


# Nursing care plan for the prevention of pressure ulcers secondary to prone positioning in COVID-19 patients

Reflection Article

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Plan de cuidados de enfermería para la prevención de úlceras por presión secundarias a la posición prono en pacientes COVID-19

Plano de cuidados de enfermagem para a prevenção de úlceras por pressão secundárias à posição prona em pacientes com COVID-19

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## Abstract

**Introduction:** Prone positioning (PP) is a widely recommended and implemented therapeutic alternative in patients with COVID-19. However, although it is a non-invasive procedure, it is complex and associated with adverse events such as pressure ulcers (PUs). Our aim is to propose a nursing care plan based on standardized language NANDA-I, NIC, NOC for the prevention of PP secondary PUs in COVID-19 disease. Content summary: In patients with COVID-19, in addition to patient-specific risk factors such as advanced age and the presence of comorbidities, PP contributes to the presence of the nursing diagnoses of pressure ulcer risk [00249], impaired skin [00047] and tissue integrity [00248]. In turn, nursing intervention for pressure ulcer prevention [3540], is key to minimize the development of this complication, improve the quality of care and prognosis in this type of patients. Finally, to determine the effectiveness of nursing care, the NOC, outcomes consequences of immobility: physiological [0204] and tissue integrity: skin and mucous membranes [1101] are proposed. Conclusion: PP is a recommended adjuvant therapy for the management of critically ill COVID-19 patients since it optimizes pulmonary function, however it is associated with adverse events such as PUs. This article presents recommendations based on a narrative review to facilitate the implementation of preventive nursing care to reduce its frequency in this population.

**Keywords:** Prevention & control, Pressure Ulcer, Prone Position, Coronavirus infections, Pandemics.

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## Plan de cuidados de enfermería para la prevención de úlceras por presión secundarias a la posición prono en pacientes COVID-19

### Resumen

**Introducción:** La posición prono (PP) es una alternativa terapéutica ampliamente recomendada e implementada en los pacientes con COVID-19. Sin embargo, aunque es un procedimiento no invasivo, es complejo y se asocia con eventos adversos como las úlceras por presión (UPP). Nuestro objetivo es proponer un plan de cuidados de enfermería basado en el lenguaje estandarizado NANDA-I, NIC, NOC para la prevención de las UPP secundarias a la PP en la enfermedad de COVID-19. **Síntesis del contenido:** En los pacientes con COVID-19, además de factores de riesgo propios del paciente como la edad avanzada y la presencia de comorbilidades, la PP contribuye a la presencia de los diagnósticos de enfermería de riesgo de úlcera por presión [00249], de deterioro de la integridad cutánea [00047] y tisular [00248]. Por su parte, la intervención de enfermería prevención de úlceras por presión [3540], es clave para minimizar el desarrollo de esta complicación, mejorar la calidad de la atención y el pronóstico en este tipo de pacientes. Finalmente, para determinar la efectividad del cuidado de enfermería se proponen los resultados NOC consecuencias de la inmovilidad: fisiológicas [0204] e integridad tisular: piel y membranas mucosas [1101].

**Conclusión:** La PP es una terapia coadyuvante recomendada para el manejo de los pacientes con COVID-19 críticamente enfermos, debido a que optimiza la función pulmonar, sin embargo está asociada a eventos adversos como las UPP. Este artículo presenta recomendaciones basadas en una revisión narrativa para facilitar la implementación de cuidados de enfermería preventivos que reduzcan su frecuencia en esta población.

**Palabras clave:** Prevención & control; Úlcera por presión; Posición prona; Infecciones por Coronavirus; Pandemias.

## Plano de cuidados de enfermagem para a prevenção de úlceras por pressão secundárias à posição prona em pacientes com COVID-19

### Resumo

**Introdução:** A posição prona (PP) é uma alternativa terapéutica amplamente recomendada e implementada em pacientes com COVID-19. No entanto, embora seja um procedimento não invasivo, é complexo e está associado a eventos adversos, como úlceras por pressão (UP). Nosso objetivo é propor um plano de cuidados de enfermagem baseado na linguagem padronizada NANDA-I, NIC, NOC para a prevenção de UP secundárias à PP na doença COVID-19. **Síntese de conteúdo:** Em pacientes com COVID-19, além dos próprios fatores de risco do paciente, como idade avançada e presença de comorbidades, a PP contribui para a presença de diagnósticos de enfermagem de risco de úlcera por pressão [00249], de deterioração da pele [00047] e do tecido Integridade. Por sua vez, a intervenção de enfermagem na prevenção de úlceras por pressão [3540] é fundamental para minimizar o desenvolvimento desta complicação, melhorar a qualidade da assistência e o prognóstico neste tipo de paciente. Por fim, para determinar a eficácia da assistência de enfermagem, são propostos os resultados da NOC, consequências da imobilidade: fisiológicas [0204] e integridade do tecido: pele e mucosas [1101]. **Conclusão:** PP é uma terapia adjuvante recomendada para o tratamento de pacientes graves com COVID-19, pois otimiza a função pulmonar, porém está associada a eventos adversos, como UP. Este artigo apresenta recomendações baseadas em revisão narrativa para facilitar a implementação de cuidados preventivos de enfermagem que reduzam sua frequência nesta população.

**Palavras chave:** Prevenção & controle; Lesão por Pressão; Decúbito Ventral; Infecções por coronavirus; Pandemias.

## Introduction

The main feature of severe coronavirus disease 2019 (COVID-19) is acute lung injury manifested in acute respiratory distress syndrome (ARDS)<sup>1</sup>, which has a prevalence ranging from 20-41%<sup>2</sup>. Prone positioning (PP) is indicated in 16%<sup>3</sup> to 33%<sup>4</sup> of people with ARDS to treat ventilator-associated lung injury and promote oxygenation in severe cases<sup>1,5,6</sup>. In PP, the patient lays down with the front of the body facing downward and their head in a neutral position; it is distinguished from pronation (i.e., rotation of the forearm such that the palm of the hand is facing downward) and is the opposite of the supine position<sup>7</sup>.

PP is indicated for spine and neck surgeries, neurosurgery, colorectal surgeries, and vascular surgeries and, more recently, to treat COVID-19 patients<sup>5</sup>. The main mechanisms of prone position in the improvement of ARDS patients' condition are improving recruitment in dorsal lung regions, increasing end-expiratory lung volume and increasing chest wall elastance, decreasing alveolar shunt, and improving tidal volume<sup>8</sup>.

According to the results of two meta-analyses, PP was associated with a decrease in mortality, although it was not statistically significant<sup>9,10</sup>. However, subgroup analyses showed that PP reduced the risk of death in 42% of patients ventilated with low tidal volume; of these, 40% were in prolonged pronation, 51% started PP within the 48 hours of disease evolution, and 49% had hypoxemia<sup>9</sup>. It also reduced mortality in 26% of patients with 12 hours or greater duration in PP and for patients with moderate to severe ARDS and PaO<sub>2</sub>/FiO<sub>2</sub> ratio on day 4 was significantly higher in the PP group compared to the supine position group (mean difference, 23.5; 95% CI, 12.4–34.5)<sup>10</sup>.

Due to these benefits and the good response to ventilation of critical patients, the use of PP has increased as a therapeutic alternative in the treatment of COVID-19<sup>11</sup>, and it has been recommended internationally in intensive care clinical practice guidelines<sup>12,13</sup>.

However, PP has some aspects to consider before its implementation. Although it is a non-invasive procedure, PP is complex and can cause significant adverse events that require trained teams to prevent them. In addition, it is an exhausting and demanding task for ICU staff under stressful conditions<sup>6</sup>. Added to the particularities of the pandemic, such as the constant uncertainty about resources, capabilities, and risks faced by health care workers, as well as exposure to suffering, death, and threats to their own safety, the workload is increased, especially for nurses<sup>14</sup>.

On the other hand, PP is associated with complications such as pressure ulcers (PUs), the most frequent adverse event (34%), ventilator-associated pneumonia (21%), orotracheal tube obstruction (15%), accidental extubation (11%), venous access loss (11%), pneumothorax (6%), and displacement of the orotracheal tube (4%)<sup>9</sup>. Particularly, in patients ventilated in PP with COVID-19, the prevalence of PUs ranges from 48%<sup>15</sup> to 61%<sup>16</sup>. Regarding the location of PUs, a higher frequency was observed on the chin, forehead, cheekbones, and nose<sup>16</sup>; in terms of severity, grade II lesions were the most common (~64%)<sup>17,18</sup>.

**PP is associated with complications such as pressure ulcers (PUs), the most frequent adverse event (34%),**

Several factors associated with the development of PUs secondary to PP have been described in comparison to supine position, and they increase 3.3-fold the risk of PUs, with greater harm of the facial area as previously described<sup>19-22</sup>. These factors are similar to those described for other critically ill populations that require PP within the management plan, including the following: a) immobility, poor sensory perception and response and b) individual susceptibility and tolerance where the skin characteristics, poor perfusion and nutrition, diabetes, moisture, and low albumin were causal factors<sup>23</sup>. Besides, a clear risk factor is the average duration of proning, which is directly related to the occurrence and severity of PUs in people with COVID-19<sup>15-17</sup>, substantially increasing the risk of PUs, even from the third day<sup>15</sup>.

Regarding the treatment of PUs, it is lengthy and places a significant economic burden on the health system. In the United States, an estimated \$11 billion is spent yearly on PUs care and \$500 to \$70,000 on a single wound<sup>24</sup>. Although no estimate has been made of the increase in costs associated with PU care in patients with COVID-19, a significant impact has been presumed to the point that wound care has become more relevant, going from being an underestimated area to a key axis within care guidelines and protocols, including those related to nursing care.

In this sense, in addition to symptom control and treatment of complications secondary to COVID-19, preventive measures against PP-related PUs should be implemented<sup>21</sup> to reduce the high incidence rate of this adverse event resulting from the health care of patients with ARDS.

Considering what has been exposed so far, this article aims to propose a nursing care plan based on the guidelines established in NANDA International (NANDA-I), NIC (Nursing Interventions Classification), and NOC (Nursing Outcomes Classification) for the prevention of PUs secondary to PP in COVID-19 patients. The aim is to guide the implementation and evaluation of interventions based on a narrative review that contributes to greater safety and quality of care, taking into account that PUs are considered an adverse event resulting from failures in nursing care.

**This article aims to propose a nursing care plan based on the guidelines established in NANDA International (NANDA-I), NIC (Nursing Interventions Classification), and NOC (Nursing Outcomes Classification) for the prevention of PUs secondary to PP in COVID-19 patients.**

### **Risk factors and nursing diagnoses of PUs**

Patients with COVID-19 hospitalized in critical care units present risk factors that favor the development of PUs, for example, extremes of age (advanced age  $60.5 \pm 14.5$  years), unbalanced nutrition status (overweight/obesity, median body mass index of 30.5, Q1=26.6; Q3=36.2), chemical irritants/secretions (nausea or vomiting 17.7%, diarrhea 20.8%), comorbidities (hypertension 59.7%, diabetes 38.9%, chronic lung disease 24.0%) and hypoxemia (median PaO<sub>2</sub>/FiO<sub>2</sub> 124, Q1=86; Q3=188) caused by dyspnea (74.9%), fatigue (32.5%) or vasopressor treatment (48.3%)<sup>25</sup>.

Similarly, severe COVID-19 cases had lower hemoglobin compared to moderate cases (weighted mean difference [WMD] of hemoglobin -4.08 g/L; 95% CI -5.12; -3.05)<sup>26</sup>, friction/decreased mobility (prone position 27.0% and 38.5%)<sup>25,27</sup>, and hyperthermia (median fever 38.1°C, Q1=37.3; Q3=38.9)<sup>25</sup>.

Considering these characteristics and the coincidence of risk factors with those stated in NANDA-I, three nursing diagnoses are proposed to prevent PUs secondary to PP in COVID-19 patients: “risk for impaired skin integrity [00047]” defined as susceptibility to alteration in epidermis and/or dermis, which may compromise health, “risk for impaired tissue integrity [00248]” defined as susceptibility to damage to the mucous membrane, cornea, integumentary system, muscular fascia, muscle, tendon, bone, cartilage, joint capsule and/or ligament, which may compromise health, and “risk for pressure ulcer [00249]” defined as vulnerability to localized damage to the skin and/or underlying tissue usually over bony prominences, as a result of pressure, or pressure in combination with shear<sup>28</sup>.

### Nursing care for preventing PUs

Linkages between NANDA-I (2018-2020), NOC (6th edition), and NIC (7th edition) classifications, identified with the NNNConsult tool, were taken into account to select nursing interventions and outcomes<sup>28</sup>. Intervention “Pressure ulcer prevention [3540]”, defined as the prevention of PUs for an individual at high risk for developing them, was prioritized given its soundness to address the risk factors identified by the three nursing diagnoses previously proposed and the general scope of the activities suggested by this intervention. A narrative review was carried out to support the activities described in this intervention, for which the PUBMED, EMBASE, and CINALH databases were searched, combining the following free terms: “Pressure Ulcers” OR “Pressure Sore” OR “Pressure Injuries” AND “Prone Position” AND “COVID-19”. The articles that justified the chosen activities were selected (Table 1).

**Intervention “Pressure ulcer prevention [3540]”, defined as the prevention of PUs for an individual at high risk for developing them, was prioritized given its soundness to address the risk factors identified by the three nursing diagnoses previously proposed and the general scope of the activities suggested by this intervention.**

**Table 1. Nursing intervention: Pressure ulcer prevention (3540)**

Activities (NIC) <sup>28</sup>	References
Use an established risk assessment tool to monitor individual’s risk factors (Braden scale)	PU risk assessment should be undertaken before proning and following positioning the patient back into the supine position, according to the plan of care <sup>29</sup> . PU risk assessment is considered a good care practice. However, the frequency with which it should be performed is not well defined; it depends on clinical judgment and the inherent risk to the patient, given by the clinical prognosis and the number of medical devices used <sup>30</sup> . No specific scale has been described to assess PU risk in this population. However, the results of a meta-analysis suggest that the Braden, Norton, and Waterlow scales have similar sensitivity, specificity, and predictive values and can be applied in critical care settings <sup>31,32</sup> . In cases where the pressure ulcer is observed, a risk assessment should be done using the International NPUAP/ EPUAP Pressure Ulcer Classification System <sup>33</sup> . More than two daily PU risk assessments are recommended for patients with multiple medical devices, frequent fluid shifts, and exhibiting signs of localized or generalized edema <sup>33</sup> .
Document skin status on admission and daily.	Monitoring skin features should include assessment of mucous membrane since nonblanchable erythema is not very visible. Performing a detailed examination of the oral mucosa is important because superficial lesions may be deeper and associated with a wider spread <sup>33</sup> .
Remove excessive moisture on the skin resulting from perspiration, wound drainage, and fecal or urinary incontinence.	It is necessary to maintain the skin clean and moisturized at an optimal level, avoiding excessive moisture or dryness that can cause tissue breakdown <sup>30</sup> . Monitoring skin hydration is critical because most ARDS patients are driven to achieve a negative fluid balance <sup>33</sup> . The frequency of skin cleansing should be determined individually so as not to affect the skin hydration, which has a natural barrier function against friction <sup>33</sup> .



Activities (NIC) <sup>28</sup>	References
<p>Monitor pressure and friction sources Inspect skin over bony prominences and other pressure points when repositioning at least daily</p>	<p>Face and weight-bearing parts of the body such as the breast region, thorax, clavicle, iliac crest, and knees have been identified in the literature as being the areas of highest risk for PUs in these patients<sup>4,20,33,35</sup>. See Figure 1.</p> <p>Forehead, cheekbones, and chin are the most prone to the development of PUs in patients in PP. Therefore, periodic assessments of PUs should be extremely exercised, and sources of pressure or friction cut off<sup>36</sup>.</p> <p>In males, it is particularly important to monitor there is no pressure on the genital area<sup>35</sup>.</p> <p>The presence of medical devices (IV infusion set, vital sign monitoring, or catheters) is a risk factor for patients in PP due to the sustained pressure they exert on certain areas of the body, so close contact with them should be avoided<sup>33,37</sup>.</p> <p>In people with endotracheal tubes, the anatomical sites that have been associated with a higher frequency of PUs are the lips and tongue<sup>35,38</sup>.</p> <p>In people with nasogastric tubes, assessment of the nose, nares, and nasal bridge is essential because these lesions are more frequent in these anatomical sites<sup>35,38</sup>.</p>
<p>Avoid hot water and use mild soap when bathing. Apply protective barriers, such as creams or moisture-absorbing pads, to remove excess moisture, as appropriate.</p> <p>Position with pillows to elevate pressure points off the bed.</p> <p>Use devices on the bed (sheepskin) that protect the individual.</p> <p>Avoid "donut" type devices to sacral area.</p>	<p>It is essential to keep the skin clean and moisturized using pH-balanced cleansers. However, the evidence to support the type of moisturizer that should be used is inconsistent<sup>29</sup>.</p> <p>Traditionally, soap and water have been used as a cleanser. However, evidence exists that it impacts the skin's pH balance unfavorably. Other cleansers containing surfactants may provide better protection for the skin<sup>33,39,40</sup>.</p> <p>The use of cleansers ranging from pH 4.0 to 7.0 (slightly acidic to neutral) has been cost-effective in reducing skin dryness, erythema, irritation, and incidence in general of PUs<sup>33,39,40</sup>.</p> <p>The application of hyperoxygenated fatty acids effectively prevents mechanical ventilation-related PUs in this group of patients<sup>41</sup>.</p> <p>The prophylactic use of dressings, such as hydrocolloids, transparent film, and silicone has been effective in decreasing pressure and facial skin breakdown, mainly<sup>19,29</sup>. See Figure 2.</p> <p>The use of hydrocolloids and transparent films reduces the incidence of PUs in facial areas by up to 50%<sup>42</sup>.</p> <p>The prophylactic use of dressings in the skin surrounding medical devices such as mechanical ventilation circuits, nasogastric tubes, or drug infusion systems is recommended to reduce pressure and friction<sup>5,30,33,38</sup>.</p> <p>Considering that endotracheal tubes and nasotracheal tubes increase the risk of PUs formation, lateral repositioning of the tubes has proved to be beneficial in the prevention of soft tissue injuries<sup>33</sup>.</p> <p>The use of suitable support surfaces and pillows is crucial to prevent tissue deformation and enhance tissue perfusion<sup>43</sup>.</p> <p>The use of prone-head support systems significantly reduces the incidence of PUs<sup>43</sup>.</p> <p>Regarding head support devices, those ring- or donut-shaped devices should be avoided because they cause increased shearing and pressure on the surface and inner layers of the skin, increasing the risk of PUs<sup>44,45</sup>.</p> <p>The use of pillows for cushioning facial structures has been effective in reducing the incidence of PUs<sup>46</sup>.</p> <p>Skin and soft tissue displacement does not depend on mattress hardness; rather, it depends on its shape. Increased mattress inclination increases skin surface displacement and the risk of PUs<sup>47</sup>.</p> <p>As part of nursing care, it is a priority to identify specific activities for certain body areas at high risk<sup>5</sup>:</p> <p>Eyes: In addition to corneal abrasion, PP can cause vision loss mainly due to ischaemic optic neuropathy or ocular compartment syndrome. For prevention, head holders are recommended to ease direct pressure from ocular structures<sup>18,46,48</sup>.</p> <p>Apply ophthalmic lubricant and tape eyelids shut is also recommended<sup>18</sup>.</p> <p>Additionally, the Trendelenburg bed position is helps reduce ocular pressure and edema<sup>48</sup>.</p> <p>Chest: Cables of hemodynamic monitoring devices or infusion systems should be repositioned in the back or laterally on the extremities to avoid pressure.</p> <p>Ensure central lines, arterial lines, or cannulas are perfectly secured and, if possible, fixed away from the chest<sup>18</sup>.</p> <p>Genitals and lower extremities: Urinary catheters or devices for fecal elimination should be positioned away from the area in close contact with the bed<sup>18</sup>.</p> <p>The use of prophylactic foam dressings to patella and pretibial area is recommended<sup>18</sup>.</p> <p>The use of positioning devices for high-risk areas and position changes are highly recommended to offload pressure points on the face and other parts of the body<sup>29</sup>.</p> <p>Support surfaces function to redistribute pressure and skin shear, enhancing tissue perfusion and preventing tissue deformation<sup>49,50</sup>.</p>

Activities (NIC) <sup>28</sup>	References
Turn every 1 to 2 hours, as appropriate.	Changing position habitually with a determined frequency according to risk assessment and repositioning of medical devices are efficient to decrease pressure areas and avoid skin and soft tissue breakdown <sup>33</sup> .
Turn with care (e.g., avoid shearing) to prevent injury to fragile skin.	Body repositioning should be performed at least every two hours in patients left 12 hours or more in this position <sup>5,35</sup> .
Post a turning schedule at the bedside, as appropriate.	When changing body position, skeletal alignment is crucial to ensure there is minimal undue stress placed on the muscles. The NPIAP recommends the swimming position with pillows to support body areas alternating the arms and the head every 2 hours to avoid the development of PUs on the elbows and the face (Figure 3). Ensure that the endotracheal tube is not dislodged or obstructed during repositioning <sup>5,18,51</sup> .

NIC: Nursing Intervention Classification.

### Evolution and efficiency of PUs preventive care

The selection of outcomes took into account the population studied in the articles (critical patients with ARDS secondary to COVID-19 in PP, in intensive care units and sedated)<sup>52</sup> and the NANDA-I, NOC, and NIC linkages. Therefore, we suggest two outcomes to monitor the effectiveness of the interventions and prevent progression to actual nursing diagnoses. The first outcome is “Tissue integrity: skin and mucous membranes [1101]” defined as the normal structural integrity and physiological function of the skin and mucous membranes, with the indicators of hydration [110104], tissue perfusion [110111], and skin integrity [110113], measured with the scale 01 (Extent of impairment of health or well-being) and indicators mucous membrane lesions [110116], erythema [1101121], blanching [110122] evaluated with scale 14 (Extent of negative or adverse state or response) with the following response options: severe (1), substantial (2), moderate (3), mild (4), and none (5)<sup>28</sup>. The second outcome is entitled “Immobility consequences: Physiological [0204]”, defined as severity of compromise in physiological functioning due to impaired physical mobility, and the most relevant indicator is pressure ulcers [20401]<sup>28</sup>.

Table 2 shows an example of the operationalization of the pressure ulcer indicator [20401]<sup>28</sup> using the PU risk assessment scales. Each parameter assessed scores from 1 to 4 (1 is the worst condition and 4 the best) and in terms of nursing outcomes (Severe:1, Moderate:2, Mild:3, and None:4). We arbitrarily omitted the response category “substantial” to match the measurement scales of the instruments to assess PU risk and thus not alter their psychometric properties.

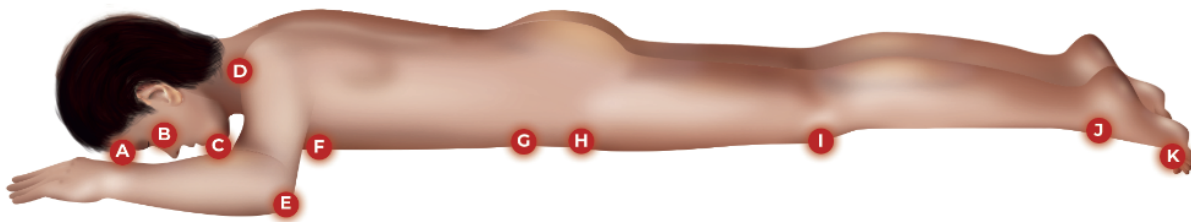
**Table 2 shows an example of the operationalization of the pressure ulcer indicator [20401]<sup>28</sup> using the PU risk assessment scales.**

**Table 2. Operationalization of the pressure ulcer indicator [20401] using the risk assessment scales**

Immobility consequences: Physiological [0204] (28)					
NOC Indicator	Parameter to be evaluated	Severe (1)	Moderate (2)	Mild (3)	None (4)
Pressure ulcers (Braden scale) <sup>53</sup>	Sensory perception	Completely limited	Very limited	Slightly limited	No impairment
	Moisture	Constantly moist	Often moist	Occasionally moist	Rarely moist
	Physical activity	Bedfast	Chairfast	Walks occasionally	Walks frequently
	Mobility/change body position	Completely Immobile	Very limited	Slightly limited	No limitations
	Nutrition	Very poor	Probably inadequate	Adequate	Excellent
	Friction and shear	Problem	Potential problem	No apparent problem	
NOC Indicator	Parameter to be evaluated	Severe (1)	Moderate (2)	Mild (3)	None (4)
Pressure ulcers (Norton scale) <sup>54</sup>	Physical condition	Very bad	Poor	Fair	Good
	Mental condition	Stuporous	Confused	Apathetic	Alert
	Mobility	Bedridden	Chair bound	Walks with help	Ambulant
	Activity	Fully dependent	Very dependent	Slightly dependent	Ambulant
	Incontinence	Urinary and fecal	Urinary or fecal	Occasional	None

NOC: Nursing Outcomes Classification

**Figure 1. Potential pressure areas in prone position**

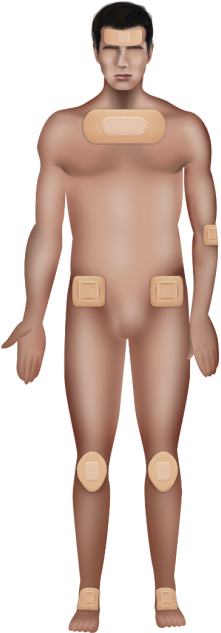


- |                                                                                                                                                                              |                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>A. Forehead</li> <li>B. Cheeks and nose</li> <li>C. Chin</li> <li>D. Clavicle/shoulder</li> <li>E. Elbow</li> <li>F. Chest</li> </ul> | <ul style="list-style-type: none"> <li>G. Genitals</li> <li>H. Anterior pelvic bones</li> <li>I. Knees</li> <li>J. Dorsal feet</li> <li>K. Toes</li> </ul> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|

Source: Authors' elaboration

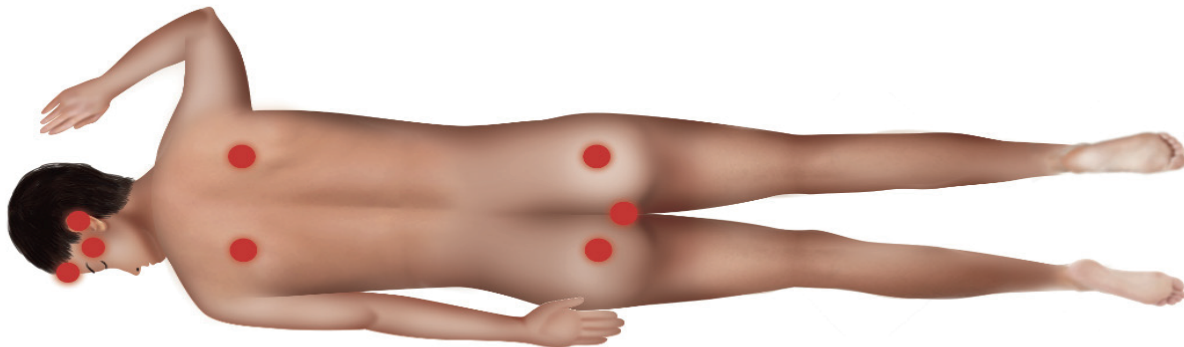


**Figure 2. Guidelines for the use of prophylactic dressings to reduce pressure and prevent pressure ulcers**

	Location	Shape
	Forehead	Oval
	Chin	Oval
	Clavicle or thorax	Oval
	Elbow	Oval Square
	Iliac crest	Square
	Knee	Oval
	Dorsal feet	Square

Source: Authors' elaboration

**Figure 3. Swimming position, freestyle**



Source: Authors' elaboration. The pressure points in the figure correspond to the body's surface against the mattress, previously indicated in Figure 1.

**Concluding Considerations**

Skilled and trained teams are required both to provide PP-related care and to prevent PUs, as this demands more intensive work and is challenging for nursing staff. A tool is available to demonstrate nursing competence in PP, and it assesses five aspects: 1) State indications for positioning patient prone; 2) state contraindications to positioning patient prone; 3) prepares the patient for prone positioning; 4) assist patients into the prone position and ensures correct anatomical position, and 5) assesses patient's response to PP<sup>55</sup>.

**Skilled and trained teams are required both to provide PP-related care and to prevent PUs, as this demands more intensive work and is challenging for nursing staff.**

In summary, PP is a recommended adjuvant therapy for the management of critically ill COVID-19 patients with signs of severe ARDS. The use of PP has increased due to the benefits in improving

pulmonary function; however, PP is also associated with adverse events such as PUs and other complications.

This article presents recommendations based on the scientific literature to support a nursing care plan aimed at implementing preventive activities that reduce the frequency of PUs secondary to PP in COVID-19 patients, promoting comprehensive and quality care. However, caution should be exercised in interpreting these recommendations, given that a narrative review was performed to support the care plan, and, due to the scope of this review, the methodological quality of the articles was not evaluated. Therefore, a systematic search is required to define the level of evidence and degree of recommendation in clinical nursing practice.

**This article presents recommendations based on the scientific literature to support a nursing care plan aimed at implementing preventive activities that reduce the frequency of PUs secondary to PP in COVID-19 patients**

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## References

1. **Barker J, Koeckerling D, West R.** A need for prone position CPR guidance for intubated and non-intubated patients during the COVID-19 pandemic. *Resuscitation*. 2020. 151:135-6. <https://doi.org/10.1016/j.resuscitation.2020.04.029>
2. **Coppo A, Bellani G, Winterton D, Di Pierro M, Soria A, Faverio P,** et al. Feasibility and physiological effects of prone positioning in non-intubated patients with acute respiratory failure due to COVID-19 (PRON-COVID): a prospective cohort study. *Lancet Respir Med*. 2020. 8(8):765-74. [https://doi.org/10.1016/S2213-2600\(20\)30268-X](https://doi.org/10.1016/S2213-2600(20)30268-X)
3. **Bellani G, Laffey JG, Pham T, Madotto F, Fan E, Brochard L,** et al. Noninvasive Ventilation of Patients with Acute Respiratory Distress Syndrome. Insights from the LUNG SAFE Study. *Am J Respir Crit Care Med*. 2017. 195(1):67-77. <https://doi.org/10.1164/rccm.201606-1306OC>
4. **Guerin C, Beuret P, Constantin JM, Bellani G, Garcia-Olivares P, Roca O,** et al. A prospective international observational prevalence study on prone positioning of ARDS patients: the APRONET (ARDS Prone Position Network) study. *Intensive Care Med*. 2018. 44(1):22-37. <https://doi.org/10.1007/s00134-017-4996-5>
5. **Barakat-Johnson M, Carey R, Coleman K, Counter K, Hocking K, Leong T,** et al. Pressure injury prevention for COVID-19 patients in a prone position. *Wound Practice and Research*. 2020. 28(2):50-7. <https://doi.org/10.33235/wpr.28.2.50-57>
6. **Settembre N, Maurice P, Paysant J, Theurel J, Claudon L, Kimmoun A,** et al. The use of exoskeletons to help with prone positioning in the intensive care unit during COVID-19. *Ann Phys Rehabil Med*. 2020. 63(4):379-82. <https://doi.org/10.1016/j.rehab.2020.05.004>
7. **Schub E, Pilgrim J.** Patient positioning (critical care patients): prone. *Nursing practice & Skill*. 2018. [https://www.baccn.org/static/uploads/resources/NRCP\\_Prone\\_Position\\_ICU\\_pt.pdf](https://www.baccn.org/static/uploads/resources/NRCP_Prone_Position_ICU_pt.pdf)
8. **Ghelichkhani P, Esmaeili M.** Prone Position in Management of COVID-19 Patients; a Commentary. *Arch Acad Emerg Med*. 2020. 8(1):e48. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7158870/>
9. **Mora-Arteaga JA, Bernal-Ramirez OJ, Rodriguez SJ.** The effects of prone position ventilation in patients with acute respiratory distress syndrome. A systematic review and metaanalysis. *Med Intensiva*. 2015. 39(6):359-72. <https://doi.org/10.1016/j.medine.2014.11.004>

10. **Munshi L, Del Sorbo L, Adhikari NKJ, Hodgson CL, Wunsch H, Meade MO**, et al. Prone Position for Acute Respiratory Distress Syndrome. A Systematic Review and Meta-Analysis. *Ann Am Thorac Soc*. 2017. 14(Supplement\_4):S280-S8. <https://doi.org/10.1513/AnnalsATS.201704-343OT>
11. **Stephen-Haynes J, Maries M**. Pressure ulcers and the prone position. *Br J Nurs*. 2020. 29(12):S6. <https://doi.org/10.12968/bjon.2020.29.12.S6>
12. **Bentley SK, Iavicoli L, Cherkas D, Lane R, Wang E, Atienza M**, et al. Guidance and Patient Instructions for Prone and Repositioning of Awake, Nonintubated COVID-19 Patients. *Acad Emerg Med*. 2020. <https://doi.org/10.1111/acem.14067>
13. **Bamford P, Bentley A, Dean J, Whitmore D, Wilson-Baig N**. ICS Guidance for Prone Positioning of the Conscious COVID Patient 2020. *Intensive care society*. <https://emcrit.org/wp-content/uploads/2020/04/2020-04-12-Guidance-for-conscious-proning.pdf>
14. **Albott CS, Wozniak JR, McGlinch BP, Wall MH, Gold BS, Vinogradov S**. Battle Buddies: Rapid Deployment of a Psychological Resilience Intervention for Health Care Workers During the COVID-19 Pandemic. *Anesth Analg*. 2020. 131(1):43-54. <https://doi.org/10.1213/ANE.0000000000004912>
15. **Shearer SC, Parsa KM, Newark A, Peesay T, Walsh AR, Fernandez S**, et al. Facial Pressure Injuries from Prone Positioning in the COVID-19 Era. *Laryngoscope*. 2021. <https://doi.org/10.1002/lary.29374>
16. **Rodriguez-Huerta MD, Diez-Fernandez A, Rodriguez-Alonso MJ, Robles-Gonzalez M, Martin-Rodriguez M, Gonzalez-Garcia A**. Nursing care and prevalence of adverse events in prone position: Characteristics of mechanically ventilated patients with severe SARS-CoV-2 pulmonary infection. *Nurs Crit Care*. 2021. <https://doi.org/10.1111/nicc.12606>
17. **Ibarra G, Rivera A, Fernandez-Ibarburu B, Lorca-Garcia C, Garcia-Ruano A**. Prone position pressure sores in the COVID-19 pandemic: The Madrid experience. *J Plast Reconstr Aesthet Surg*. 2020. <https://doi.org/10.1016/j.bjps.2020.12.057>
18. **Capasso V, Cox J, Cuddigan J, Delmore B, Tescher A, Solmos S**. Pressure injury prevention-pip tips for prone positioning. *National pressure injury advisory panel*. 2020 [https://cdn.ymaws.com/npiap.com/resource/resmgr/online\\_store/posters/npiap\\_pip\\_tips\\_-\\_proning\\_202.pdf](https://cdn.ymaws.com/npiap.com/resource/resmgr/online_store/posters/npiap_pip_tips_-_proning_202.pdf)
19. **Peko L, Barakat-Johnson M, Gefen A**. Protecting prone positioned patients from facial pressure ulcers using prophylactic dressings: A timely biomechanical analysis in the context of the COVID-19 pandemic. *Int Wound J*. 2020. <https://doi.org/10.1111/iwj.13435>
20. **Kim RS, Mullins K**. Preventing Facial Pressure Ulcers in Acute Respiratory Distress Syndrome (ARDS). *J Wound Ostomy Continence Nurs*. 2016. 43(4):427-9. <https://doi.org/10.1097/WON.0000000000000247>
21. **Zingarelli EM, Ghiglione M, Pesce M, Orejuela I, Scarrone S, Panizza R**. Facial Pressure Ulcers in a COVID-19 50-year-old Female Intubated Patient. *Indian J Plast Surg*. 2020. 53(1):144-6. <https://doi.org/10.1055/s-0040-1710403>
22. **Perrillat A, Foletti JM, Lacagne AS, Guyot L, Graillon N**. Facial pressure ulcers in COVID-19 patients undergoing prone positioning: How to prevent an underestimated epidemic?. *J Stomatol Oral Maxillofac Surg*. 2020. <https://doi.org/10.1016/j.jormas.2020.06.008>
23. **Coleman S, Nixon J, Keen J, Wilson L, McGinnis E, Dealey C**, et al. A new pressure ulcer conceptual framework. *J Adv Nurs*. 2014. 70(10):2222-34. <https://doi.org/10.1111/jan.12405>
24. **Boyko TV, Longaker MT, Yang GP**. Review of the Current Management of Pressure Ulcers. *Adv Wound Care (New Rochelle)*. 2018. 7(2):57-67. <https://doi.org/10.1089/wound.2016.0697>
25. **Gupta S, Hayek SS, Wang W, Chan L, Mathews KS, Melamed ML**, et al. Factors Associated With Death in Critically Ill Patients With Coronavirus Disease 2019 in the US. *JAMA Intern Med*. 2020. <https://doi.org/10.1001/jamainternmed.2020.3596>

26. **Taneri PE, Gomez-Ochoa SA, Llanaj E, Raguindin PF, Rojas LZ, Roa-Diaz ZM, et al.** Anemia and iron metabolism in COVID-19: a systematic review and meta-analysis. *Eur J Epidemiol.* 2020. <https://doi.org/10.1101/2020.06.04.20122267>
27. **Grasselli G, Zangrillo A, Zanella A, Antonelli M, Cabrini L, Castelli A, et al.** Baseline Characteristics and Outcomes of 1591 Patients Infected With SARS-CoV-2 Admitted to ICUs of the Lombardy Region, Italy. *JAMA.* 2020. <https://doi.org/10.1001/jama.2020.5394>
28. Herramienta online para la consulta y diseño de planes de cuidados de enfermería. NNN-Consult. *Elsevier.* 2015 [cited 2021Abril08]. <http://www.nnnconsult.com/>
29. **Moore Z, Patton D, Avsar P, McEvoy NL, Curley G, Budri A, et al.** Prevention of pressure ulcers among individuals cared for in the prone position: lessons for the COVID-19 emergency. *J Wound Care.* 2020. 29(6):312-20. <https://doi.org/10.12968/jowc.2020.29.6.312>
30. **Gefen A, Alves P, Ciprandi G, Coyer F, Milne CT, Ousey K, et al.** Device-related pressure ulcers: SECURE prevention. *J Wound Care.* 2020. 29(Sup2a):S1-S52. <https://doi.org/10.12968/jowc.2020.29.Sup2a.S1>
31. **Park SH, Lee YS, Kwon YM.** Predictive Validity of Pressure Ulcer Risk Assessment Tools for Elderly: A Meta-Analysis. *West J Nurs Res.* 2016. 38(4):459-83. <https://doi.org/10.1177/0193945915602259>
32. **Park SH, Lee HS.** Assessing Predictive Validity of Pressure Ulcer Risk Scales- A Systematic Review and Meta-Analysis. *Iran J Public Health.* 2016. 45(2):122-33. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4841867/>
33. European Pressure Ulcer Advisory Panel NPIAPaPPPIA. Prevention and treatment of pressure ulcers/injuries: clinical practice guideline. *The International Guideline.* 2019. 3rd: <http://www.internationalguideline.com>
34. **Girard R, Baboi L, Ayzac L, Richard JC, Guerin C, Proseva trial g.** The impact of patient positioning on pressure ulcers in patients with severe ARDS: results from a multicentre randomised controlled trial on prone positioning. *Intensive Care Med.* 2014. 40(3):397-403. <https://doi.org/10.1007/s00134-013-3188-1>
35. **Baktoft B.** Nursing care of patients in the prone position. *The World of Critical Care Nursing.* 2001. 1(3):83-6. <https://doi.org/10.1891/1748-6254.1.3.87>
36. **Lucchini A, Bambi S, Mattiussi E, Elli S, Villa L, Bondi H, et al.** Prone Position in Acute Respiratory Distress Syndrome Patients: A Retrospective Analysis of Complications. *Dimens Crit Care Nurs.* 2020. 39(1):39-46. <https://doi.org/10.1097/DCC.0000000000000393>
37. **Barakat-Johnson M, Lai M, Wand T, Li M, White K, Coyer F.** The incidence and prevalence of medical device-related pressure ulcers in intensive care: a systematic review. *J Wound Care.* 2019. 28(8):512-21. <https://doi.org/10.12968/jowc.2019.28.8.512>
38. **Black J, Alves P, Brindle CT, Dealey C, Santamaria N, Call E, et al.** Use of wound dressings to enhance prevention of pressure ulcers caused by medical devices. *Int Wound J.* 2015. 12(3):322-7. <https://doi.org/10.1111/iwj.12111>
39. **Park KH, Kim KS.** Effect of a structured skin care regimen on patients with fecal incontinence: a comparison cohort study. *J Wound Ostomy Continence Nurs.* 2014. 41(2):161-7. <https://doi.org/10.1097/WON.0000000000000005>
40. **Avsar P, Karadag A.** Efficacy and Cost-Effectiveness Analysis of Evidence-Based Nursing Interventions to Maintain Tissue Integrity to Prevent Pressure Ulcers and Incontinence-Associated Dermatitis. *Worldviews Evid Based Nurs.* 2018. 15(1):54-61. <https://doi.org/10.1111/wvn.12264>
41. **Otero DP, Dominguez DV, Fernandez LH, Magarino AS, Gonzalez VJ, Klepzing JV, et al.** Preventing facial pressure ulcers in patients under non-invasive mechanical ventilation: a randomised control trial. *J Wound Care.* 2017. 26(3):128-36. <https://doi.org/10.12968/jowc.2017.26.3.128>



- 42. Weng MH.** The effect of protective treatment in reducing pressure ulcers for non-invasive ventilation patients. *Intensive Crit Care Nurs.* 2008. 24(5):295-9. <https://doi.org/10.1016/j.iccn.2007.11.005>
- 43. Prebio M, Katz-Papatheophilou E, Heindl W, Gelbmann H, Burghuber OC.** Reduction of pressure sores during prone positioning of ventilated intensive care patients by the prone-head support system: a pilot study. *Wien Klin Wochenschr.* 2005. 117(3):98-105. <https://doi.org/10.1007/s00508-004-0299-2>
- 44. Katzengold R, Gefen A.** What makes a good head positioner for preventing occipital pressure ulcers. *Int Wound J.* 2018. 15(2):243-9. <https://doi.org/10.1111/iwj.12857>
- 45. Levy A, Kopplin K, Gefen A.** Device-related pressure ulcers from a biomechanical perspective. *J Tissue Viability.* 2017. 26(1):57-68. <https://doi.org/10.1016/j.jtv.2016.02.002>
- 46. Grisell M, Place HM.** Face tissue pressure in prone positioning: a comparison of three face pillows while in the prone position for spinal surgery. *Spine.* 2008. 33(26):2938-41. <https://doi.org/10.1097/BRS.0b013e31818b9029>
- 47. Kumagai A, Ohno N, Miyati T, Okuwa M, Nakatani T, Sanada H, et al.** Investigation of effects of urethane foam mattress hardness on skin and soft tissue deformation in the prone position using magnetic resonance imaging. *J Tissue Viability.* 2019. 28(1):14-20. <https://doi.org/10.1016/j.jtv.2018.10.007>
- 48. Roth S.** Perioperative visual loss: what do we know, what can we do?. *Br J Anaesth.* 2009. 103 Suppl 1:i31-40. <https://doi.org/10.1093/bja/aep295>
- 49. Gefen A, Farid KJ, Shaywitz I.** A review of deep tissue injury development, detection, and prevention: shear savvy. *Ostomy Wound Manage.* 2013. 59(2):26-35. <https://pubmed.ncbi.nlm.nih.gov/23388395/>
- 50. Shi C, Dumville JC, Cullum N.** Support surfaces for pressure ulcer prevention: A network meta-analysis. *PLoS One.* 2018. 13(2):e0192707. <https://doi.org/10.1371/journal.pone.0192707>
- 51. Guerin C, Reignier J, Richard JC, Beuret P, Gacouin A, Boulain T, et al.** Prone positioning in severe acute respiratory distress syndrome. *N Engl J Med.* 2013. 368(23):2159-68. <https://doi.org/10.1056/NEJMoa1214103>
- 52. Araujo MS, Santos M, Silva CJA, Menezes RMP, Feijao AR, Medeiros SM.** Prone positioning as an emerging tool in the care provided to patients infected with COVID-19: a scoping review. *Rev Lat Am Enfermagem.* 2021. 29:e3397. <https://doi.org/10.1590/1518-8345.4732.3397>
- 53. Bergstrom N, Braden BJ, Laguzza A, Holman V.** The Braden Scale for Predicting Pressure Sore Risk. *Nurs Res.* 1987. 36(4):205-10. <https://doi.org/10.1097/00006199-198707000-00002>
- 54. Norton D, McLaren R, Exton-Smith A.** An investigation of geriatric nursing problems in hospital. London: Churchill Livingstone. *Scientific Research.* 1962. [https://www.scirp.org/\(S\(czeh2tfqyw2orz553k1w0r45\)\)/reference/ReferencesPapers.aspx?ReferenceID=1191367](https://www.scirp.org/(S(czeh2tfqyw2orz553k1w0r45))/reference/ReferencesPapers.aspx?ReferenceID=1191367)
- 55. Drahnak DM, Custer N.** Prone Positioning of Patients With Acute Respiratory Distress Syndrome. *Crit Care Nurse.* 2015. 35(6):29-37. <https://doi.org/10.4037/ccn2015753>