

Clinical Burden of Inpatient Wound Care in Internal Medicine Units During the First Wave of COVID-19 Outbreak

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ABSTRACT

Objective: To explore the clinical burden and epidemiologic profile of hospitalized patients with wounds during the first wave of COVID-19.

Methods: A retrospective and observational study was conducted to analyze the inpatient episodes of wound care in the University Hospital of Salamanca (Spain) during the initial COVID-19 crisis from March 1, 2020, to June 1, 2020. Data were collected from nursing care reports and clinical discharge reports. Included patients were 18 years or older, had a hospital length of stay of 1 day or longer, and were hospitalized in an internal medicine unit. Surgical and traumatic wounds and pediatric patients were excluded.

Results: A total of 116 patients and 216 wounds were included. The overall wound prevalence was 7.6%, and incidence was 3.5% in the internal medicine units. Pressure injuries (PIs) were the most common wound type, and patients with COVID-19 had significantly higher PI risk (odds ratio [OR], 2.0; 95% confidence interval [CI], 1.1–4.0; $P = .042$). Significant differences in PI staging were noted: 83.2% of wounds in patients with COVID-19 were stages I–II versus 67.8% in patients without COVID-19; the probability of stage III–IV PIs among patients without COVID-19 was doubled (OR, 2.3; 95% CI, 1.2–4.5; $P = .009$). The probability of acute wounds tripled in patients with COVID-19 (OR, 3.7; 95% CI, 2.1–6.6; $P < .001$). Patients with COVID-19 also had longer mean hospital stays and higher ICU admission rates. No case fatality rate differences were observed.

Conclusions: In this context of clinical practice, protocolized assessment and implementation of preventive measures must be ensured among older adult populations, patients with associated comorbidities, and ICU patients.

Keywords: COVID-19, internal medicine units, length of stay, pressure injury, skin injuries, wounds

ADV SKIN WOUND CARE 2022;35:1–7.

DOI: 10.1097/01.ASW.0000824564.25976.e8

INTRODUCTION

The COVID-19 pandemic has pushed the limits of healthcare systems in many countries at all levels of care. According to the situational report by the World Health Organization, which revealed 239,801 confirmed cases of COVID-19 and 29,045 deaths as of June 2020, Spain is one of the European countries most severely affected by the COVID-19 pandemic.¹

Chronic wounds fail to evolve through the normal phases of wound healing in a timely manner and may include vascular ulcers (eg, venous and arterial ulcers), diabetic foot ulcers, and pressure injuries (PIs), among others.² These wounds, especially PIs, are preventable, but remain a challenging problem in hospitalized patients and are associated with high morbidity, mortality, infection, and economic cost.^{3–7}

The COVID-19 pandemic may lead to increased risks related to the appearance or aggravation of wounds because of a lack of health professionals and high workloads, lack of support surfaces, the high incidence of patients with COVID-19 needing hospitalization, and the pathology of COVID-19 and its comorbidities. To assess the healthcare performance of chronic wound treatments, the first step is to develop effective prevention and therapeutic strategies to improve future care crisis protocols. Thus, the authors performed a single-site retrospective study of patients hospitalized in internal medicine units in the Salamanca University Hospital Complex (province of Salamanca, Spain) during the COVID-19 crisis who exhibited a skin wound episode to identify the wound prevalence and epidemiologic profile of these patients.

METHODS

Study Design and Setting

A descriptive longitudinal retrospective study was performed following the STROBE (Strengthening the

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Reporting of Observational Studies in Epidemiology) statement.⁸ This study was conducted in the Salamanca University Hospital Complex (Complejo Asistencial Universitario de Salamanca; CAUSA, in Spanish) in the province of Salamanca, Spain. The CAUSA hospital complex is a public, tertiary hospital that includes five institutions (Clinical Hospital, Virgen de la Vega Hospital, Virgen del Castañar Hospital, Montalvos Hospital, and the Specialized Centre of Ciudad Rodrigo), with 903 acute beds, 110 medium-long stay beds, and 45 hospital medical services. It provides healthcare coverage to 331,048 inhabitants.⁹

During the study period, many units turned into COVID-19 wards because of the need for beds to hospitalize patients with COVID-19. This high flow of hospitalizations forced healthcare organizations to adjust clinical and structural resources. For this reason, CAUSA created a response plan to COVID-19 that included, among other measures, the restructuring of the Clinical Hospital and Montalvos Hospital as COVID reference areas (new COVID units were opened progressively to meet the needs and number of patients admitted), whereas Virgen de la Vega Hospital was a non-COVID hospital; the other rural hospitals transferred their health professionals and material resources to cover the needs of these three hospitals.

Data Source and Data Collection

Two sources of information were used to collect the relevant information on patients: nursing care reports (NCRs) and clinical discharge reports. Two investigators/researchers reviewed both records of hospitalized patients who had one or more episodes of wound care during their hospital stay at the Internal Medicine Units of the Salamanca University Hospital Complex. Data were collected between March 1, 2020, and June 1, 2020, the most critical period of hospitalizations and hospital overload of the first wave of COVID-19 in Salamanca.

The researchers first extracted data on wound care episodes from NCRs through the electronic nursing healthcare management program Gacela-Care, which is a software program used to record nursing interventions and care plans in hospitalized patients. This health information system uses the “episode of care” as the unit of record, which is defined as “the process of care for an illness or demand made by the patient, which begins with the first contact with the health services and ends with the last contact related to the specific episode.” The researchers then reviewed the clinical discharge report corresponding to the previously selected episodes to extract complete patient clinical information.

The following data were collected: (1) demographic variables, such as sex, age, and hospitalization unit; (2) clinical variables and comorbidities: principal diagnosis and secondary diagnosis/other diagnosis, reason for

discharge, hospital length of stay, mortality; (3) variables related to the specific characteristics of the wound, such as etiology (vascular ulcer, diabetic ulcer, PI, moisture-associated skin damage [MASD] and oncology process), number of wounds per patient, location, wound origin (domicile, internal medicine unit, ICU, or primary healthcare), and stage graded from I to IV according to tissue damage and based on the National Pressure Ulcer Advisory Panel staging system.¹⁰ Data were collected and analyzed by two analysts. Patients were grouped according to the principal diagnosis (COVID-19 group and non-COVID-19 group), and demographic and clinical characteristics of both groups were compared.

Participants and Sample Size

Participant inclusion criteria were as follows: adult patients (≥ 18 years old) hospitalized for more than 24 hours in internal medicine units during the period March 1, 2020, to June 1, 2020, with recorded episodes of skin injuries or chronic wounds that received nursing care. The episodes included the following diagnoses: PI, vascular ulcer (arterial or venous ulcer), MASD, neuropathic diabetes foot, and neoplastic lesions. Exclusion criteria were as follows: episodes of surgical or traumatic wounds, pediatric population, and hospitalization in units other than internal medicine.

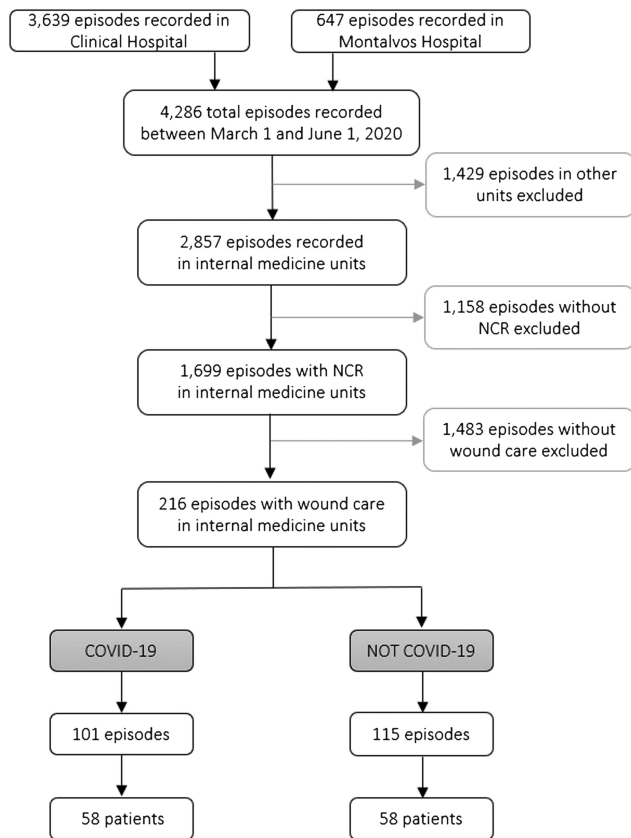
From March 1, 2020, to June 1, 2020, a total of 4,286 wound episodes were recorded in Salamanca University Hospital Complex, 2,857 of which were recorded in the internal medicine units. Of these, 1,699 episodes were reported in the NCR, and 216 wound episodes required nursing care during the first peak of SARS-CoV-2 infections. These 216 episodes corresponded to 116 patients (Figure 1).

Statistical Analyses

Categorical variables were expressed as frequencies (n) and percentages (%). Continuous variables were described with mean and SD, unless the distribution was not normal, in which case they were expressed as median and interquartile range (Q3-Q1). The Shapiro-Wilk test was used to verify normality. In the bivariate analysis, a χ^2 test was used to compare associations between demographics and clinical categorical variables of patients with and without COVID, and the measured outcome was expressed as the odds ratio (OR) together with the 95% confidence interval (CI) for OR. Continuous variables were compared with Student *t* test or the Mann-Whitney *U* test for two groups, depending on their normal or nonnormal distribution. The authors used analysis of variance to analyze the influence of independent nominal variables on a continuous dependent variable. $P < .05$ was considered statistically significant. Data analysis was performed using SPSS version 26.0 (IBM, Armonk, New York).



Figure 1. FLOW DIAGRAM SHOWING EPISODES RECORDED



Abbreviation: NCR, nursing care report.

Ethics Statement

The database supporting the findings of this study is available from the authors. The study was approved by the Ethics Committee of the University Hospital of Salamanca (code: PI 2019 03 208). All data were kept confidential and processed anonymously in accordance with the requirements of Law 3/2018 of 5 December on the Protection of Personal Data and Guarantee of Digital Rights.¹¹

RESULTS

Prevalence and Incidence of Wound Episodes

A total of 216 wound episodes required nursing care in the internal medicine units from March 1, 2020, to June 1, 2020; 266 wound episodes were recorded during the same time period in the year prior to the pandemic (from March 1, 2019, to June 1, 2019). The prevalence of wound episodes during the first wave of COVID-19 pandemic was 7.6% (216/2,857) in the internal medicine units and 5% (216/4,286) in Salamanca University Hospital Complex. Of these, 108 episodes (50%) corresponded to injuries prior to hospital admission, and 97 episodes (44.9%) were injuries that occurred during the hospital

stay (for 11 episodes, the site and time of appearance are unknown). The incidence of wound episodes during the first peak of infection was 3.5% in the internal medicine units. These 216 episodes corresponded to 116 patients: 101 episodes occurred in 58 patients with COVID-19, and 115 episodes occurred in patients without COVID-19. Only two patients required hospital readmission during the study period for SARS-CoV-2 transmission during their first hospital stay.

Patient Characteristics

Of the total 116 patients, 51 (44%) were men, and 65 (56%) were women. Mean age was 82 (SD, 11.4) years (range, 38–100 years; median 84 years, interquartile range 89–76 years). No statistically significant age differences were observed between men and women (80.0 [SD, 11.6] years vs 83.6 [SD, 11.0] years, respectively; $P = .094$).

In half of the recorded patients, the principal diagnosis was SARS-CoV-2 infection. Among patients without COVID-19, the most common principal diagnoses were sepsis, septic shock, and bacteremia (18 patients). More than half of the sample (55.2%) had only one episode of wound care during their hospital stay at the internal medicine units. Table 1 shows the global data describing the cohort of patients.

COVID-19 Versus non-COVID-19 Wound Episodes

Table 2 compares the variables of the groups with and without COVID-19. No significant differences in sex ($P = .853$) or mean age ($P = .138$) were observed across the patient groups.

Overall, PIs were the most common wound type in both study groups (85.1% COVID-19 vs 73.9% non-COVID-19). Patients with COVID-19 had a significantly higher PI risk (OR, 2.0; 95% CI, 1.1–4.0; $P = .042$), whereas venous ulcer occurrence was twice as high among patients without COVID-19 (13.9% vs 6.9%; OR, 2.2; 95% CI, 0.8–5.5; $P = .097$). There were significant differences in wound staging between the groups: 83.2% of skin ulcers in patients with COVID-19 were stages I and II versus 67.8% in the non-COVID-19 group; thus, the probability of stage III and IV skin ulcers among patients without COVID-19 diagnosis is doubled (OR, 2.3; 95% CI, 1.2–4.5; $P = .009$). In patients with COVID-19, 59 episodes (58.4%) were acute wounds (occurred during their hospital stay); in contrast, 39 episodes (33.9%) were acute wounds in the non-COVID-19 group ($P < .001$). Thus, the risk or probability (OR) of acute wounds was three times higher in patients with COVID-19 during the first wave of the pandemic in the internal medicine units at this hospital (OR, 3.7; 95% CI, 2.1–6.6; $P < .001$). As shown in Figure 2, the sacral region (34.7% vs 29.6%) and heel (29.7% vs 29.6%) were the most common locations.

Table 1. PATIENT CHARACTERISTICS (N = 116)

Qualitative Variables	n (%)		
Sex			
Male	51 (44.0)		
Female	65 (56.0)		
Age, y			
<60	2 (1.7)		
60–69	18 (15.5)		
70–79	18 (15.5)		
80–89	50 (43.1)		
90–99	26 (22.4)		
100	2 (1.7)		
No. episodes per patient			
1	64 (55.2)		
2	29 (25.0)		
≥3	23 (19.8)		
Principal diagnosis			
COVID-19	58 (50.0)		
Other diagnosis	58 (50.0)		
Sepsis, septic shock, bacteremia	18 (15.5)		
Pneumonia, respiratory infection	14 (12.1)		
Urinary tract infection	8 (6.9)		
Chronic renal disease	5 (4.3)		
Neoplasm diagnosis	7 (6.0)		
Heart failure	3 (2.6)		
Digestive disease	3 (2.6)		
Stay in critical care unit	14 (12.1)		
Case fatality rate	19 (16.4)		
Quantitative Variables			
	Mean (SD)	Median (Interquartile Range)	Range
Age, y	82.0 (11.4)	84 (89–76)	38–100
No. episodes per patient	1.9 (1.3)	1 (2-1)	1–7
Hospital stay, d	21.3 (14.1)	19 (29-11)	1–67

Mean hospital stay was significantly longer in patients with COVID-19 (26.0 [SD, 14.1] days vs 16.8 [SD, 12.6] days; $P < .001$), and 17.2% of patients with COVID-19 required intensive care versus 6.9% in the non-COVID-19 group ($P = .088$). No differences were observed in the case fatality rate (17.2% vs 15.5%).

DISCUSSION

Wound care is one of many areas that have been seriously affected by the global health crisis related to the COVID-19 pandemic. Recent studies that surveyed patients and healthcare professionals evidence a negative impact of COVID-19 in patients with chronic wounds in term of diagnostics, follow-up, and access to specialists.^{12,13} In the current study, the authors aimed to identify the profile of patients in need of wound care during the months

of the first wave of COVID-19 in Spain, specifically in the province of Salamanca, one of the most affected by the pandemic with 31,998 accumulated confirmed patients as of May 2021.¹⁴

In their fifth national study in 2017, the National Advisory Group for the study of Pressure Ulcers and Chronic Wounds (original Spanish name: Grupo Nacional para el Estudio y Asesoramiento en Úlceras por Presión y Heridas Crónicas) estimated that global overall prevalence of dependence-related skin lesions in Spanish hospitals was 8.7%; PIs were the most frequently occurring, followed by combined injuries, moisture-associated lesions, friction, and skin tears.¹⁵ In contrast, the current study found a lower prevalence rate (7.6%) despite including a broader etiologic spectrum of wound care episodes, which was unexpected for a period of care

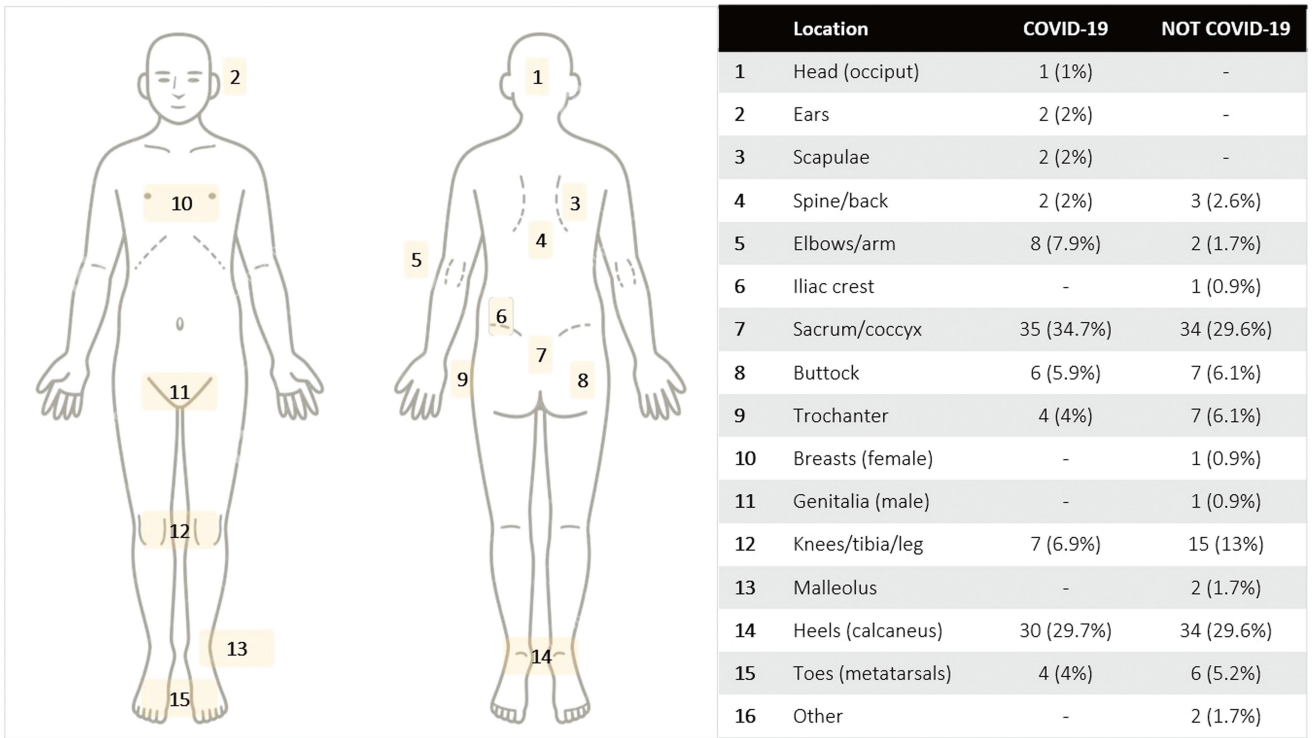
Table 2. COMPARING VARIABLES BETWEEN GROUPS

Variables	COVID-19 (n = 58)	non-COVID-19 (n = 58)	P^a
Patient characteristics			
Male-to-female ratio	27/32	26/33	.853
Age, mean (SD), y	80.4 (13.1)	83.6 (9.1)	.138
No. episodes per patient (SD)	1.8 (1.2)	2.0 (1.4)	.393
Hospital stay, mean (SD), d	26.0 (14.1)	16.8 (12.6)	<.001
Patients with stay in critical care unit	10 (17.2)	4 (6.9)	.088
Case fatality rate	10 (17.2)	9 (15.5)	.802
Wounds			
	n = 101	n = 115	
Pressure injury	86 (85.1)	85 (73.9)	.042
Venous ulcer	7 (6.9)	16 (13.9)	.097
Moisture-associated skin damage	4 (4.0)	7 (6.1)	.478
Arterial ulcer	2 (2.0)	1 (0.9)	—
Tumor	1 (1.0)	2 (1.7)	—
Neuropathic diabetic foot ulcer	1 (1.0)	4 (3.5)	—
Stage			
I	27 (26.7)	26 (22.6)	
II	57 (56.4)	52 (45.2)	
III	13 (12.9)	17 (14.8)	
IV	4 (4.0)	20 (17.4)	.014
Wounds by type and site			
Acute wounds			
Actual unit	26 (25.7)	15 (13.0)	
Critical care unit	15 (14.9)	7 (6.1)	
Other unit	18 (17.8)	16 (13.9)	
Chronic wounds			
Home	4 (4.0)	42 (36.5)	
Social and healthcare center	28 (27.7)	34 (29.6)	
Not recorded	10 (9.9)	1 (0.9)	<.001

^aStatistical significance level $P < .05$.



Figure 2. LOCATION OF WOUNDS IN PATIENTS BY COVID-19 DIAGNOSIS



overload and high rate of hospital admissions. In fact, the rates were lower than those reported in NCRs collected during the same time period the previous year. Accordingly, results must be interpreted cautiously; wounds may have been underreported because health professionals prioritized healthcare over registration tasks due to lack of time and resources.

In most cases, COVID-19 has a mild clinical course,¹⁶ but people of advanced age and/or those with underlying comorbidities may have serious complications.^{17,18} Several meta-analyses have found hypertension, cardiovascular diseases, diabetes mellitus, chronic obstructive pulmonary disease, and chronic kidney disease among the major risk factors for patients hospitalized with COVID-19.^{19,20} These chronic conditions also factor into risks of wound development and may hinder the healing process due to their association with conditions such as immobilization, tissue ischemia, malnutrition, and so on.²¹⁻²⁴

The profiles of both groups included in the current study corresponded to patients with a mean age older than 80 years who presented several clinical situations or comorbidities in addition to the main admission diagnosis. Given the demographic characteristics of the local population with a high average age and life expectancy, it was observed that the COVID-19 group reflected the most affected population of the first wave in this province. Among patients without COVID-19, the main admission diagnoses were related to sepsis and pneumonia or respi-

ratory infections, followed by urinary tract infections. It should be noted that during this time, outpatient consultations and scheduled interventions were suspended, and internal medicine units were almost exclusively dedicated to patients with COVID-19. Therefore, the rest of the pathologies without admission criteria were treated through alternatives such as primary care or telemedicine.

Regarding mortality, the meta-analysis by Bonanad et al¹⁷ performed with national reports on May 7, 2020, indicates that the global mortality in patients with COVID-19 is approximately 12.10%, but higher rates are observed in patients older than 80 years, whose risk may be six times higher than that of younger patients. In the current study, no significant differences in mortality rates were found between groups, perhaps because of the homogeneity of age and clinical characteristics in both groups.

Recent research has shown that a high percentage of patients hospitalized with COVID-19 require mechanical ventilation systems and ICU care.²⁵ The present data show significant differences in this regard, with longer hospital length of stay and more ICU admissions in the COVID-19 group versus the non-COVID-19 group. As reported in the literature, critically ill patients acquire ICU-specific risk factors related to the development of PIs—a common situation among patients with COVID-19—such as limited mobility/activity, vasopressor infusion, and poor perfusion.²⁶

No statistical differences were found in the number or location of wounds between groups; sacral region and heels were the most common wound locations in both groups. However, statistical differences were observed in the wound staging: 32.2% of wounds were stage III or IV in the non-COVID-19 group, whereas only 16.9% of wounds were stage III or IV in the COVID-19 group. Moreover, it is important to highlight the statistical differences regarding the time of appearance of the wounds. The non-COVID-19 group presented higher percentages of wounds prior to hospitalization, originating at home or at social-health centers, whereas in patients with COVID-19, wounds were more frequently acquired during the hospital stay. However, a high number of wounds in both groups had an unknown moment of appearance, which may indicate a deficit in their assessment or healthcare providers' lacking time to correctly complete documentation.

During the first wave of the pandemic, given the lack of knowledge regarding COVID-19 and what it could entail, no specific plan was established for the follow-up and treatment of chronic wounds; instead, efforts were focused on treating the new disease. For this reason, the established plans for the prevention and treatment of chronic wounds at University Hospital of Salamanca, both in the ICU and in the conventional hospitalization wards, were maintained, but no new plan was established.²⁷ Thus, one purpose of the current research was to report whether there are significant differences between wound care in patients with SARS COV-2 infection and those without, in order to establish different criteria, if necessary.

Limitations, Strengths, Implications for Practice, and Recommendations for Future Studies

The main strength of the study is that it is the first to quantify and analyze the clinical impact of wound care in hospitals overburdened by the COVID-19 pandemic. Because COVID-19 is a new disease and appeared in the form of a global pandemic, its effect on wound care was unknown; this descriptive research sets the basis for future studies.

Some limitations of this research should be considered. First, this study was limited by the nature of its retrospective design, so it is impossible to establish causality. Second, although hospital protocols normalize nursing activity on prevention, communication, and follow-up of wounds, it is possible that some episodes were poorly or incompletely documented because of the high workloads and lack of nursing professionals during the worst months of the pandemic. Third, the staging system used by the Gacela Care program, based on the National Pressure Ulcer Advisory Panel/European Pressure Ulcer Advisory Panel system for PIs, is the same for all types of wounds (vascular, neoplastic, MASD, etc). Therefore, the fact that the program allows the recording of the four

stages according to the extent of tissue damage without distinguishing etiology may indicate a bias in its analysis.

CONCLUSIONS

During the first wave of the COVID-19 pandemic, the requirements for wound care mainly related to older adult populations, patients with associated comorbidities, and ICU patients. Therefore, it is important for nursing professionals to ensure the implementation of preventive measures, skin assessment, and follow-up. ●

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