

Selected correlates conditioning the occurrence of pressure ulcers and their actual occurrence among residents of long-term residential care. Test report

Wybrane korelaty warunkujące wystąpienie odleżyn a ich faktyczne występowanie wśród pensjonariuszy stacjonarnej opieki długoterminowej. Raport z badania

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Słowa kluczowe: stan odżywienia, opieka długoterminowa, odleżyna.

Abstract

Aim of the research: To assess the relationship between selected determinants of the incidence of bedsores and their actual occurrence among inpatients in long-term care.

Material and methods: This prospective observational study involved 47 patients of an inpatient long-term care centre. An estimation method was used. A primary assessment (study 0) and a secondary assessment (study1) were conducted over 4 weeks. Study data were collected by means of a scientific questionnaire, which used clinical tools in addition to sociodemographic data and vital signs assessment: the Barthel scale, Glasgow Coma Scale (GCS), Nutritional Risk Index (NRI), body mass index (BMI), and the Braden pressure ulcer risk scale.

Results: There was a correlation in terms of comorbidities and the incidence of pressure sores. A correlation was confirmed between the incidence of pressure sores, renal failure ($p = 0.026$), and cardiovascular failure ($p = 0.030$). An association was observed between albumin levels in the group of residents with and without bedsores ($p < 0.001$). The albumin level in the second measurement was higher in the group of patients without pressure sores ($p < 0.001$). There was also a correlation found in the assessment of the degree of self-care and the occurrence of pressure sores ($p < 0.004$).

Conclusions: Hypoalbuminemia and immobilisation in the course of chronic diseases increase the risk of pressure ulcers in the long-term care group. The implementation of multidirectional and interdisciplinary prevention is a fundamental pillar of professional care for the chronically ill.

Streszczenie

Cel pracy: Ocena związku między wybranymi czynnikami determinującymi występowanie odleżyn a ich faktycznym występowaniem wśród pacjentów hospitalizowanych w ramach opieki długoterminowej.

Materiał i metody: W prospektywnym badaniu obserwacyjnym wzięło udział 47 pacjentów stacjonarnego ośrodka opieki długoterminowej. Zastosowano metodę szacunkową. Ocenę pierwotną (badanie 0) i ocenę wtórną (badanie 1.) przeprowadzono w ciągu 4 tygodni. Dane z badania zebrano za pomocą kwestionariusza naukowego, w którym oprócz danych socjodemograficznych i oceny parametrów życiowych wykorzystano narzędzia kliniczne: skalę Barthel, skalę Glasgow, *Nutritional Risk Index* (NRI), wskaźnik masy ciała (*body mass index* – BMI) i skalę ryzyka odleżyn Bradena.

Wyniki: Wykazano korelację w zakresie posiadanych chorób współistniejących a występowaniem odleżyn. Potwierdzono zależność między występowaniem odleżyn a niewydolnością nerek ($p = 0,026$) oraz niewydolnością układu krążenia ($p = 0,030$). Zaobserwowano związek pomiędzy stężeniem albuminy w grupie pensjonariuszy z odleżynami i bez odleżyn ($p < 0,001$). Stężenie albuminy w drugim pomiarze było wyższe w grupie pacjentów bez odleżyn ($p < 0,001$). Wykazano także zależność między oceną stopnia samoopieki a występowaniem odleżyn ($p < 0,004$).

Wnioski: Hipoalbuminemia i unieruchomienie w przebiegu chorób przewlekłych zwiększają ryzyko występowania odleżyn w grupie badanych objętych opieką długoterminową. Wdrożenie wielokierunkowej i interdyscyplinarnej profilaktyki stanowi podstawowy filar profesjonalnej opieki nad przewlekle chorym.

Introduction

Prevalence of pressure sores among people with severe self-care disorders due to age and progressive chronic diseases is a worldwide problem. Increasing human life expectancy, multimorbidity and innovative medical techniques are driving observable improvements in quality of life. Ageing societies and the related consequences determine the ever-increasing demand for nursing and caring services. According to the data of the Central Statistical Office in Poland (GUS), by 2050 people aged 60 years and over will constitute nearly 40% of the population. Simultaneously, approximately 67% of them will be burdened with long-term health problems or chronic diseases. This condition may require long-term nursing care [1].

The term long-term care means the provision of services, assistance, and support for chronically ill or disabled people, and the list of guaranteed benefits in this respect is regulated by legal acts [2]. The priority of health policy is to ensure that citizens can stay in the environment in which they live and function for as long as possible with optimal quality of life. The home environment is a natural place to live in health and disease. However, there are some dysfunctions and lack of care situations that must be considered for residential care. These are special situations related to dysfunction or inability to provide care in the home environment. Approximately 93% of all patients under inpatient care are aged 65 or older, and the majority of them are dependent with significant motor dysfunctions resulting from age, chronic diseases, coexisting eating disorders, of various aetiologies [3]. Pressure ulcers in this group are the result of many endo- and exogenous factors. Scientific reports indicate that the incidence of pressure ulcers is higher (8.2%) in long-term centres than in intensive care wards (2.7%). These data are related to the generally poor clinical condition of patients, who, as well as age and chronic diseases, often present with dementia [4]. The presence of modifiable factors and coexisting causes of pressure ulcers resulting from the patient's general condition, self-care deficit, and disease in self-care as well as neurodestructive conditions increase the risk of pressure injuries [3]. The presence pressure-related skin damage is a health problem for sufferers, lowering primarily the quality of life and increasing the costs of care and potential treatment. In practice, it is recommended that assessment and monitoring be done according to the adopted internal procedures using screening scales standardised in terms of the risk of developing bedsores and malnutrition. Conducting an assessment according to Waterloo, Braden, and CBO gives the opportunity to verify variables related to perception, mobility, nutrition, age, and comorbidities [4]. However, often, despite the multidirectional prevention of pressure injuries, the occurrence of pressure ulcers is inevitable,

being the result of age and chronic diseases and general bad condition of the body [5]. The sick cared for in the inpatient centres are a diverse group in terms of general condition, including level of consciousness, perception, nutrition, and mobility. The risk of pressure injuries increases dramatically in people who are incapable of self-care, who are immobile and who have nervous system or cardiovascular disease [6–8]. Simple pressure and action of physical forces such as friction and shear directly contribute to the destruction of tissues, and pressure injuries contribute to the formation of pressure sores, thereby exposing the patient to suffering [9, 10]. Of particular difficulty are fulminating bedsores that may manifest as rapidly progressing infection, leading to systemic infection of the body and the development of a cytokine storm, which may result in sepsis and subsequent death. Following current prevention practice guidelines for the prevention of malnutrition, skin protection and daily assessment of the patient's condition and multidirectional professional care effectively reduce the risk of pressure ulcers [11, 12]. The authors undertook the study to evaluate selected variables conditioning the formation of pressure ulcers in the group of residents of long-term residential care.

Aim of the research

The aim of the work is to assess the relationship between selected determinants of the incidence of bedsores and their actual occurrence among inpatients in long-term care.

Material and methods

Study design and patient population

Fifty patients were enrolled in a prospective-observational study. They were included on the basis of the adopted selection criteria (patients staying in the ward/long-term health care facility for 24 h or more). Three subjects were excluded from the study group (2 people were discharged, and one person died before completion of a 4-week follow-up). In the course of the study, the subjects were divided into 2 subgroups with respect to the incidence of bedsores: the group diagnosed with bedsores and the subjects without lesions suggestive of pressure ulcers. Eligibility for the study is presented in the flowchart in Figure 1.

While designing the study, the method of controlled observation and analysis of the literature on the subject and the method of estimation were used. The technique of directly standardised observation, analysis of medical records, and measurement techniques were used. Two assessments were made (primary [Test 0] and secondary [Test 1]) in the subjects with concomitant risk of pressure ulcers and with pressure ulcers in the period of 4–5 weeks. The data

were collected on the basis of a proprietary scientific and research questionnaire consisting of 3 parts. Part I of the questionnaire contained basic sociodemographic, anthropometric self-care assessment (according to Barthel) [13], assessment of nutrition (Numerical Rating Scale [NRS] and Nutrition Risk Index [NRI]), and the results of laboratory tests. Part II contained data on comorbidities and disease symptoms. Part III included assessment data on wounds, their location, damage depth according to the National Pressure Injury Advisory Panel (NPIAP), and their appearance (wound colour rating). The risk of pressure injuries was assessed with the Braden scale [14]. The study was conducted by an educated medical staff not employed in any of the 2 deliberately selected stationary long-term care facilities located within the Podkarpackie province.

Statistical analysis

The statistical analysis of the collected material was carried out using the Statistica 13.1 package by StatSoft. Parametric and non-parametric tests were used. Choice of the parametric test was conditioned by the fulfilment of its basic assumptions, i.e. compliance of the distributions of the examined variables with the normal distribution, which was verified with the Shapiro-Wilk test. To assess differences in the average level of the quotient trait in 2 populations, Student's *t*-test for independent variables was used or alternatively the non-parametric Mann-Whitney *U* test. For the assessment of intra-group variability, the Wilcoxon pairwise order test was used in 2 populations. Variables that had the characteristic of qualitative data were analysed using the Pearson χ^2 test. The strength of all relationships was normalised to assume values in the range 0–1. From 0–0.29 – weak relationship, 0.30–0.49 – moderate relationship, and 0.5–1 – strong relationship. For numerical variables, descriptive statistics were calculated, i.e. average, median, minimum, maximum, first and third quartiles, and standard deviation. The level of statistical significance was adopted at $p < 0.05$.

Bioethical standards

The study protocol was approved by the Bioethics Committee of the University of Rzeszow: Resolution No. 2018/01/07 of 11 January 2018). In addition, the Declaration of Helsinki was adhered to during the research. The consent of the managers of the entities and legal guardians was obtained to conduct the research, due to the inability to obtain consent due to incomplete verbal or logical contact, or lack of it.

Characteristics of the study group

Forty-seven patients were included in the statistical analysis. The study included people with diagnosed

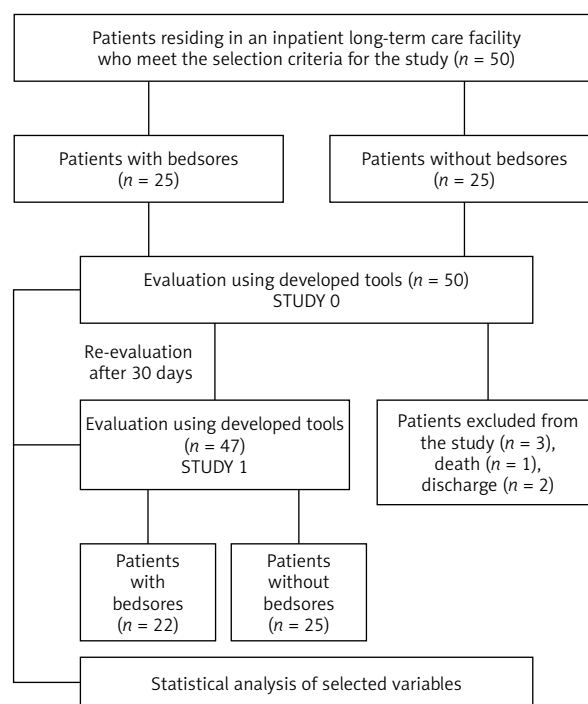


Figure 1. Concept of own research

dysfunctions, most often it was the condition after ischaemic stroke 21.2% (10 people), multiple sclerosis (MS) 10.6% (5 people), or dementia/Alzheimer 8.4% (4 persons) (Table 1). Women accounted for 63.8% ($n = 30$) and men 36.2% ($n = 17$). The average age of the subjects was 64.19 ($M = 18.65$) years, and the mean time of the stay in the facility was 831 days. During the research process at both stages of the study vital parameters were measured. In the first stage of the study, the average the values of the selected parameters assessed were as follows: heart rate 79.37 ± 14.22 beats per minute, in second part of the study 78.64 ± 12.44 beats per minute, systolic blood pressure 117.66 mm Hg, and diastolic pressure 50–95 mm Hg; in the second stage, systolic blood pressure 115.74 mm Hg, diastolic 68.3 mm Hg, saturation 96.28%, in test II 96.09%, in the test II body temperature 36.41°C , in the second test 36.58°C . The average level of capillary glucose in the first measurement was 120.23 mg%, while in II it was 126.17 mg%.

Most of the subjects (85%) were fed enterally, and orally – 5 people, which accounted for 10.6% of the study group. One person covered by the study was fed in a mixed way (2.1%). The average kcal intake by the residents was about 900–1500 kcal, depending on the individual assessment of the patients' energy requirements.

All persons included in the study presented a significant self-care deficit (Barthel average 4.26 points ± 9.72 points), the catheter in the bladder to drain the urine concerned the entire group, 39 (83.0%)

subjects had a nutritional gastrostomy, and tracheostomy 21 (44.7%) people.

Results

Anti-pressure injury prophylaxis

In terms of preventive actions, staff (physiotherapists and nurses) used activation, movement exercises, and changing position average every 3 h in both stages of the study, based on scientific guidelines and recommendations adapted to internal company procedures. All subjects used an anti-pressure injury mattress

and various forms of aids used in the form of rollers (55.3%), anti-pressure injury discs (72.3%), and anti-pressure injury pillows (72.3%) in both stages of the study. During our study, statistical significance was demonstrated ($V_{Cr} = 0.52$) in terms of use of a strictly defined type of anti-pressure injury mattress in the group of respondents with and without pressure ulcers ($p = 0.001$). Variable pressure tubular mattresses were used more often in the group of people with pressure ulcers (59.1%), while in the group of people without pressure sores, alternating pressure alveolar (56.0%) or static (32.0%) mattresses were used (Table 1).

Table 1. Characteristics of the study group

Factor	<i>n</i>	$\bar{x}$	Me	Min.	Max.	Q1	Q3	SD
Age [years]	47	64.19	66.00	24.00	94.00	45.00	80.00	18.65
Day of the stay at the time of research study I	47	831.85	273.00	12.00	4291.00	83.00	1099.00	1071.35
Day of the stay at the time of research study II	47	862.85	304.00	43.00	4322.00	114.00	1130.00	1071.35
Recognition:							<i>n</i>	%
SM							5	10.6
Conditions after ischaemic stroke							10	21.2
Alzheimer`s, dementia syndrome							4	8.5
Conditions after haemorrhagic stroke							7	14.9
Generalised atherosclerosis							2	4.3
Conditions after SCA							7	14.9
Conditions after femoral neck fracture							3	6.4
Quadriplegia, spinal injury							3	6.3
Frontal lobe damage							1	2.1
Conditions after head injury							2	4.2
Head injury, cerebral haemorrhage							1	2.1
Swallowing disorders							3	6.3
Multiple pressure sores							1	2.1
Total							47	100.0
Nutrition			Enteral				40	85.1
			Parenteral				1	2.1
			Mixed				1	2.1
			Oral				5	10.6
			Total				47	100.0
Change of position			1				2	4.3
			3				38	80.9
			4				7	14.9
Physiotherapy [x per day]			1				48	100
Facilities			Shafts				20	42.6
			Antibesorders discs				26	55.3
			Pressure sore pillows				34	72.3

The risk of developing pressure injuries

During the research, the risk of developing pressure ulcers was assessed twice on the Braden scale. No statistically significant relationships were found ($p = 0.169$) (Table 2). During the study, the relationship between

patients' mobility and the incidence of pressure injuries was verified. Low self-care and the associated lack of mobility was not a factor that would lead to the development of pressure injuries. Assessment on the Barthel scale did not reveal any significant statistical correlations ($p = 0.169$) in both stages of the study.

Table 2. Selected variables vs. incidence of pressure sores

Parameter		<i>n</i>	$\bar{x}$	Me	Min.	Max.	Q1	Q3	SD
Age (years)	Decubitus ulcer	22	64.68	65.00	37.00	94.00	53.00	80.00	17.05
	No decubitus ulcer	25	63.76	72.00	24.00	90.00	45.00	81.00	20.30
	Total	47	64.19	66.00	24.00	94.00	45.00	80.00	18.65
	<i>P</i> -value	$Z = -0.01; p = 0.991$							
Parameter		Decubitus ulcer		No decubitus ulcer		Total			
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%		
Gender	Women	12	54.6	18	72.0	30	63.8		
	Men	10	45.5	7	28.0	17	36.2		
	Total	22	100.0	25	100.0	47	100.0		
	<i>P</i> -value	$\chi^2(1) = 1.54; p = 0.213$							
Parameter		<i>n</i>	$\bar{x}$	Me	Min.	Max.	Q1	Q3	SD
Barthel scale [pts.]	Decubitus ulcer	22	1.59	0.00	0.00	20.00	0.00	0.00	5.21
	No decubitus ulcer	25	6.60	0.00	0.00	45.00	0.00	5.00	12.05
	Total	47	4.26	0.00	0.00	45.00	0.00	0.00	9.72
	<i>P</i> -value	$Z = -1.38; p = 0.169$							
Albumins [g/dl] – measurement I	Decubitus ulcer	22	2.76	2.75	2.10	3.80	2.40	3.20	0.47
	No decubitus ulcer	25	3.28	3.20	2.40	4.30	3.00	3.60	0.41
	Total	47	3.04	3.10	2.10	4.30	2.70	3.40	0.51
	<i>P</i> -value	$t = 3.95; p < 0.001$							
Albumins [g/dl] – measurement II	Decubitus ulcer	22	2.82	2.80	2.00	4.20	2.50	3.10	0.50
	No decubitus ulcer	25	3.33	3.30	2.20	4.10	3.00	3.70	0.48
	Total	47	3.09	3.00	2.00	4.20	2.70	3.60	0.55
	<i>P</i> -value	$t = -3.55; p < 0.001$							
Albumins [g/dl] – difference II	Decubitus ulcer	22	-0.06	-0.15	-0.40	0.30	-0.20	0.10	0.22
	No decubitus ulcer	25	-0.05	-0.10	-0.70	0.40	-0.20	0.10	0.24
	Total	47	-0.06	-0.10	-0.70	0.40	-0.20	0.10	0.23
	<i>P</i> -value	$Z = -0.52; p = 0.601$							
BMI [kg/m ²] – measurement I	Decubitus ulcer	22	18.45	18.00	13.00	27.00	16.00	21.00	3.53
	No decubitus ulcer	25	21.88	22.00	16.00	32.00	18.00	25.00	4.04
	Total	47	20.28	21.00	13.00	32.00	17.00	23.00	4.15
	<i>P</i> -value	$t = -3.07; p = 0.004$							
BMI [kg/m ²] – measurement II	Decubitus ulcer	22	18.73	18.00	14.00	27.00	16.00	21.00	3.25
	No decubitus ulcer	25	22.00	22.00	15.00	32.00	19.00	25.00	3.88
	Total	47	20.47	20.00	14.00	32.00	18.00	23.00	3.93
	<i>P</i> -value	$t = -3.11; p = 0.003$							

Table 2. Cont.

Parameter		<i>n</i>	$\bar{x}$	Me	Min.	Max.	Q1	Q3	SD
NRI [pts.] – measurement I	Decubitus ulcer	22	80.70	79.25	65.20	93.50	74.70	89.20	8.51
	No decubitus ulcer	25	90.90	90.00	76.90	107.60	87.30	95.50	6.53
	Total	47	86.12	87.50	65.20	107.60	78.80	92.80	9.04
	<i>P</i> -value	$t = -4.64; p < 0.001$							
NRI [pts.] – measurement II	Decubitus ulcer	22	82.04	80.45	66.10	102.60	76.60	87.40	8.54
	No decubitus ulcer	25	91.81	91.40	71.80	103.40	85.90	98.60	7.74
	Total	47	87.23	86.60	66.10	103.40	79.70	96.40	9.43
	<i>P</i> -value	$t = -4.11; p < 0.001$							
Braden	Decubitus ulcer	22	9.45	9.50	7.00	15.00	8.00	10.00	1.82
	No Decubitus ulcer	25	11.36	10.00	7.00	19.00	9.00	14.00	3.43
	Total	47	10.47	10.00	7.00	19.00	8.00	12.00	2.93
	<i>P</i> -value	$Z = -1.68; p = 0.092$							
Number of chronic diseases and dysfunctions	Decubitus ulcer	22	5.86	6.00	4.00	8.00	5.00	6.00	1.13
	No decubitus ulcer	25	5.20	5.00	3.00	8.00	5.00	6.00	1.08
	Total	47	5.51	5.00	3.00	8.00	5.00	6.00	1.14
	<i>P</i> -value	$Z = 2.08; p = 0.038$							

The average Barthel scale score for residents covered by the two-stage examination was 4.26 points, which allows us to classify their general condition as serious. Patients with pressure injuries obtained 1.59 points in the Barthel scale, while those without pressure injuries scored 6.60 points. There was no correlation between the 2 groups of patients (with and without pressure injuries) in the assessment using the Braden scale. The value of the probability index was close to the significance threshold ($p = 0.092$).

Skin inspection and the incidence of pressure injuries

During the study, the skin was assessed twice. In both stages the skin was rated as clean ($72.3 \pm 76.6\%$). In $42.6 \pm 36.2\%$ of people the skin was assessed as dry, which may increase the risk of skin damage due to the loss of skin elasticity. The occurrence of oedema in both stages of the study was observed in 19.1% of the respondents.

Detailed data are presented in Table 3. Skin lesions such as pustules, abrasions, blanching, and skin redness were diagnosed in virtually all subjects; however, according to researchers they did not constitute the basis for serious health problems. Additionally, in 4 respondents ulceration in the lower leg due to venous insufficiency was confirmed (Table 3).

In the first stage, the absence of pressure ulcers was noted in 25 people, which constitutes 53.2%. Pressure injuries were recorded in 22 people, which constituted 46.8% in both measurements. At least one

pressure injury was found in 29.8%, while 2 pressure ulcers were found in 10.6% (Table 2). Most pressure ulcers were confirmed in the trochanter area (26.1%), ears (13%), and heels and sacrum (4 people each, i.e. 8.7% of the respondents). Among people with barotrauma, 25.5% were deep destructive and potentially life-threatening, located mainly in the trochanter. Non-fading local redness (I°) was seen in 23.4% during test 0, while test 1 showed the occurrence of redness in 17% of respondents. In the group of patients with confirmed pressure ulcers, a correlation was shown in terms of comorbidities. In the study group in which pressure sores occurred, the patients were diagnosed with renal failure ($p = 0.026$). An increased risk of pressure ulcers was also confirmed in the group of patients diagnosed with circulatory system failure ($p = 0.030$) (Figure 2). Bedsores were more common among people with chronic diseases and dysfunctions ($p = 0.038$).

The state of nourishment

The statistical analysis carried out confirms the importance of nutritional status in increasing the risk of pressure ulcers. Its statistical significance was demonstrated in connection with body mass index (BMI) and the risk of pressure ulcers ($p = 0.004$). The average BMI value in test 0 in the group of people with pressure ulcers was $18.45 \pm 3.53 \text{ kg/m}^2$, and in the group of people without pressure ulcers it was $21.88 \pm 4.04 \text{ kg/m}^2$. In test 1, the value of the BMI index in the group of people with pressure ulcers was 18.73

Table 3. Skin assessment and location of pressure injury

Factor	I measurement		II measurement	
	n	%	n	%
Skin assessment:				
Skin pure	34	72.3	36	76.6
Skin dry	20	42.6	17	36.2
Skin pale	7	14.9	5	10.6
Skin flaky	16	34.0	11	23.4
Skin swollen	9	19.1	9	19.1
Location of pressure ulcers wounds present:				
Finger	1	2.2	0	0.0
Heel	4	8.7	5	10.9
Sacra region	4	8.7	4	8.7
Molester	12	26.1	12	26.1
Sciatic tumour	3	6.5	3	6.5
Vane	2	4.3	2	4.3
Knee	2	4.3	2	4.3
Ear	6	13.0	6	13.0
Elbow	1	2.2	1	2.2
Other location	1	2.2	1	2.2
Skin lesion:				
Pimples	7	14.9	6	12.8
Abrasion	8	17.0	5	10.6
Redness	11	23.4	8	17.0
Trophic ulceration	4	8.5	4	8.5
Besorders	22	46.8	22	46.8
No	7	14.9	9	19.1
Other	3	6.4	2	4.3

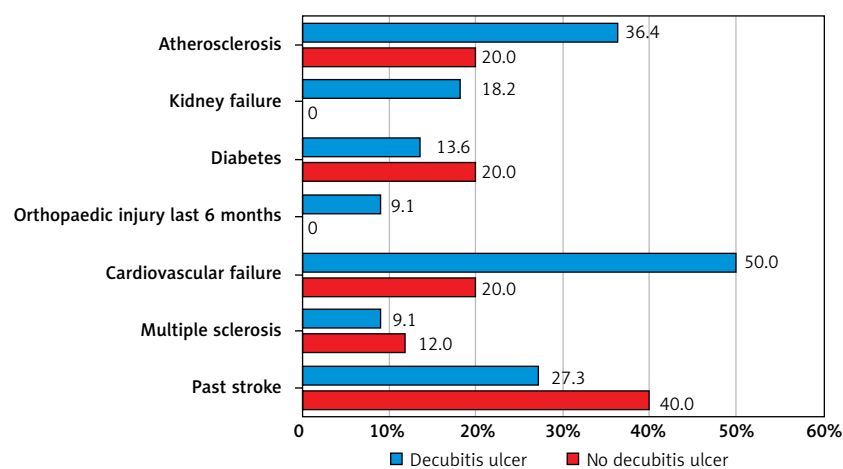


Figure 2. Comorbidities vs. incidence of sores

$\pm 3.25 \text{ kg/m}^2$, and in the group of people without pressure ulcers it was $22.0 \pm 3.88 \text{ kg/m}^2$ ($p = 0.003$). The nutritional status was assessed using the recommended NRI scale. The relationship between the NRI assessment and the risk of pressure ulcers in both stages of the study was found. In test 0 of the study it was 90.9 points ($p < 0.001$), and in test 1 it was 82.04 points ($p < 0.001$). Detailed data, presenting the collected measurements and the division into groups of patients covered by the study, are included in Table 2. A correlation was found between the nutritional status of the respondents and the risk of developing pressure injuries. When examining nutritional status, including double albumin measurement, in both tests of the study, the presence of a statistically significant difference was confirmed in the albumin level in test 0 in the group of people with and without pressure ulcers ($p < 0.001$). The albumin level in test 1 was higher in people who did not have pressure injuries (mean $3.33 \pm 0.48 \text{ g/dl}$) compared to people with pressure ulcers (mean $2.82 \pm 0.50 \text{ g/dl}$) ($p < 0.001$).

Discussion

Chronic wounds, including pressure ulcers, constitute a global problem in medical practice. From a therapeutic, as well as a social and economic perspective, despite modern therapy, and available medical and preventive products, the number of patients has been drastically increasing. It is estimated that pressure ulcers occur in 1/10 of hospitalised adult patients. The incidence of pressure ulcers in US nursing long-term facilities is on average 8.2–32.2%. Complications resulting from the occurrence of pressure sores can be varied and lead to limb amputation, sepsis, or death [15]. The present study offers a clear picture of the profile of the potential resident staying in a long-term care facility requiring constant interdisciplinary care. A sick, elderly man with many chronic diseases has significant deficits in self-care and limited intellectual abilities. Despite proper and careful care in such a specific sample of respondents, the occurrence of pressure ulcers and their high level of development risk is not surprising. There was a belief that pressure ulcers were common in chronic patients as a result of a deficit of or unprofessional care. In 2008 a panel of experts was appointed to formulate a consensus regarding skin lesions at the end of life (skin changes at life's end – SCALE). It was noted that the occurrence of so-called “unavoidable pressure ulcers” is highly likely to occur in critically ill patients and patients at the end of life [16, 17].

In their study, Pilch *et al.* [18] confirmed that circulatory system failure affected 70% of the respondents, and nutritional disorders predisposed to the development of pressure injuries. According to Lee *et al.* [19], the occurrence of pressure sores in the heel area in patients of the intensive cardiovascular therapy wards

draw attention to the significant impact of dysfunction of the vascular system, eating disorders, and age. The authors pay attention to the high importance of cardiovascular failure and low perfusion leading to hypoxia and secondary tissue destruction.

The problem of malnutrition is the second risk factor connected with sarcopaenia and the occurrence of pressure ulcers; it is associated with poor functional outcomes in people covered by long-term care. Kokuura and Momosaki [20] in their work on evaluation of malnutrition according to GLIM (Global Leadership Initiative on Malnutrition) criteria in Japan showed that 12–54% of elderly people admitted to long-term care facilities were malnourished. In our study, when the concentration of albumin was assessed twice in peripheral blood, their level showed a significant statistical difference in the group of people with and without pressure ulcers in both measurements ($p < 0.001$ and $p < 0.001$). The albumin level in both cases was higher in the respondents without pressure injuries compared to subjects with pressure ulcers. The average albumin concentration in test 0 in people with pressure ulcers was 2.76 g/dl and in people without pressure ulcers it was 3.28 g/dl . In turn, in test I, the average albumin level in people with pressure ulcers reached 2.82 g/dl , while in people without pressure ulcers it was 3.33 g/dl . Bazaliński *et al.* [21] confirmed the need to monitor biochemical parameters, including albumin, and to conduct assessments using clinical scales in relation to the risk of pressure ulcers. The authors point out that patients with the lowest albumin levels also had the highest recorded C-reactive protein (CRP) values. This suggests mobilisation of this type of protein during protein production in the acute phase. In our study, CRP values were not monitored in the study group; hence, it is not possible to clearly compare the group of patients requiring intensive care, and patients receiving long-term care; however, the importance and significance of the albumin level in the prevention of pressure ulcers was confirmed.

In the global guidelines for the prevention and treatment of pressure injuries published in 2019, it was recommended to “determine the frequency of position changes taking into account the individual level of activity, mobility, and ability to change positions independently” at the level of evidence, and “using the position lying on the side at an angle of 30° , preferring the lying position at an angle of 90° when laying” was recommended at the evidence level [11]. As shown in our study, the position in the study group was changed on average every 3 h, and as a part of the prevention of pressure sores, rollers (42.6%) and anti-decubitus discs (72.3%) were also used. Soy Buğdaycı and Paker [22], in their Cochrane review summary in 2021 in the field of patient positioning, confirmed that the position change in patients should take into account their individual level of activity, mobility,

and ability to independently change position. They also compared the risk of developing pressure ulcers in groups of people in whom the positioning was changed every 2 and 4 h regardless of support surface. They did not confirm clear evidence in relation to the increased or decreased incidence of pressure ulcers.

Experts from the Polish Wound Healing Association recommend implementing local prophylaxis in the form of skin care, changes in positioning, and the use of topical dressings to protect tissues from physical forces [23]. Chrzan *et al.* [24] emphasise the role of secondary anti-decubitus prevention in the treatment of bedsores. The research was conducted over 18 months and 12 months in 2 independent facilities, among patients admitted to the palliative ward. Full anti-decubitus prophylaxis was implemented in 124 of the 300 patients. An important role in prevention was demonstrated by nurses. Despite the lack of modern equipment in 59 patients, no new damage to the skin and soft tissues occurred.

McLarney *et al.* [25] presented the results of an analysis of the documentation of 148 patients treated for COVID-19 in the intensive care unit. They showed that decreasing body mass index may predispose to an increased risk of pressure ulcers in the Braden scale. The analysis of our results showed statistical significance between BMI measurement and the risk of pressure ulcers, which confirms the observations of other authors, related to the loss of muscle mass. The guidelines and expert recommendations advise the use of pressure relief to reduce the risk of pressure ulcers [11, 26]. As demonstrated by our study, selection of an anti-decubitus mattress, change of position, and use facilitation in the study group shows strong statistical significance ($V_{Cr} = 0.52$) in the group of patients with pressure ulcers who used a tubular alternating pressure mattress. Woo *et al.* [27] evaluated the effectiveness of a nutritional support protocol for patients with pressure ulcers in a prospective study and proved that nutritional support carried out with regular monitoring of biochemical parameters such as: prealbumin, transferrin, cholesterol and zinc in serum, was the most effective preventive factor leading to improvement in the treatment of pressure ulcers. A correct nutritional level accounts for many aspects of health, reduces the risk of pressure sores, and improves the wellbeing of patients [26, 28].

The literature review confirms our observations related to the assessment of selected variables regarding nutritional status and comorbidities that impact the functionality of patients, which are strong predictors of pressure ulcers. Although the occurrence of skin damage is in many cases inevitable, the prevention of these events is cheap and highly effective in the process of deepening the destruction. Superficial bedsores are not a threat to patients, but fulminant

and deep ones can be costly in long-term treatment, increasing the risk of serious health problems.

Conclusions

Hypoalbuminaemia in the course of chronic diseases, including renal and systemic circulation failure, increase the risk of pressure ulcers in the group of respondents in long-term care. A significant self-care deficit resulting from general condition and dementia is a strong predictor of the risk of pressure ulcers. Implementation of multidirectional and interdisciplinary prevention is the basic pillar of professional care for the chronically ill. Regular assessment of nutritional status and values of blood biochemistry enables early detection of the risk of malnutrition and implementation of subsequent therapeutic actions.

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Ethical approval

The study protocol was approved by the Bioethics Committee of the University of Rzeszow: Resolution No. 2018/01/07 of 11 January 2018).

Conflict of interest

The authors declare no conflict of interest.

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