaluated in the upper and lower limbs with reduced joint and muscle movement.  - Absent pain in joint movement.
Ventilation	-Spontaneous ventilation performing oxygen therapy at 0.5 L/min per T-piece.  - Regular, superficial and predominantly abdominal breathing pattern, with reduced but symmetrical chest expansion, without the use of accessory muscles.  - Pulmonary auscultation with AS
Airway Cleaning Mechanisms (Cough reflex)	Decreased cough reflex, difficulty in mobilizing secretions; aspiration of frequent secretions

Table 4 – Initial assessment of person D Source: own elaboration.

From the initial assessment, the following nursing diagnoses were formulated:

- Diagnosis 1 - Risk of high-stage pressure ulcer;
- Diagnosis 2 - Risk of joint stiffness;
- Diagnosis 3 - Ineffective airway clearance;
- Diagnosis 4 - Impaired ventilation.

During the implementation of the intervention project, person D improved his state of consciousness, showing an increase in the GCS score from 9 to 11T (spontaneously eyes opening and following simple orders).

During the 5 FMR sessions, person D did not manifest pain, and passive mobilization exercises were always performed. At the end of the 5th session, the ROM was re-evaluated. In general, ROM remained or increased; however there was a decrease in ROM in terms of shoulder flexion and right elbow flexion.

Regarding the instituted preventive measures against pressure ulcers, the change in decubitus was reinforced, with full help, the application of moisturizing cream and the maintenance of dry skin, and in the 4<sup>th</sup> session, the transfer to the chair without load (using a hoist) was performed. At the end of the 5th session, person D maintained a high risk of pressure ulcers; however patient went from 10 to 12 points on the Braden Scale. During the intervention project, the patient kept his skin intact.

The intervention project included 5 sessions of FRR, verifying that the person maintained hemodynamic stability. FRR interventions allowed decreasing respiratory rates, which can translate into greater control of breathing. SpO<sub>2</sub> values were always constant, remaining at the maximum possible value (100%), with person D undergoing oxygen therapy per T-piece at 1 L/min.

Throughout all FRR sessions, ventilation and the presence of respiratory effort were evaluated. Person D before the sessions had a regular, superficial and predominantly abdominal breathing pattern, with reduced chest expansion. After the sessions, and from the 3<sup>rd</sup> session, there was an improvement in the breath amplitude and after the 5<sup>th</sup> session, patient presented mixed breathing. Regarding respiratory effort, it was only observed in the 1<sup>st</sup> session after moderate efforts (associated with selective costal opening).

Regarding pulmonary auscultation, it was performed before and after all sessions, verifying that the presence of AS was eliminated with the FRR interventions performed. The VM that was initially reduced in the lung bases in the first three sessions, after the 3<sup>rd</sup> session of FRR, it was maintained in all lung fields.

During the sessions, person D presented a reduced cough reflex, requiring aspiration of secretions in the oropharynx and through the ETT. The characteristics of secretions, either in the oropharynx or through the ETT, varied from session to session; however, at the end of the 4<sup>th</sup> session, they were presented in a smaller amount.

## DISCUSSION

After the initial assessment of the four people participating in the project, the Rehabilitation Nursing diagnoses were formulated, and the interventions that best adapted to each person's situation were carried

out, taking into account the literature review carried out. It was found that the diagnoses of Risk for pressure ulcer in a high stage; Ineffective airway clearance and impaired ventilation were present in participants A, B and D. The diagnosis of Risk for joint stiffness was common to all four participants in this project.

In total, 37 sessions were carried out, 17 under the FRR and 20 under the FMR as a result of identifying the diagnoses. At the same time, a plan of care for the prevention of pressure ulcers was established for people at high risk.

Regarding the risk of joint stiffness, in person C, the instituted nursing interventions contributed to achieving the expected result, that is, the maintenance or improvement of ROM at the level of the shoulder, elbow, knee and ankle joints. In people A, B and D, it was found that the ROM was maintained or improved in some of the joint movements evaluated.

These results are in line with similar cases described in the literature, namely the study by Modragon-Barrera<sup>(27)</sup>, whose participants were inpatients in the ICU and where it was also found that after a joint mobilization program was carried out, there was an increase in ROM at the level of shoulder abduction and flexion, hip abduction and ankle dorsiflexion, proving what has been advocated for some time by other authors<sup>(28)</sup> on the benefits of performing passive mobilization exercises, active-assisted in people in critical situations.

However, the result in person A was different from what was expected, since this patient presented a decrease in ROM in terms of shoulder flexion, elbow flexion and ankle plantar flexion; person B showed a decrease in ROM at the level of right shoulder abduction, right elbow flexion and ankle plantar flexion, and person D also decreased ROM at the level of shoulder flexion and right elbow flexion. The difference between the expected results and those obtained in the Rehabilitation Nursing programs can be explained by multiple factors, including the fact that the elbow, ankle and shoulder joints have a greater predisposition to the development of contractures<sup>(6)</sup>, and that the study of Nepomuceno Júnior, Martinez, Neto<sup>(29)</sup> also proved it with a program of exercises for joint mobilization in these joints. In general, in people who were part of the intervention project, joint ranges were maintained or improved, attesting to the importance of range of motion exercises and therapeutic positioning, in people in critical situations, as these interventions contribute to the prevention of harmful effects of prolonged immobility and for the maintenance or improvement of people's motor functionality<sup>(28,30,31)</sup>.

With regard to the risk of pressure ulcers, during the period in which the intervention project took place, people B and D decreased their risk (assessed with the Braden scale) and person A remained constant. Anticipatory interventions that include the systematic assessment of skin integrity and risk assessment, the repositioning and use of support surfaces and appropriate therapeutic dressings, together with the promotion of skin hydration and the reduction of

moisture in the skin have proven effective because, despite of maintaining a high risk of pressure ulcers none of the people developed this consequence of immobility. These results are in line with others already described<sup>(32-35)</sup>, proving that the systematic monitoring of this problem preceded by the awareness of it by the entire nursing team and its valorization, especially by the RN, allowed individual intervention in the people and prevent the emergence of new pressure ulcers, confirming as recommended by the National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel and Pan Pacific Pressure Injury Alliance<sup>(36)</sup> that the structured approach to risk assessment, which includes an assessment of activity/mobility and the condition of the skin, which has strength of Evidence B, should be strongly recommended.

Overall, after the FRR sessions, people A, B and D improved their breathing pattern, with an increase in respiratory amplitude and chest expansion, noting that in the final sessions they presented a regular, medium-range and mixed breathing pattern. We also found that the episodes of respiratory effort evident in some sessions (a session of person B and a session of person D), were resolved, not being visible in subsequent sessions. Although participants A and B had occasionally (at the end of one or several sessions) an increase in respiratory rate, we observed that in most sessions, respiratory rates decreased in all people, after the FRR interventions. These results demonstrate that the intended objectives with the nursing intervention in the field of FRR were achieved, as asynergy and ventilatory deficiencies were corrected and prevented, which may have contributed to an improvement in respiratory function, as explained by several authors<sup>(28, 37-39)</sup>.

With regard to the SpO<sub>2</sub> parameter, the percentages in participants A, B, and D remained constant after the FRR interventions, or increased slightly. Although the project participants are not ventilated, the results obtained are consistent with those described in the literature, verifying that the implementation of an intervention plan within the scope of FRR in people in critical condition promotes more effective ventilation, with this effect being visible through the increase in SpO<sub>2</sub><sup>(40,44)</sup>.

Throughout all the FRR sessions, people kept their cough reflex reduced; it is a situation that may be associated with the presence of an artificial airway (ETT)<sup>(45)</sup>, or with a decrease in muscle strength due to their critical condition and immobility<sup>(7)</sup>. It was also found that at the beginning of the sessions, people had the presence of AS (snoring) on pulmonary auscultation, indicative of the presence of secretions<sup>46</sup>. Thus, the association of several bronchial hygiene maneuvers contributed to the expected results being achieved, as evidenced by the absence of AR at the end of the sessions. It can be seen that a care plan that combines different techniques for mobilizing and eliminating secretions promotes greater cleaning of the airways, as was also observed in the studies carried out by Avena, Duarte, Cravo, Sologuren, Gastaldi<sup>(40)</sup> and Naue, Forgiarini Junior, Dias, Vieira<sup>(47)</sup>, minimizing secretion stasis and consequently the episodes of bronchial obstruction that precipitate atelectasis<sup>(48)</sup>.

The person designated by C, unlike the other people, was aware and oriented, showing the ability to assimilate the information and instruction of the techniques implemented in the intervention plan. In addition, participant also demonstrated to be motivated to acquire new knowledge that would make it possible to prevent the complications arising from immobility and maximize the capabilities in terms of motor and respiratory functions, which was essential for our intervention to be successful. Potential nursing diagnoses to improve ability to perform muscle and joint exercise techniques; potential to improve knowledge about self-control of the breathing pattern; potential to improve knowledge about respiratory technique; potential to improve ability to self-control breathing pattern and potential to improve ability to use breathing techniques were only identified in this person. Thus, throughout the intervention project, person C assimilated the transmitted knowledge and the instructed techniques, being able to independently perform the range of motion exercises and adequately employ the respiratory techniques taught, confirming what Habel<sup>(49)</sup> refers, who RN, by investing in people's education, promote their empowerment, since they are provided with the knowledge and skills necessary to manage their own care and control their lives, that is, to be as independent as possible.

The results of this intervention project also allowed us to verify that the early planning of the provision of adequate and individualized rehabilitation nursing care, in the areas of Motor Functional Reeducation, pressure ulcer prevention and Respiratory Functional Reeducation, can contribute to prevention of the motor, integumentary and respiratory consequences of immobility in people in critical condition. Rehabilitation Nursing has a crucial role in promoting preventive practices within the multidisciplinary team. These patient safety-oriented practices meet the first specific competence of the RN, which is to be able to care for people with special needs in all contexts of practice and care<sup>(22)</sup> and who are unable to perform basic activities independently, identifying the needs for specialized intervention, implementing and evaluating programs aimed at reducing risks. And their ways of intervening are the execution, teaching and demonstration of techniques that promote self-care.

In summary, the results obtained in this intervention project prove the importance of anticipatory care<sup>(17)</sup>, since planning and an early RNs intervention prevent the occurrence of negative events, in this case the consequences of immobility, which can compromise a successful health/disease transition, experienced by people in critical situations, which is somewhat in line with what is defended by Ludin, Arbon, Parker<sup>(15)</sup>, who state that people in critical situations need a more comprehensive transition planning, which implies a greater focus on its anticipation and its effects.

## CONCLUSION

The results obtained in this intervention project allowed us to verify that the participants maintained or

improved range of motion, and despite the high risk, they did not develop pressure ulcers, having also improved their respiratory condition. Although the results cannot be generalized, due to methodological limitations, the expected results derived from the planned interventions implemented, with the collaboration of the other elements of the nursing team, and were achieved.

The time limitation for project implementation was also a limitation. It is considered that in a future replication of this project it would be pertinent to extend its implementation time, allowing for a greater number of cases.

Despite its limitations, this intervention project can be a contribution to the development of knowledge in Rehabilitation Nursing and a propellant for other studies to be created, as it also demonstrates the importance of the RN intervention aimed at people admitted to ICU.

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