

# A path analysis study of factors influencing decubitus in a geriatric nursing home: a preliminary study

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**A** – Study Design, **B** – Data Collection, **C** – Statistical Analysis, **D** – Data Interpretation, **E** – Manuscript Preparation, **F** – Literature Search, **G** – Funds Collection

**Summary Background.** 33.3% of the elderly who stayed and were treated at a geriatric nursing home in Dewanata, Cilacap, Indonesia, experienced decubitus. Nutritional status, length of bed rest, inappropriate use of mattresses, immobilization, and skin moisture due to frequent incontinence are considered to be a factor influencing the high incidence of decubitus in this area.

**Objectives.** The study aims to analyze the effect of nutritional status and bed rest on pressure, humidity, and friction and its effect on decubitus.

**Material and methods.** This case-control study involved 30 respondents who experienced decubitus as a case group and 30 respondents as a control group with no decubitus. Nutritional status, bed rest, pressure, humidity, and friction were observed and measured one by one through standard instruments. Data were analyzed by path analysis. Furthermore, the results were selected as a model to obtain an overview of the correlation between variables.

**Results.** There was a direct effect of nutritional status ( $p_{2x1}$ : -0.347) and duration of bed rest ( $p_{2x2}$ : 0.347) toward decubitus incidents, and there was an indirect effect of nutritional status and bed rest on decubitus incidents by pressure factor ( $p_{y1z}$ : 0.327), humidity ( $p_{y2z}$ : 0.264) and friction ( $p_{y3z}$ : 0.230).

**Conclusions.** Nutritional status and bed rest have an effect on pressure, humidity, and friction, which increases the incidence of decubitus in older people who stay in a geriatric nursing home.

**Key words:** geriatric nursing, nutritional status, bed rest, friction, pressure ulcer.

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## Background

The decubitus is still a significant and complicated health problem in hospitals and other public health services, one of which is in the geriatric nursing home. Incidences of decubitus have risen in the aging population, especially in those with disabilities [1]. In general, a study illustrated that the prevalence of decubitus in patients administered to the hospital was 18.96%, women put at the highest incidence, while men [2].

In Indonesia, there is no national data on decubitus prevalence rates. However, several studies conducted in several hospitals and other public health services in several cities in Indonesia discovered the prevalence of decubitus ranged from 3.6–10% [3, 4]. The incidences of decubitus occurred mostly in the elderly group. The elderly presented a greater risk to suffer from decubitus due to several factors, such as various chronic diseases, nutritional factors, immobilization, tissue ischemia, reduction of sensory perception, friction, sleep position shifts and caregiver factors [5–7].

30 (33.3%) out of 90 elderly who lived and were treated in the geriatric nursing home in Dewanata, Cilacap, Indonesia, experienced decubitus. The highest incident occurred in the elderly who experienced immobilization problem. Immobilization causes the elderly to rest for long periods of time, resulting in lengthy stress on certain body tissues. Skin moisture due to urine exposure in the elderly who experienced immobilization also stimulated the risk of decubitus [8].

Mattress materials selected in the geriatric nursing home in Dewanata, Cilacap, Indonesia, were also considered as a factor which caused a high incidence of decubitus here. Not all el-

derly who lived and were treated in the geriatric nursing home in Dewanata, Cilacap, Indonesia, utilized a special mattress for decubitus prevention because this health service belonged to the government, which had limited funds and budget. Inappropriate mattresses, such as those with a rough and hard surface, increase pressure and friction on the skin, thereby stimulating the incidence of decubitus [9, 10]. Poor nutritional status often experienced by the elderly could also raise the risk of decubitus, and the study revealed that poor nutrition could accelerate decubitus [11].

Based on the factors thought to be the cause of the high number of decubitus in the geriatric nursing home, Dewanata, Cilacap, Indonesia. This study aims to analyze the pathways that cause decubitus in the elderly in this place. Thus, a solution can be immediately to reduce the number of decubitus events in that place or other geriatric nursing homes.

## Objectives

This study aims to analyze the effect of nutritional status and bed rest on pressure, humidity and friction, and its effect on the incidence of decubitus in older people in the geriatric nursing home in Dewanata, Cilacap, Indonesia.

## Material and methods

### Study design

The design of this study was a case-control study.



## Study location and respondents

This study was conducted in the geriatric nursing home in Dewanata, Cilacap, Indonesia, in May–October 2018. The population in this study was all older people living in the geriatric nursing home in Dewanata, Cilacap, Indonesia. The sample selected in this study was decubitus elderly ( $n = 30$ ) and non-decubitus patients ( $n = 30$ ) as a control group.

## Variable and measurements

The variables studied were nutrition (X1) and the duration of bed rest (X2) as exogenous variables, while pressure (Y1), humidity (Y2), and friction (Y3) were endogenous and intervening variables. An incidence of decubitus (Z) was selected as an endogenous variable or the effect [12].

The Body Mass Index (BMI) of all respondents was calculated to determine their nutritional status (malnutrition  $< 18.5$  kg/m<sup>2</sup>; normal nutrition: 18.5–24.9 kg/m<sup>2</sup>; over nutrition:  $> 25$  kg/m<sup>2</sup>) [13], then, observed an average bed rest per day. Body pressure on the bed of respondents was also measured using a sphygmomanometer mattress (low pressure: 6–12 mm Hg; moderate pressure: 13–20 mm Hg; high pressure: 21–32 mm Hg) [14]. Skin moisture was calculated via a digital moisture monitor for skin ( $\leq 33\%$ : very dry skin; 34–37%: dry skin; 38–42%: normal skin; 43–50%: moist skin) [15]. The friction variable was measured through friction tools modified from the Braden Scale (Mild, Moderate, and Hard friction) [16].

## Statistical analysis

The analysis implemented was path analysis, which was a further section of regression analysis [17–19]. To assess the feasibility of the data, prerequisite tests were conducted, such as normality, multicollinearity, linearity, and autocorrelation. The result of the residual plot analysis discovered that the data was normally distributed. The result of multicollinearity analysis illustrated that there was no multicollinearity problem (the standard error was less than one); thus, the test results were considered to be reliable. The result of the ANOVA linearity test obtained a value of  $p < 0.001$ ; thus, the data was regarded to be linear, and the results of the residual analysis indicated no autocorrelation.

## Model fit evaluation

The preliminary assessment showed a good fit ( $\chi^2/df = 2$ ; CFI = 0.98, RMSEA = 0.04). Root mean square error of approximation (RMSEA) values of less than 0.05 showed a positive fit to the template [20]. The Comparative Fit Index (CFI) is regarded

to be marginal and a good fit with values higher than 0.90 [21]. The relative chi-square (CMIN/DF) is used to evaluate the model fit because it depends heavily on the sample size. A value of less than 3 is an acceptable fit [22].

## Ethical consideration

This study was approved by the Health Research Ethics Committee of Universitas Muhammadiyah Purwokerto, Reg. No.: KEPK/UMP/9/V/2018, and obtained research permission from the geriatric social service nursing home in Dewanata, Cilacap, Indonesia, under No.: 028/071/2018. All respondents signed an informed consent form. All patient data was guaranteed confidential and was only used for research purposes. The researchers did not provide incentives to the respondents.

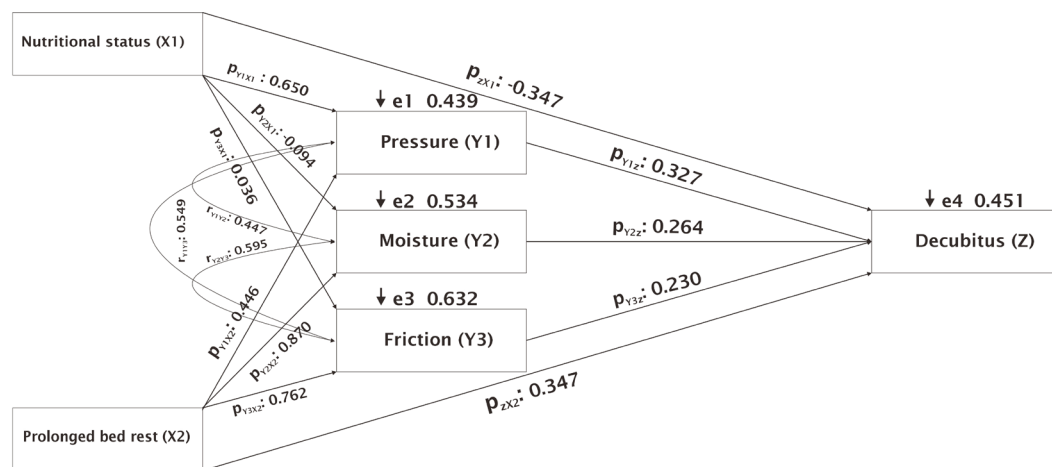
## Results

The respondents in both the case and control groups amounted to 75% female, ranging from 57 to 90 years of age ( $70.4 \pm 7.9$ ). 30% of the respondents suffered from malnutrition, while 20% experienced over nutrition. The duration of bed rest of the respondent varied between 7–21 hours/day, and most of the respondents in the case group lay in bed for more than 10 hours/day.

The results of the calculation of body pressure average on the bed ware  $18.2 \pm 5.1$  mm Hg, with a minimum pressure of 9 mm Hg and a maximum of 30 mm Hg. Only 13.3% of respondents obtained normal skin moisture, while 53.3% had dry skin, and 33.3% of the respondents had moist skin. On friction variable calculation, most respondents suffered from moderate friction (45%), and 40% of the respondents experienced a risk of hard friction, with only 15% of the respondents showing a minimum risk of friction.

The results of the study revealed that nutritional status significantly affected the pressure ( $p_{Y1X1}$ : 0.650), but there was no significant effect on moisture, and friction ( $p_{Y2X1}$ : -0.094;  $p_{Y3X1}$ : 0.036). The duration of bed rest significantly affected pressure ( $p_{Y1X2}$ : 0.446), humidity ( $p_{Y2X2}$ : 0.870) and friction ( $p_{Y3X2}$ : 0.762). The pressure was related to humidity and friction ( $r_{Y1Y2}$ : 0.447;  $r_{Y1Y3}$ : 0.549), and humidity was related to friction ( $r_{Y2Y3}$ : 0.595).

Nutritional status had a direct effect on the incidence of decubitus ( $p_{ZX1}$ : -0.347), and this negative relationship indicated that the lower the nutritional status, the greater the risk of decubitus. The duration of bed rest had a direct effect on the incidence of decubitus ( $p_{ZX2}$ : 0.347), meaning that the longer the bed rest, the higher the risk of decubitus. Nutritional status and duration of bed rest also indirectly affected the incidence of decubitus through pressure ( $p_{Y1Z}$ : 0.327), humidity ( $p_{Y2Z}$ : 0.264), and friction ( $p_{Y3Z}$ : 0.230). The structural results of the path analysis model can be seen in Figure 1.



**Figure 1.** Path diagram [18], the effect of nutrition, and duration of bed rest on pressure, humidity, and friction and its effect on the incidence of decubitus

$p$  – path coefficient is the direct effect of an exogenous variable on endogenous variables;  $r$  – correlation between variables;  $e$  – residual is the effect of other unobserved variables and error calculation.

## Discussion

The results discovered that nutritional factors and duration of bed rest directly affected decubitus incidents ( $p_{x1z}$ : -0.347;  $p_{xz}$ : 0.347). However, nutritional factors and duration of bed rest also indirectly influenced decubitus incidents through pressure, humidity, and friction ( $e4$ : 0.451). Malnutrition and food deficiency were the main risk factors for the onset of decubitus [23]. Some studies have also revealed that weight loss and inadequate nutritional intake had a higher risk of decubitus [24–27]. A person with underweight due to malnutrition often experienced muscle atrophy and subcutaneous tissue. As a result, the tissue role as a cushion between the skin and bones was thin. Therefore, the effect of pressure increases on these tissues accelerated the onset of decubitus [28].

Weight loss in malnutrition patients was also associated with a decline in total protein, albumin, hemoglobin, electrolytes, and vitamins [29, 30]. Total protein and hypoalbuminemia levels also correlated with the occurrence of decubitus [31]. Poor nutrition would disrupt fluid and electrolyte balance. The level of hypo protein and hypoalbuminemia reduced osmotic pressure, triggering displacement of the volume of extracellular fluid into the tissue, which affected to interstitial edema. Edema decreased the blood supply and oxygen in the tissues [14, 32]. A decline in oxygen supply accelerated tissue ischemia, which stimulated tissue injury [23].

This study also revealed an indirect effect of nutritional status and duration of bed rest on the occurrence of decubitus through a pressure factor ( $p_{y1z}$ : 0.327). This study discovered that improving nutritional status and length of bed rest would increase the pressure, which affected the incidence of decubitus. The study results support previous studies that found that obese patients were two times more at risk of experiencing decubitus than patients with normal weight [33]. Fat tissue could reduce decubitus at certain locations, especially on bone protrusions, because it worked as a cushion to protect the skin from pressure [34]. However, in moderate-to-severe obesity, fat tissue vascularisation was not good, and thus fat tissue and other underlying tissues were susceptible to damage due to ischemia [35].

Tissue damage occurred when the pressure on the capillaries was large and blocked the capillaries. If the pressure exceeded the norm (> 22.5 mm Hg), the capillaries would be closed, and vascularity to the tissue would be low, which triggered ischemia [36, 37]. When the patient was lying down or sitting, the pressure moved to the protrusion of the bone. The longer the pressure, the greater the risk of skin damage.

This study discovered that the duration of bed rest contributed to a significant effect on skin moisture and friction ( $p_{y2x2}$ : 0.870;  $p_{y3x2}$ : 0.762), while the nutritional factor did not significantly influence skin moisture and friction ( $p_{y2x1}$ : -0.094;  $p_{y3x1}$ : 0.036). However, both nutritional factors and duration of bed rest had an indirect effect on decubitus through the humidity and friction factor ( $p_{y2z}$ : 0.264;  $p_{y3z}$ : 0.230). The duration of bed rest is directly related to immobilization problems, as these patients tended to rest in bed longer than patients with no immobilization problem. Long bed rest would stimulate pressure, humidity, and friction between the skin and bedcovers, which affected decubitus.

Patients with immobilization problems also tended to experience incontinence. The incidence of decubitus in incontinent patients was higher than for patients with no incontinence, especially patients with faecal incontinence [8]. The results of previous studies also showed that there was a correlation between incontinence and skin moisture, which contributed to the occurrence of decubitus [38]. Skin exposed to urine, feces, or sweat for hours was more susceptible to irritation and damage. This might occur in people who often wear wet diapers for a longer period. Softened skin tended to be damaged [39]. Humidity might accelerate compressive wounds by increasing the coefficient of friction (COF) between the skin and textiles. Therefore, reducing the moisture of the patient's skin was the main step to prevent compressive wounds [40].

## Limitations of the study

The number of samples in this study was not well calculated, and the researchers only analyzed the cases in the study location, neglecting the minimum sample size. To obtain satisfying results, samples should be above 100.

## Conclusions and recommendations

Nutritional status and bed rest have an effect on pressure, humidity, and friction, which increases the incidence of decubitus in older people who stay in a geriatric nursing home. The researcher advised the manager and health workers in the geriatric nursing home to pay attention to the nutritional status and length of bed rest of the elderly because poor nutritional status and long bed rest without changes in position could contribute to decubitus. Minimizing pressure by using a special decubitus mattress in immobilized patients, as well as reducing the skin's moisture in the elderly by changing diapers immediately, will reduce the effect of decubitus.

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