THE RELATIONSHIP BETWEEN FOOD INTAKE, DEMOGRAPHIC VARIABLES AND THE FORMATION OF PRESSURE ULCERS IN SOUTHEASTERN OKLAHOMA LONG TERM CARE FACILITY RESIDENTS

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CHAPTER ONE

INTRODUCTION

Pressure ulcers are not a new problem. Evidence of the condition has been found on the mummies of ancient Egypt (1, p 235), and pressure ulcers continue to constitute a major and ongoing problem for hospitals and long term care facilities across the United States. They are a source of concern not only in terms of pain and discomfort for the resident and anxiety for the family, but also they represent a financial burden to the facility. Patients with pressure ulcers require approximately 50% more nursing time, they remain hospitalized longer, and their hospital costs are higher than those without pressure ulcers (2).

The cost of pressure ulcer treatment in the United States is estimated to be greater than $5 billion dollars annually, with the cost per individual ulcer to be between $5,000 and $50,000 per year (3). The formation of pressure ulcers increases the use of supplies, equipment and nursing time, thereby increasing cost. These costs include staff time, materials used and possibly extra days of hospitalization. Given this information, it would seem that prevention of pressure ulcers is less expensive than treatment (4).

The presence or absence of pressure ulcers is acknowledged as an indicator of the quality of care given by a facility (5). The Secretary of Health and Human Services listed

pressure ulcers as a parameter for evaluating the quality of care delivered by long term care facilities in the Omnibus Budget Reconciliation Act (OBRA) (6, p 273).

Some residents are admitted to long term care with a pressure ulcer while other pressure ulcers develop in the facility. Another problem noted by long term care facility staff is that residents who have no skin breakdown but are hospitalized due to illness may return to the facility with pressure ulcers. This might occur with a hospital stay of only a few days. In animal studies, ischemic changes to muscle have been demonstrated with two hours of applied pressure and complete muscle degeneration with six hours (6, p 19).

The purpose of this study was to identify common characteristics among those residents of long term care facilities who develop pressure ulcers during hospitalization. Data for this study were collected from the medical records of residents of long term care facilities in Southeastern Oklahoma who were admitted to an acute care hospital without pressure ulcers.

Hypothesis

The objectives of this study are to investigate the relationships between medical history, demographics, anthropometric, biochemical and clinical data and the formation of pressure ulcers in long term care facility residents. These relationships were investigated in those who were residents of long term care without pressure ulcers but develop them while hospitalized.

The following hypotheses were developed for this study:

•Ho1 : there will be no significant differences in anthropometric measurements between patients who develop or do not develop pressure ulcers in the hospital;

•Ho2 : there will be no significant differences in any diagnoses between patients who develop or do not develop pressure ulcers in the hospital;

•Ho3 : there will be no significant differences in length of hospitalization between patients who develop or do not develop pressure ulcers in the hospital;

•Ho4 : there will be no significant differences in any medication between patients who develop or do not develop pressure ulcers in the hospital; and

•Ho5 : there will be no significant differences in any biochemical parameters between patients who develop or do not develop pressure ulcers in the hospital.

Definition of Terms

Pressure ulcer – a localized area of tissue necrosis that tends to develop when soft tissue is compressed between a bony prominence and an external surface for a prolonged period of time (7). Previously known as bedsore, decubitus or pressure sore.

OBRA - Omnibus Budget Reconciliation Act of 1989. Federal act mandating actions of the Health Care Financing Administration (HCFA) regarding long term care (6, p 273).

AHCPR - Agency for Health Care Policy and Research. A branch of the U. S. Department of Health and Human Services. Established under OBRA, 1989, to enhance the quality, appropriateness, and effectiveness of health care services and access to these services (6, p 274).

National Pressure Ulcer Advisory Panel (NPUAP) - a nonprofit multidisciplinary organization of health care professionals dedicated to the prevention of pressure ulcers (7).

Malnutrition - a condition caused by either an insufficient amount of food or the impaired absorption, assimilation, or use of foods (8).

Cachexia - a state of ill health, malnutrition and wasting in which the depletion of lean body mass occurs disproportionately to caloric intake (8).

Friction – Rubbing one object against another (8). May occur due to turning or moving in bed and may be the beginning of tissue breakdown in the epidermis. Friction is frequently associated with the formation of heel ulcers.

Shear – An applied force or pressure exerted against the surface and layers of the skin as tissues slide in opposite but parallel planes (8). Comes into play when the head of a bed is too high and the patient tends to slide down. Damage will result to the muscle tissue interface.

Eschar – A scab or dry crust resulting from a thermal or chemical burn, infection or excoriating disease (8).

Incidence - the number of new events occurring over a given time period, usually a year (3).

Prevalence - the number of new and old instances of a condition or event at one point or period of time as assessed on a survey of a population (3).

Trochanter – One of the two bony projections on the proximal end of the femur that serve as the point of attachment of various muscles (8).

Ischial tuberosity - A rounded protuberance of the lower part of the ischium. It forms a bony area on which the human body rests when in a sitting position (8).

Braden scale - an instrument developed by Barbara Braden, PhD, RN, and Nancy Bergstrom, PhD, RN, of the University of Nebraska Medical Center College of Nursing in 1987 for use in long term care facilities to assess the risk that a resident will develop a pressure ulcer. This scale contains a nutrition component (Appendix A).

ICD 9 Codes - International Classification of Diseases 9th Edition (8). A codification of diseases, injuries, conditions and procedures used to standardize reporting and allow international comparison of data.

DRG - Diagnosis Related Group (8). A system designed to standardize prospective payment for medical care.

Limitations of the Study

This study is based on a convenience sample of a limited population in a relatively small geographic area, and the results, therefore, cannot be generalized. As a retrospective study, it is limited to information available in the medical record of patients selected. A further limitation of this study was that no patient had been assessed for pressure ulcer risk on admission.

As a descriptive study, the project does not provide answers to the question of the causes of pressure ulcer development among long term care residents. It may, however, provide the basis for hypotheses in future analytic research.

CHAPTER TWO

REVIEW OF LITERATURE

Pathophysiology of Pressure Ulcers

Physiology of the Skin

In order to understand the causes and treatment of pressure ulcers, it is necessary to have a rudimentary understanding of the physiology of human skin. The integument is the largest organ of the body and has multiple functions. It protects the inner tissues from invasion, transmits sensations, regulates body temperature, aids in excretion and prevents excessive loss of body fluids. It consists of three layers, the epidermis, the dermis and the subcutaneous layer. The fascia lies below the subcutaneous layer (6, p 3).

Epidermis. The cells on the surface of the epidermis are constantly being replaced by new cells pushing to the top, and a new epidermis is formed every four to six weeks. This layer also contains melanocytes. These cells release the melanin that is responsible for skin color. With aging, the melanocytes become larger and less alike. This contributes to the changes in appearance of aging skin (6, p 4).

Dermis. The dermis supplies both support and nutrition to the epidermis (6, p 6). It is composed of collagen which provides strength and elastic fibers that help the skin stretch. In addition, it is rich with blood vessels and nerves, and it functions in wound healing. With aging, however, there is degeneration of collagen and elastic fibers that leads to loss of dermal and epidermal tissues as well as loss of elasticity (9).

Dermal-epidermal junction. The dermal-epidermal junction plays the important role of both separating and attaching the two layers. These layers fit together with structures that somewhat resemble a waffle iron. During aging, there is flattening of these structures with as much as a one-third decrease in the area of contact between the two layers. This condition predisposes the elderly to skin tears from dermal-epidermal separation (6, p 5).

Subcutaneous. The subcutaneous tissue is made up of both connective and adipose tissue and contains blood, lymph vessels, and nerves. Major functions of this layer include heat insulation, a reservoir of fat that can be utilized during periods of illness or starvation, and the mechanical aspect of shock absorption. As with all skin tissue, this layer thins during aging (6, p 6).

Fascia. The fascia performs the function of connecting the skin to the parts below it easing movement and providing a dense, connective tissue covering for muscles, nerves and blood vessels. It apparently does not undergo extensive changes during aging (6, p 7).

Aging Skin

The skin constantly renews itself, but there are changes that occur normally during aging. The number of sweat glands diminishes in addition to the atrophy of the various layers. There is little subcutaneous fat on the forearms and legs even though there may be excess abdominal or hip fat. This may result in the prominence of bony protuberances such as the heels or trochanters. Aged skin is thin, dry and inelastic. Older people frequently complain of itchiness of the skin and of being cold. Because of the reduced amount of melanin, the hair grays and Caucasian skin becomes whiter. Reduced cutaneous blood supply also contributes to a pale appearance during aging. Other factors that affect skin condition in old age are sun damage, heredity and hormone fluctuation. In short, the skin of elderly people becomes fragile and requires special care (6, p 9).

Pressure Ulcer Stages

The description of pressure ulcer stages by the Agency for Health Care Policy and Research (AHCPR) follows the recommendations of the National Pressure Ulcer Advisory Panel (7). This system indicates the depth of the pressure ulcer and describes its severity.

Stage I is described as nonblanchable erythema of intact skin (7). The skin is painful and warm when touched but should not be massaged because additional tissue damage may result. A low incidence of Stage I ulcers in dark-skinned patients and accompanying higher rates of full thickness ulcers has been reported (10). The Stage I

pressure ulcers in these patients may be more difficult to detect because the erythema may be masked by the melanin of dark skin, and, consequently, the assessment skills of the health care worker become even more important. Because of this problem, some studies do not collect data on Stage I ulcers.

Stage II is partial thickness skin loss. The identifying characteristic is broken skin. The outer layer of the skin is broken and involves the epidermis and/or dermis. It may be described as an abrasion, blister, or shallow crater (7).

Stage III is full thickness skin loss. A deep crater is present that may extend to, but not through, the fascia. There may be foul-smelling drainage and necrotic tissue present.

In Stage IV there is also full thickness skin loss but with extensive tissue damage accompanied by foul smelling drainage and necrotic tissue (7). The damage may involve the fascia, muscle, bone, and supporting structures such as tendons or joint capsules. Osteomyelitis or bone infection may develop and amputation may become a necessity. As many as 25% of nonhealing ulcers may have underlying osteomyelitis (6, p 60).

Closed Pressure Ulcer

A special situation is a closed pressure ulcer (6, p 59). Although closed pressure ulcers are not staged, they are caused by the same type of pathophysiological processes. A large bursa-like cavity below the skin is filled with necrotic debris that extends to the deep fascia or the bone. The skin remains closed until, eventually, it ruptures and creates a small fissure to the surface. The extent of the ulcer is not known until it is surgically opened; the only acceptable treatment involves surgical excision and closure.

Morbidity and Mortality

Stage IV ulcers have been associated with high morbidity and mortality but the presence and severity of co-existing conditions may account for the association of pressure ulcers and death. The appearance of new pressure ulcers during hospitalization may be markers for coexisting illnesses, impaired nutrition and poor functional status rather than an indication of increased mortality risk (11). Using the Norton scale to assess risk, Allman et al. (12) found no significant difference in death rate between hospitalized patients with pressure ulcers and those who were only at risk.

Assessment of Pressure Ulcer Risk

Health care professionals have realized the need for a standardized assessment tool to predict a patient's risk for developing a pressure ulcer. Several attempts have been made to develop an assessment tool.

Norton Scale. Doreen Norton did early work in the 1960's in Great Britain (13). Her scale grades the parameters of physical condition, mental state, activity, mobility and incontinence on a scale of 1 to 4 with 1 being very bad and 4 being good. Total scores can range from 5 to 20. Nutrition was considered under the "physical condition" category. The cutoff score for being considered "at risk" is 14 and 12 or below indicates high risk.

Gosnell Scale. The Gosnell Scale was based on the Norton Scale. Gosnell states her scale was published in 1973 and revised in 1983 (14). Categories evaluated are mental status, continence, mobility, activity and nutrition. Each category has a rating scale and

descriptive words or phrases with 5 the lowest or best score and 20 the highest or worst score. The cutoff score for "at risk" is 11 or higher. This scale is somewhat longer and more complicated than the Norton Scale.

Braden Scale. The Braden scale is in widest use (Appendix A). It attempts to overcome difficulties encountered in completing the Norton and Gosnell scales. The categories of the Braden Scale are sensory perception, moisture, activity, mobility, nutrition, and friction and shear (15). Each category is defined and each level of scoring is described with a brief word picture. Nutrition, for example, has categories of very poor, probably inadequate, adequate and excellent. Scoring ranges from one to four except for "friction and shear" that has a maximum of three points. The best possible score is 23 and the worst is 6 with a score of 16 generally accepted as the cutoff score for being "at risk". A score of 15 to 18 is now considered to be mild risk for older subjects (16). This scale has been tested extensively for inter-observer reliability and predictive validity (15); it may be used by staffs of long term care facilities to evaluate each resident on admission for pressure sore risk. In addition, it may be used as a research tool (17).

Bergstrom et al. (18) used the Braden scale to determine pressure ulcer risk. They found a mean score of 19.8 in subjects who did not develop pressure ulcers, 18.1 in those who developed a Stage I and 16.3 in those who developed a Stage II pressure ulcer.

Breslow and Bergstrom (19) found a low Braden scale score to be an important factor in identifying pressure ulcer risk. In their study of 200 skilled nursing facility residents, Bergstrom and Braden (20), found the Braden score one week prior to the first pressure sore was the strongest predictor of pressure ulcer development. Scores of 12 or

below indicated high risk, 13 to 15 were at moderate risk and 16 or 17 were at mild risk in this study.

Langemo et al. (3) reported that a cut-off score of 15 in the acute care setting and 18 in the skilled facility setting were the best predictors of pressure ulcer development. Their study followed 190 adults for two to four weeks.

Smith et al (5) reviewed articles reporting research on pressure ulcers in the elderly. They found the Braden scale has good sensitivity and specificity, is easy to administer and has inter-observer reliability. These researchers did not recommend any particular scale but suggest selecting one assessment instrument, using it on admission and reassessing every two weeks thereafter.

Peiper and Weiland (21) studied 91 patients in a rehabilitation facility that were followed for 5 to 49 days. They found thirty eight percent to be at-risk for pressure ulcers using a Braden score of 16 as the cut-off point.

Tourtual et al. (22) attempted to determine the predictors of hospital acquired heel pressure ulcers. They found a statistically significant difference in Braden scale scores between subjects who did and who did not develop pressure ulcers. The mean score of the ulcer group was 16.21 ± 3.25 compared to the non-ulcer group which scored 18.36 ± 3.20. Surprisingly, when comparing scores of the subscales of the Braden scale between the two groups, however, they found a statistical difference in each item except the nutrition item.

Researchers have used the Braden Scale to evaluate pressure ulcer risk in acute care, long term care, rehabilitation centers, Veterans Administration hospitals, home care

and hospice. The reliability of scoring by various health care professionals has been validated. A score of 15 or lower is accepted as a reliable indicator of risk for acute care patients and a score of 16 to18 is considered an indication of pressure ulcer risk for long term care residents (16).

Some researchers, however, have reported limitations of the Braden Scale. In a study that evaluated fifty patients, Capobianco and McDonald (23) found two groups who developed Stage 1 pressure ulcers but had not been identified by the Braden Scale as being at risk. The first group was underweight patients. The degree of underweight was not given, but they did state the patients were underweight at admission. The second group was patients who had an acceptable overall score, yet had scored low on the nutrition component.

Three of the fifty patients in the Capobianco and McDonald study were predicted to be at risk and but did not develop pressure ulcers. The factors these three patients had in common were:

- they were placed on alternating air mattresses at admission;
- they had a history of cardiovascular disease and hypothyroidism;
- they were receiving the thyroid hormone replacement drug levothyroxine.

The researchers did not attempt to draw conclusions regarding the significance of these commonalties. False negatives as well as false positives are to be expected with any rating scale. Few false readings have been reported with the Braden Scale, it may be the best predictive tool available at this time (22).

Theories of Pressure Ulcer Development

Maklebust and Sieggreen (6, p 24) describe two of the theories of mechanisms for pressure ulcer formation. The top-to-bottom approach suggests the ulceration occurs first in the epidermis and later in the deeper tissues. In other words, the damage occurs first to the outer layer of skin, and the necrosis gradually extends to the inner tissues. In contrast, the bottom-to-top school of thought states the damage occurs first in the deep skeletal muscles and connective tissues. The tissue necrosis moves to the surface and becomes evident. These authors state both models may be accurate in different situations but that more research is required to determine the exact process.

Risk Factors for Developing Pressure Ulcers

Friction and Shear. Friction and shear are discussed by Maklebust and Sieggreen (6, p 24). They state that shear occurs when the head of the bed is elevated to a semi-reclining position of greater than 30° and the patient "slides down." Tissue attached to bone is pulled in one direction because of body weight but the epidermis remains stationary. Damage to deep tissues results. Friction is a situation occurring primarily when the patients cannot lift themselves sufficiently during positioning. Controlling these factors is crucial to controlling pressure ulcer formation.

Immobility. Several researchers have noted the importance of immobility in the development of pressure ulcers (10, 19, 24, 25). Bergstrom et al. (18) conducted a multi-site study involving 843 patients to determine if there was a difference in the preventive

services prescribed for people who do or do not develop pressure ulcers. Turning was prescribed for older subjects more than for the younger subjects in this study and less than half the time for patients who were at low or moderate risk for pressure ulcers. These researchers found that physicians did not perform risk assessments and were not informed of the risk scores that were obtained by the research staff. They hypothesized that if more risk assessments had been performed, more turning might have been prescribed for at-risk subjects. Further research is needed to clarify the relationship between turning and pressure ulcer development.

Turning is considered costly because of the labor required (5) but the exact frequency of turning required probably varies among patients. Data have not been gathered to substantiate the claim that turning is cost effective, according to these authors.

Incontinence. Moisture is a factor in pressure ulcer formation. Urinary and fecal incontinence make this component especially pertinent to many residents of long term care facilities. In their study that included 291 subjects, Tourtual et al. (22) found that two statistically significant variables for heel ulcers were incontinence and the moisture item on the Braden Scale This was not an expected finding. Spector et al. (26) reported that 35.4% of their subjects with pressure ulcers had foley catheters and, therefore, no exposure to urine. To explain the apparent incongruity of this information, Tortural et al. (22), suggest the physical factors that lead to incontinence may be the actual predictors for heel pressure ulcers, not the moisture itself.

A literature review by Jeter and Lutz (27) found evidence that incontinence, particularly the moisture associated with fecal incontinence, is a primary risk factor for

pressure ulcer development. Normal skin has a protective acid mantle, but when urine and feces combine, the bacteria in the stool changes the urea in the urine to ammonia which shifts both the skin and the stool to the alkaline range. In this alkaline medium, the digestive enzymes are reactivated which may explain the deleterious effects of fecal incontinence on the skin. These researchers found that Stage I and Stage II ulcers may heal once the patient becomes dry. Jeter and Lutz (27) further state the most important concepts in the care of incontinence are that skin integrity will be compromised quickly by the caustic effects of urine, stool and irritating cleansers. The other important concept these workers propose is that skin is vulnerable to injury from vigorous scrubbing, abrasion, pressure when the patient is moved or repositioned, is placed on a bedpan, or is wearing restrictive garments or devices.

Schnelle et al (25) assessed skin disorders and moisture in 100 incontinent residents of long term care facilities. They found the severity of incontinence to be related to pressure ulcer development. There was a positive correlation between the severity of incontinence and the severity of the blanchable erythema. The severity of blanchable erythema was predictive of Stage I (nonblanchable erythema) and Stage II pressure ulcers.

Other researchers have found incontinence, particularly fecal incontinence, to be a risk factor for developing pressure ulcers (12, 19, 24). Excess moisture is a common problem with both standard and pressure-reduction mattresses and this contributes to pressure ulcer formation (10). Berlowitz and Wilking (2) found that patients with a Foley catheter were prone to develop pressure ulcers in their study that included 301 hospital admissions. Controlling moisture may be key to controlling skin breakdown. Moisture

from incontinence, perspiration, or wound drainage makes the skin susceptible to injury (17).

Age. Bergstrom et al. (18), discovered that long term care residents who developed pressure ulcers were older, 79.7 years, than those who did not, 73.6 years, illustrating the fact that pressure ulcer formation is frequently associated with advanced age. According to Allman et al (24), age greater than 75 years is associated with pressure ulcer development while Breslow and Bergstrom (19) state "older age" is a risk factor. In a study of 200 subjects, Bergstrom and Braden (20) found those who developed pressure ulcers were significantly older than those who did not. With Stage I, the mean age was 80 ± 7 years ($P < 0.01$). With Stage II+, the mean age was 81 ± 7 years ($P < 0.001$). For those who did not develop pressure ulcers, the mean age was 77 ± 7 years. There was, however, no statistically significant difference in age between those with Stage I and Stage II+ pressure ulcers. Tourtual et al. (22) found their subjects who had heel pressure ulcers were significantly older than those who did not.

In their report of the Fourth National Pressure Ulcer Prevalence Survey, Barczak et al. (10) found that more than half the patients in the survey with pressure ulcers were over 70 years of age. The authors stated that in 1995, when the survey was conducted, 13% of the United States population was 65 years of age or older and that this age group accounted for 29.5% of hospital stays. Furthermore, their average length of hospital stay was 8.4 days compared with 5.4 days for younger persons. They found that 29% of the age group 71 to 80 years had pressure ulcers. This has been the age group with the greatest number of pressure ulcers in all the pressure ulcer prevalence surveys.

Of the 843 subjects in six facilities studied by Bergstrom et al. (18), the oldest were long term care facility residents and among these, residents who developed Stage I or II pressure ulcers were significantly older than those who did not. Those with no pressure ulcers averaged 73.0 years, those with Stage I had a mean age of 73.6 years and those with Stage II had a mean age of 79.7 years. When samples from all facilities were pooled, there was a significant difference in age between subjects who developed pressure ulcers and those who did not with the older subjects developing more Stage II ulcers.

In contrast, Peiper and Weiland (22) worked with a younger population in a rehabilitation facility caring primarily for patients with spinal cord injuries. They used a Braden score of 16 to determine "at-risk" status and found no significant difference in age between the at-risk, 56.6 ± 20.2 years, and the not at-risk, 59.1 ± 16.4 years.

Smith et al. (5) suggest another possible reason for the increased diagnosis of pressure ulcers in older subjects. They point out the proportion of over 85 year olds is increasing in the general population, and they assert that, as the size of this age group increases, age will continue to play a major role in pressure ulcer prevention and treatment.

Gender. In a large study (843 subjects) conducted in two skilled nursing homes, two university operated tertiary care hospitals, and two Veteran's Administration Medical Centers, Bergstrom et al. (18) found that, overall, females had proportionately more pressure ulcers than males even though females were more likely to have pressure reduction surfaces ordered by their physician. There were no significant differences

between the numbers of male and female subjects who developed pressure ulcers in any of the individual locations. When the data were combined, the researchers found 16% of the women and 11% of the men had developed pressure ulcers and this difference was significant (P=0.05).

Barczak et al. (10) found that of the patients identified with pressure ulcers in the Fourth National Pressure Ulcer Prevalence Survey, 48% were female and 47% were male. Gender was not reported in 5% of the patients. In the study by Tourtual et al. (22), 16.3% of the females and 10.5% of the males developed pressure ulcers.

Many studies do not report differences by gender (11, 12, 24, 25, 28), others have reported that gender did not differ between those who did or did not develop pressure ulcers (2, 18, 21). Other studies do not specify the gender of their subjects (3, 4, 29). Bergstrom and Braden (20) reported that females demonstrated slightly more pressure ulcers than males. Conclusions cannot be drawn from this information, however.

Race. Bergstrom et al. (18) evaluated the relationship between race and the formation of pressure ulcers and found white subjects had a higher incidence of pressure ulcers than African American or others. This finding concurred with an earlier study by these same workers (20). Peiper and Weiland (21), however, reported a different finding in a study that followed 91 subjects. They found that risk status was not significantly different between the Caucasian and African American patients. Barczak et al (10), reached yet another conclusion. Of the patients observed in the Fourth National Pressure Ulcer Prevalence Survey, 77% were Caucasian and 16% were African American. These researchers found that of the Caucasians who had pressure ulcers, 46% had Stage I, 34%

Stage II, 8% Stage 3, 5% Stage IV, and 7% eschar. Among the African American patients who had pressure ulcers, 19% had Stage I, 39% Stage II, 15% Stage III, 12% Stage IV and 14% eschar. They suggest that among dark skinned persons, Stage I ulcers are more likely to go undetected, and they will not receive the level of care required to prevent deterioration to a partial-thickness or full-thickness ulcer.

Skin pH. Jeter and Lutz (27) reviewed the etiology of adult incontinence dermatitis. They state that this condition is due to a series of events that cause the skin to weaken and become vulnerable. They list the factors that can bring about skin breakdown as moisture from urine and sweat accompanied by frequent washings and increased friction and shear leading to physical and chemical irritation. Fecal enzymes attack the skin producing ammonia and increasing pH, accompanied by an increase in enzymatic and microbial activity and resulting in incontinence dermatitis. At this point, pressure, poor nutrition and concurrent diseases can result in partial-thickness or full-thickness skin loss.

Jeter and Lutz (27) further state the pH of normal skin is slightly acid but that most bar soaps are alkaline and are, therefore, not appropriate for use on "at risk" skin. The authors state that using alkaline soap removes the skin's natural acid covering and encourages microbial growth.

Dry Skin. A report by Capobianco and McDonald (23) with 50 adult medical/surgical patients revealed that those admitted to the study during winter months developed more than three times the number of pressure ulcers than those admitted during warm weather. These authors suggest one possible explanation for this

phenomenon is that cold, dry weather leads to dry skin that is more vulnerable to the development of pressure ulcers.

Allman et al (24) found dry sacral skin to be an important predictor of in-hospital pressure ulcer development in chairfast or bedfast patients. Barczak et al (0) state that preventive intervention should be initiated when an immobile patient has dry sacral skin. The Agency for Health Care Policy and Research (AHCPR) (17) recommends that dry skin should be treated with moisturizers. They further recommend that the environmental factors of humidity less than 40% and exposure to cold should be minimized to help prevent skin breakdown.

Length of Hospital Stay. In a study of hospital acquired heel pressure ulcers, length of hospital stay was identified by Tourtual et al. (22) as statistically significant. Their ulcer group had a mean length of stay of 21.42 ± 21.72 days and the non-ulcer group had a mean length of stay of 8.56 ± 9.82 days (p .0001). In addition to longer hospital stays, the ulcer group had other statistically significant differences. They were older, had lower initial and final weight, lower initial and final hemoglobin and albumin levels, and had the highest pulse readings and a greater number of diagnoses.

Allman et al (24) followed 286 patients in a large urban, teaching hospital who were 55 years or more, were expected to be hospitalized at least 5 days or who had a hip fracture, and who did not have a Stage II or greater pressure ulcer on admission. The factors analyzed in this study were age of 75 years or more, dry sacral skin, nonblanchable erythema of the sacral skin, previous pressure ulcer, immobility, fecal incontinence always present, depleted triceps skinfold, lymphopenia and decreased body

weight. The main outcome measured was whether a Stage II or greater pressure ulcer developed during hospitalization and when it developed. They found pressure ulcers developed in 12.9% of the subjects with 73% of those developing within the first three weeks of hospitalization. These workers also found that longer hospital stays were associated with a higher incidence of pressure ulcers in each of the factors analyzed in their study. For example, among the group of patients greater than 75 years, 1.6% had a pressure ulcer on day 7, 11.9% at day 14, and 32.8% had pressure ulcers at day 21. The authors state this makes identification of the risk factors on admission critical.

Smith et al (5) reviewed 221 original investigations and found that among patients who developed pressure ulcers in the hospital, 34% to 81% developed in the first seven days and that 58% to 92% developed by the 14th day. They stated all the patients studied were elderly and many had hip fractures. They recommend very early intervention in the high risk populations.

Bergstrom et al (18) randomly selected 843 adult patients in a total of six facilities who did not have pressure ulcers when admitted. They found 108 (12.8%) of the subjects developed pressure ulcers and that 92% of these developed within the first three weeks following admission.

Peiper and Weiland (21) followed 91 patients in an acute rehabilitation facility. They found the patients at-risk for pressure ulcers had significantly longer rehabilitation stays, 21.6 ±11.3 days, than the not at-risk, 16.3 ± 6.7 days.

In an earlier study conducted in a skilled nursing facility, Bergstrom and Braden, (20) observed 200 newly admitted residents and found that 80% of the pressure ulcers

developed within two weeks of admission to a hospital and 92% developed by the third week.

Longer patient stay in these studies resulted in more pressure ulcers illustrating the need for early intervention. The average length of stay in Oklahoma hospitals as reported by the American Hospital Association (31) is decreasing, however. The 1993 average was 6.4 days and in 1998 the average length of stay was 5.5 days.

Decreased Food Intake and Malnutrition. Nutrition has been shown to play a role in both the prevention and healing of skin breakdown (32), and Medical Nutrition Therapy which includes both assessment and support is recommended. Breslow and Bergstrom (19) found in a literature review that risk factors for development of pressure ulcers may be nutritional or nonnutritional, and they considered malnutrition to be a major risk factor. They state risk factors for developing pressure ulcers associated with nutrition include inadequate protein and caloric intake, a poor Braden scale score and possibly low serum albumin.

Breslow and al. (29) found that inadequate dietary intake and protein calorie malnutrition were major risk factors for pressure ulcers in the 28 patients they studied. Subjects were deemed malnourished if serum albumin was less than 35 g/L or body weight was greater than 10% below the midpoint of the recommended weight range. For this study, subjects received nutritionally complete formulas either as tube feedings or as meal supplements. Formulas provided either 24% or 14% of the total calories from protein. The decrease in ulcer size demonstrated in this study correlated with dietary protein intake per kg body weight ($r_2 = -0.63$, $P < 0.01$). The authors concluded that high

protein diets may improve healing of pressure ulcers and that a high protein diet with calories adequate for weight maintenance should be provided to malnourished patients who have pressure ulcers. They state that aggressive nutritional, medical and nursing support is appropriate for patients who have inadequate dietary intake and protein calorie malnutrition.

Bergstrom and Braden (20) found the dietary intake of the 200 subjects in their study to be poor. The overall intake provided less than 70% of the RDA for calories. The energy intake of subjects who developed Stage I pressure ulcers was significantly lower. 52.8 ± 25.4 % of the RDA ($P < 0.001$), than those who did not develop pressure ulcers, 68.8 ± 26.1 %. In addition, there were significant differences in protein intake. The mean protein intake of those who did not develop pressure ulcers was 104 ± 41.5% of the RDA. Subjects with Stage I ulcers had a mean protein intake of 88.8 ± 44.0 % of the RDA ($P < 0.001$) and those with Stage II or greater, 92.9 ± 46.9% ($P < 0.01$). These figures were significantly lower than the mean protein intake of those without pressure ulcers. Bergstrom and Braden further report the intake of Vitamin C for all subjects in the study was greater than 100% of the RDA while the mean zinc intake was low for all groups but not significantly different between groups.

Other Risk Factors. In addition to factors already discussed, weight loss or excessive weight may be factors in developing pressure ulcers (6, 10). Allman et al. (24) found significant associations between previous pressure ulcers, triceps skinfold measurement (TSF), depleted for the age group, lymphopenia, and decreased weight and the formation of pressure ulcers using Kaplan-Meier survival analyses ($P < .05$). Further,

fecal incontinence was correlated with immobility, increased age with decreased body weight, and body weight was strongly correlated with TSF thickness ($P < .001$) in all instances). Among bedfast or chairfast patients, important predictors of pressure ulcer development were lymphopenia and decreased body weight. They found that the more of these risk factors that were present on admission, the greater the probability of pressure ulcers developing during the hospital stay. Interestingly, the associations between fecal incontinence and immobility and between age and body weight did not help predict pressure ulcer formation in these immobile patients.

The study conducted by Allman et al. (12) examined 634 adult patients to determine the prevalence of pressure ulcers among those who had been bedfast for at least one week. They found fractures as an indicator of the patients at risk for developing pressure ulcers.

Peiper and Weiland (21) found thirty-five of ninety-one patients were at-risk for pressure ulcer development using a Braden Scale score of 16. These thirty-five patients had significantly more diagnoses, 5.8 ± 2.2, than those not at-risk, 4.8 ± 1.8, ($p < 0.02$).

Bergstrom and Braden (20) found both elevated body temperature and decreased blood pressure to be significantly different between those who developed pressure ulcers and those who did not. They suggest the combination of fever, hypotension and low Braden Scale scores should be considered risk factors for pressure ulcers among the elderly. Waltz and Strickland (14, p 190) reported that in two of Gosnell's studies, the subjects who developed pressure ulcers had diastolic blood pressure of less than 60 mm Hg.

Berlowitz and Wilking (2) were able to identify three predictors of pressure ulcer development. These were bed- or chair-bound, a history of cardiovascular accident (CVA) and impaired nutritional intake. Criteria used for determining poor nutritional intake were a persistently poor appetite, meals held because of gastrointestinal disease, or a diet ordered that provided less than 1100 calories or 50 gm protein daily.

To summarize, factors that have been found to be associated with the formation of pressure ulcers are decreased nutritional intake and weight loss or excessive weight, depleted TSF, fractures, physical decline to the point of being bed- or chair-bound, previous pressure ulcers, lymphopenia, increased body temperature, low blood pressure, the total number of diagnoses, a history of CVA, and low Braden scale score. Many of the pressure ulcer risk factors are nutrition related, and there is recognition of the importance of nutrition in both the prevention and healing of pressure ulcers. Most researchers mention nutritional factors in reporting their studies.

Pressure Ulcer Sites

Bony prominences of the body have the least amount of cushioning and are, therefore, more susceptible to the formation of pressure ulcers. The areas that are vulnerable points when lying on the back (17) include the heel, sacrum, elbow, shoulder and the back of the head. Susceptible points when lying on the side include the ankle, knee, hip area, shoulder and ear. The ball of the foot, the heel, buttocks, elbows and shoulder blades are at risk while sitting for prolonged periods of time.

The National Pressure Ulcer Prevalence Surveys recorded data on ulcers over bony prominences in order to study only ulcers caused by pressure rather than those caused by some other factor such as excess moisture (10). In all the surveys, the sacrum has been the predominant site followed by the heel. In the 1995 survey, the percentages were sacrum (39%) and heel (28%). The findings of Bergstrom et al. (18) were similar, with 60.7% of the pressure ulcers that developed being on the coccyx/sacrum, 27.1% on the heel, 7.5% on the trochanter and 6.5% on the ischial tuberosities, the bones that bear most of the weight when sitting. The most common sites reported by Allman et al. (24) were coccyx (41%), buttocks (35%) and sacrum (11%).

Incidence and Prevalence

Two terms commonly used when discussing pressure ulcers are incidence and prevalence. Incidence of new pressure ulcer formation is conservatively estimated to be 3% to 11% annually for acute care and 5% to 26% annually for skilled care with well over a million patients affected each year (4). Allman et al. (12) observed a prevalence rate of 17% in hospitalized patients who either had pressure ulcers or were at risk for them.

The National Pressure Ulcer Advisory Panel (NPUAP) has called for research to establish the prevalence of pressure ulcers in the United States. Barczak et al. (10) report that in 1989, 1991, 1993, and 1995 surveys of acute care hospitals were conducted for this purpose. The Fourth National Pressure Ulcer Prevalence Survey was conducted in 1995 in hospitals ranging in size from less than 99 beds to 599 beds. The findings of the

studies cannot be generalized because the surveys were conducted in acute care hospitals across the United States who volunteered to participate rather than using a stratified random sample. Nevertheless, in reporting the results of the last survey, Barczak et al. (10) state that 39,874 hospital patients in 265 acute care hospitals were surveyed in November, 1995. A total of 6,603 pressure ulcers were found in 4,020 patients for an overall prevalence of 10.1% on the day of the survey with a range of 1.4% to 36.4% in all hospitals. The most frequently reported sites, sacrum and heel, were consistent with results from previous surveys, and the number of pressure ulcers in each stage has also remained similar.

Each geographic area of the United States was represented in the survey. There was no significant difference in the distribution of ulcer severity in any geographic area but some differences were noted when hospital size was considered. The highest (13%) prevalence of pressure ulcers was found in 500 to 599 bed hospitals and the lowest prevalence (7%) was in hospitals with 300 to 399 beds. The authors further report that in the four national surveys conducted, the overall prevalence of pressure ulcers has changed very little in spite of significant changes in the health care delivery system (10). The prevalence rate in 1989 was 9.2%, in 1991 the rate was 11.2%, in 1993 it was 11.1% and in 1995, 10.1%. The researchers suggest higher patient acuity, longevity of the patient population, reduction in clinical staff, less attention to pressure ulcer prevention and reduced quality of care may be responsible for these findings. In addition, they listed some factors that should have decreased pressure ulcer prevalence. Including decreased length of stay, implementation of the AHCPR guidelines and the improved use of

technology. Because these factors have been implemented and the rate of prevalence has remained almost level, Barczak et al. (10) state that it is possible the work of health care providers has actually prevented an increase in pressure ulcer prevalence. In contrast, Smith et al. (5) suggest that not all available interventions are being implemented.

Tourtual et al. (22) specifically studied hospital acquired heel pressure ulcers in 291 patients. They stated pressure ulcers at this anatomical location increased from 19% to 25% to 30% in the 1989, 1991 and 1993 national prevalence surveys while pressure ulcers in other locations of the body were either constant or declined slightly. Barczak et al. (10) report heel ulcers decreased slightly to 28% in the survey conducted in 1995 although no explanations are proposed as to the increase in each of the three previous surveys. Heel ulcers obviously remain an important problem, and special attention is required to help solve it.

Commercial Pressure Relieving Products

Many products have been developed that may be useful in the treatment of pressure ulcers. All new products require Food and Drug Administration approval to insure the device is safe and effective before being marketed (33). Of the hundreds of devices and products that are available for the management of pressure ulcers, however, decisions regarding their use is usually based on clinical judgement rather than on clinical trials or accurate, cost effective analyses. Products available include sheepskin, foam mattresses, beds employing radio waves, ultrasound and transcutaneous electrical stimulation (TENS). Other products may be soaps, petroleum jelly, sterile maggots,

biological growth factors, dressings, antibiotics, antiseptics and combinations of many of these categories (34). Ferrell further states most interventions may help prevent and improve pressure ulcer management merely because of frequent turning, dressing changes and identification of other problems such as incontinence, malnutrition and concurrent infection. Tourtal et al. (22) comment that without accurate information to identify at-risk patients, potential problems in treatment include unnecessarily using pressure relieving products, using expensive products that are ineffective in relieving pressure, and not using pressure relieving products or taking preventive steps when they are actually needed.

Three categories of support surfaces were identified in the Fourth National Pressure Prevalence Survey (10). These were standard mattresses, static and dynamic pressure-reduction surfaces such as sheepskin or eggcrate foam mattresses, and pressure-relief surfaces including low-air loss and air-fluidized mattresses. Of the patients with pressure ulcers on the day of the survey, 53.3% were on a pressure-reduction surface, 12.5% on a standard mattress and 11.1% were on a pressure-relief surface. The largest percentage of patients with ulcers were on a foam replacement mattress (17.1%).

Although no data was collected to support this point of view, the use of pressure reduction surfaces was apparently not well accepted by Bergstrom and co-workers (18). They stated there was no reason to believe those surfaces were better than a standard mattress for reducing pressure. Further, they expressed the opinion it was possible those patients on the special surfaces were turned less often than patients on a standard surface.

Superabsorbent Products

Several new absorbent products have been developed (27). These products use superabsorbent polymers that wick moisture away from the skin into a separate layer. These products have not been subjected to clinical trials, but the manufacturers claim they will usually contain multiple voids, will contain feces and control odor. While they are expensive to use, they do maintain the skin at normal pH. This method is considered preferable to catheterization as an intervention for incontinence because of the risk of catheter-related urinary tract infections (27).

Hospitalization and Pressure Ulcer Development

Bergstrom et al (18) conducted a study that included 843 patients in two skilled nursing facilities, two university operated tertiary care centers and two Veterans Administration Medical Centers (VAMC). The mean age of the patients was 63 ± 16 years. The incidence of pressure ulcers in the tertiary care hospitals was 8.5%, in the VAMC's, 7.4%, and in the long term care facilities, 23.9%. These authors speculate the high incidence of pressure ulcers in the skilled nursing home settings may be related to the acuity of the illness of those patients.

Maklebust and Sieggreen (6, p 13) report the prevalence of pressure ulcers in long term care is not higher than in acute hospitals but the residents of long term care may have more conditions that put them at risk for pressure ulcer development. They further

state that approximately 60% of long term care residents with pressure ulcers developed the pressure ulcers while hospitalized.

Smith et al. (5) reviewed 221 pressure ulcer articles. They found evidence that pressure ulcers develop more frequently in the hospital than in nursing homes and that 63% of pressure ulcers in nursing homes were present on admission. In addition, they found a pressure ulcer prevalence of 8.7% among home care patients.

Smith et al. (5) found the overall rates of hospital discharges decreased after 1983 but the rate of discharges with pressure ulcers listed as the first diagnosis (ICD-9-CM, 707.0) increased by 60%. One reason for this may be the implementation of the prospective payment system. The Diagnostic Related Group (DRG) number 271 is 'skin ulcers including decubitus ulcer' and has an above average weight of 1.26. A pressure ulcer is considered a complication or comorbidity. Because of this, if a pressure ulcer is present with any diagnosis, the weight of that diagnosis is increased for reimbursement purposes. These studies emphasize the need for patients at risk to be identified by careful examination on admission in order to implement interventions quickly.

Pressure Ulcers and Nutrition

Malnutrition

One part of the pressure ulcer puzzle is the nutritional status of the patient. Morley (35) asks the question "Why do physicians fail to recognize and treat malnutrition in older persons?" He asserts physicians have been poorly trained in making a diagnosis of malnutrition or in recognizing those at risk of developing nutritional problems. Many

doctors seem unaware that protein-energy malnutrition (PEM) may be the presenting feature of some of the diseases common in older persons, and physicians, in general, may be unaware of how to manage PEM. He states, "Geriatric assessment is not complete unless it includes a nutritional assessment."

Malnutrition contributes to both the formation and the delayed healing of most skin breakdown. Thomas (36) states that the term malnutrition does not have an exact meaning. It may imply underfeeding or it may indicate cachexia that will not be corrected even by adequate nutrient intake. He suggests the failure to distinguish between these two conditions may explain why nutrition support may show little benefit at times.

The two primary reasons for malnutrition are conditions that contribute to decreased food intake or those that increase nutrient requirements (37, p 298). Factors most often associated with decreased food intake are poor appetite, decreased food acceptability, inability to self-feed, early weight loss, low total lymphocyte count, increased numbers of infections, advanced age on admission and low body weight on admission. Conditions that cause increased nutrient requirements include fever, infection and hypermetabolic conditions such as acquired immune deficiency syndrome (AIDS), cancer or chronic obstructive pulmonary disease (COPD).

Morley et al (37, p 297) found that 39% of all skilled nursing facility residents were malnourished on admission, and, of those admitted from an acute care facility, 48% were malnourished. Pinchcofsky-Devin and Kaminski (38) found a 52% rate of malnutrition in long term care residents. One potential outcome of poor nutritional status is the possibility of skin breakdown and ulceration. These authors further report that 7%

of the residents in long term care who had pressure ulcers were severely malnourished but pressure ulcers were not present in those who were well nourished or who were only mildly to moderately malnourished. Pinchcofsky-Devin and Kaminski (38) found the parameters predictive for pressure ulcers were albumin less than 30.3 g/L and total lymphocyte count (TLC) less than 1,200 mm^3.

Of the 121 subjects in a study conducted by Mowe and Bohmer (39) in Oslo, Norway, 54% were less than 90% of their expected weight to height. This meets the ICD-9 criteria for undernutrition. They discovered, however, that only a few of the subjects had been characterized by the physician as malnourished and that none had been given a diagnosis of malnutrition. Furthermore, only two of the subjects had been given nutrition support while hospitalized. These researchers state the fact that malnutrition may not often be listed as a diagnosis leads to the misconception that it is no longer a medical problem in developed countries. Because undernutrition is a predictor of both morbidity and mortality, it is important that it be recognized and addressed regardless of other diagnoses.

Depression. Some healthcare professionals consider depression to be one of the most common causes of malnutrition in the elderly. Jamison (40) described failure to thrive in older adults (FTTOA), a relatively new concept in the field of gerontology. Anorexia and weight loss are the hallmarks of FTTOA. Patients admitted to acute care facilities with this condition demonstrate multiple diagnoses per patient, have a high rate of admission from home but subsequent dismissal to a long term care facility, and have a 13% to 16% death rate while hospitalized. Jamison believes that distinguishing between

reversible and irreversible frailty is essential in determining treatment and that nutritional assessment is an important step in that determination. Jamison recommends the SCALES Protocol developed by Morley and Miller (41) to evaluate the risk of malnutrition. This protocol evaluates sadness, cholesterol, albumin, loss of weight, eating problems and shopping or food preparation problems. Jamison (40), further states some wasting is associated with the end of life, and not all FTTOA should necessarily be treated but acknowledges the importance of knowing and following the wishes of the patient.

Egbert (42) addresses FTTOA or "the dwindles". This physician states deterioration in biological, psychological and social domains, weight loss and undernutrition with a lack of an obvious explanation for the condition are distinguishing characteristics. The physical consequences may include increased incidence of pressure ulcers. Egbert encourages other physicians who are treating "the dwindles" to use a team approach and to remember that nutritional therapy is essential. She states that, at a minimum, the team should consist of a dietitian and a social worker.

Indicators of Malnutrition.

Thomas (36) states that diagnosing malnutrition is rather easily done by a physical examination but diagnosing pre-clinical malnutrition is more difficult. Low serum albumin is the most common physiologic parameter used to define malnutrition with lymphocyte count, hemoglobin, transferrin and retinol binding protein also recommended. Lymphopenia is recognized as a risk factor for skin breakdown (10, 24). Thomas further states the most commonly used anthropometric measurements and calculations are

weight, height, triceps skinfold, arm circumference, arm muscle area and arm fat area (36); he recommends combining several physiologic and anthropometric measures to diagnose malnutrition. A cause-effect relationship between malnutrition and pressure ulcers cannot be assumed according to Thomas. He states there may be co-morbid conditions present that predispose the development of pressure ulcers.

The nutritional status of long term care residents in two facilities was studied by Abbasi and Rudman (43). They found that 30% to 50% of nursing home residents had substandard weight, midarm muscle circumference, serum albumin and serum levels of vitamins indicating decreased nutritional status.

Breslow and Bergstrom (19) cite inadequate protein and calorie intake, low body weight, low triceps skinfold (TSF) measurement, a low serum albumin, low serum cholesterol and low hemoglobin concentrations as important nutritional markers. They found no strong evidence that biochemical or dietary deficiencies of zinc, or vitamins C, A or E were risk factors for developing pressure ulcers.

There is conflicting information regarding the role of hypoalbuminemia in malnutrition. The findings of Allman et al. (12) suggest hypoalbuminemia is a factor that may help identify at-risk patients. In a study of 634 hospitalized patients, these researchers found hypoalbuminemia to be a factor that identified patients at greatest risk for pressure ulcers. Researchers found the likelihood of developing a pressure ulcer increased two to three times for each g/dL decrease in serum albumin (12). Berlowitz and Wilking (2), however, found no significant relationship between low serum albumin and the development of pressure ulcers even though they acknowledge that patients with

pressure ulcers have lower serum albumin than patients who do not. They suggest this hypoalbuminemia may be due to protein loss from the open wound especially if infection is present. Berlowitz and Wilking (2) further propose low serum albumin may be important in determining whether or not the wound shows improvement or heals.

Kerstetter et al. (44) identified causes of malnutrition in elders institutionalized in acute or long term care facilities. People at the highest risk for mortality are known to have low serum cholesterol, albumin, hemoglobin and hematocrit, body mass index (BMI), and TSF with hypocholesterolemia being identified as one of the most important markers. Achlorhydria occurs in 15 to 25% of adults over age 60 and results in decreased digestion and absorption of folic acid, B_{12}, calcium and iron and may be the cause of subclinical nutrient deficiencies. Kerstetter and co-workers believe some older patients may have trouble simply consuming adequate amounts of food. Due to budget limitations there may not be enough staff to help feed patients, or there may be unnecessary or inappropriate diet restrictions and unappetizing food. They suggest an opportunity exists for dietitians to be leaders in finding ways of cost effective, individualized care to solve nutrition problems.

Nutrition Assessment

Nutritional status is determined by nutrition assessment. Kerstetter et al (44) state that to maintain quality of life and functional status, identification of persons at nutritional risk through nutritional assessment is necessary. Morley et al. (37, p 298) recommend using standardized assessment protocols that allow accurate comparisons

among residents of different facilities. These authors state that height and body weight are two of the most descriptive parameters of nutrition assessment in the long term care setting. Most state health department regulations require monthly weight. When accurate height is difficult to obtain due to a physical problem, the use of a knee-height caliper has been validated to obtain this measurement (44). Morley et al. (37, p 298) recommend laboratory analyses be performed every 6 months or at least annually unless the patient's condition changes when it should be done more frequently. They state a 3-day food intake record should be analyzed for any deficiencies of nutrient intake. Measurements commonly used to assess nutritional status include height, weight and serum albumin (46).

There has been discussion about what should be considered as a marker for malnutrition. Ferguson et al. (47) state the marker should measure something that is associated with an adverse clinical circumstance, and this group used serum albumin as a marker. They reported severe hypoalbuminemia of 20 g/L strongly predicts 90 day mortality.

Hanan and Scheele (4) examined the medical records of 72 hospitalized patients to determine if there is a correlation between body weight, albumin and pressure ulcer development. In their study, 17% of the subjects developed pressure ulcers. Of these, 58% were more than 110% of ideal body weight (IBW) and 33% were less than 90% IBW. Of those who developed pressure ulcers, 83% had low albumin levels. Subjects in this study with both normal weight and normal serum albumin developed no pressure ulcers. The authors concluded that weight alone is not an effective predictor of nutritional

status and that serum albumin level should always be obtained. They recommend percent IBW should be calculated for patients suspected as being at risk for pressure ulcer development. The authors state that used together, percent IBW and serum albumin levels could help identify patients at risk.

Harris et al. (48) found that at age 65, a (BMI) of 23 to 25 for men and 24 to 26 for women was associated with the lowest relative risk for mortality. In younger adults these numbers would be considered above a healthy weight range. As a result, these authors recommend the IBW for nursing home residents should be adjusted upward.

Together, these studies illustrate the importance of a timely nutrition assessment conducted by a qualified health care professional. Knowledge of the patient's nutritional status is essential to knowing when interventions must take place.

Nutrition and Wound Healing.

A literature review by Hadley and Fitzsimmons (49) summarized the role of nutrition in wound healing. The complex process of wound healing includes the nature of the injury, concurrent diagnoses such as diabetes mellitus, malnutrition, circulatory impairment, mechanical stress on the wound and microbial contamination. They found the risk of impaired healing is increased in the very young and the very old. When wound edges are widely separated as in the case of a pressure ulcer, there may be significant tissue loss, microbial contamination or possibly both. In this case, the wound may be left open to heal by granulation.

Hadley and Fitzsimmons (49) describe the stages of the healing process. They include hemostasis, inflammation and the mobilization of cells capable of synthesizing granulation tissue, the formation of granulation tissue and synthesis of collagen resulting in an increase in the tensile strength of the wound. As collagen synthesis is stabilized, the color changes from pink to white and wound strength continues to increase although it may never regain the strength of the pre-injured tissue.

Any of these phases may be interrupted by lack of available nutritional substrates, disrupted immunologic competence, poor tissue oxygenation or altered circulatory capacity (49). The authors further state malnutrition contributes significantly to impaired wound healing. The protein deficient patient heals poorly and is at increased risk for developing wound infections. Glucose is the primary substrate used in wound repair, and fatty acids are needed for cell membranes. Deficiencies of fatty acids may impair wound healing. Vitamins known to play a role in tissue formation are ascorbic acid, vitamins A, D, K, and the B complex vitamins. The minerals sodium, potassium, chloride, phosphorous, magnesium, iron, copper, manganese and zinc are involved. The authors summarize by stating wound healing is a complex but systematic process and any nutritional deficiencies will impair the process and impact the recovery of the patient (49).

Dietary Recommendations for Patients with Pressure Ulcers.

Thomas (36) reports that adequate protein intake is associated with healing pressure ulcers. He states that protein intake greater than 1.5 gm/kg body weight per day,

however, may not increase protein synthesis and may cause dehydration. He, therefore, recommends a protein intake of 1.0 to 1.5 gm/kg per day for patients with pressure ulcers. He further recommends the normal caloric intake of up to 35 kcal/kg per day for patients under the stress of pressure ulcers. However, Breslow et al. (29) propose that long term care facility residents with severe pressure ulcers may need as much as 39 kcal/kg and 2.1 gm protein per kg body weight to heal their pressure ulcers.

Prevention and Treatment of Pressure Ulcers

Following a literature search of 328 articles, Smith et al. (5) concluded the first step in preventing pressure ulcers is to identify at-risk patients and that upgrading general care is the most effective prevention. This includes improving mobility, reducing incontinence and improving nutrition. Avoiding immobility by preventing fractures from falls is an important long range tactic. The 30° position when lying on the side is also recommended for prevention and this may be accomplished by placing a pillow or foam wedge at the patient's back.

Allman et al. (24) discuss the importance of including Stage I pressure ulcers in studies and the need for early interventions as suggested in the AHCPR Clinical Guidelines (17). They found that 57.9% of patients with sacral Stage I at baseline subsequently developed Stage II or greater in that same anatomic location. Of the patients without sacral Stage I at baseline, only 5.0% acquired Stage II or greater during hospitalization.

The largest percentage (74%) of pressure ulcers in the Barczak et al. (10) report were partial thickness Stage I or II, and the authors suggest aggressive interventions should begin at once when Stage I nonblanchable erythema of intact skin is noted.

The Role of the Registered Dietitian.

The role of the dietitian in the prevention and treatment of pressure ulcers is described by The American Dietetic Association (50, Appendix A). The publication guides practitioners by providing protocols for medical nutrition therapy for several conditions including pressure ulcers. According to the pressure ulcer protocol, before the initial session with a patient, the dietitian should obtain albumin, hemoglobin and hematocrit values and review the primary care provider goals for the client. In addition, the dietitian should evaluate the medical history to assess for risk factors such as peripheral vascular disease, diabetes mellitus, malnutrition, chronic obstructive pulmonary disease, chronic or end stage renal disease, liver or heart disease, or spinal cord injury. The dietitian should be aware of whether the patient is continent, should know what medications are being taken, and whether malnutrition, dehydration, or unintentional weight loss has occurred. The Braden Scale score should be obtained. During the first client interview the dietitian should obtain height and weight, and calculate the BMI. A nutrition history should be obtained including usual food and fluid intake and ability or inability to chew. A uniform system of risk assessment and careful implementation of the protocols already in place would assist in prevention of pressure ulcers both in long term and acute care facilities.

Pinchcofsky-Devin and Kaminski (38) made recommendations regarding the role of the Registered Dietitian in nutrition care. These researchers recommended the dietitian schedule some time with each patient to visually screen their nutritional status and to obtain anthropometric measurements. They state that the dietitian should recommend the collection of laboratory data such as serum albumin and total lymphocyte count and that they should recommended oral nutritional supplementation if required.

This review of the available literature illustrates the widespread existence of the problem of pressure ulcers in home care, acute care and long term care facilities. The factors involved in formation and healing are discussed and recommendations are made for the role of the registered dietitian in the process of caring for the condition.

CHAPTER THREE

METHODS

This retrospective chart review was conducted on the medical records of 83 residents in two long term care facilities in Southeastern Oklahoma. The subjects were grouped into two initial groups based on whether they did or did not develop pressure ulcers during hospitalization. The study was reviewed and approved by the institutional Review Board of Oklahoma State University and assigned approval number HE-99-042 (Appendix B). Signed consent to gather data was obtained from the administrators of the facilities involved (Appendix C). Signed consent to access information from the medical records of patients who fit the inclusion criteria was secured from one hospital (Appendix C).

The criteria for inclusion were that the resident was admitted to an acute care hospital between January 1, 1997 and August 31, 1999 and returned to the long term care facility from hospitalization. The method of study was the examination of medical records in the long term care facility and coding for the following: demographic and other descriptive information, diagnoses, medications, and laboratory results. The same data was collected as available from the hospital records. If more than one pressure ulcer was

present, data was collected on the highest stage ulcer. Data collection forms are in Appendix D.

Charts reviewed were given a unique code number, and no resident was identified by name. A master code list linked to the chart number was kept by the primary investigator in a secure location away from all data records, and destroyed at the completion of the study. Statistical analyses performed were frequencies, general linear models procedure for unbalanced groups, and Chi square using the Statistical Analyses System version 6.12 (SAS Institute Inc, Cary, NC). Significance level was set at $p < 0.05$.

Chapter four follows the Guidelines for Authors of The Journal of The American Dietetic Association for text and statistics.

CHAPTER FOUR

RESULTS

THE RELATIONSHIP BETWEEN FOOD INTAKE, DEMOGRAPHIC VARIABLES AND THE FORMATION OF PRESSURE ULCERS IN SOUTHEASTERN OKLAHOMA LONG TERM CARE FACILITY RESIDENTS.

Objective. To investigate factors related to the formation of pressure ulcers in long term care facility residents.

Design. Retrospective medical record review.

Subjects/Setting. Information was gathered from medical records of 83 residents of two long term care facilities in Southeastern Oklahoma who did not have pressure ulcers prior to hospitalization.

Statistical Analysis Performed. Frequencies, general linear models procedure for unbalanced groups, and Chi square.

Results. Subjects were grouped by pressure ulcer development during hospitalization. Weight loss while hospitalized, mobility, method of feeding, activity level, bladder incontinence, restricted diet, diastolic blood pressure, urinary tract infection, anti-ulcer

medication, low serum albumin and, for Stage II ulcers, abnormal osmolality were significantly associated with pressure ulcer development.

Applications/Conclusions. Low serum albumin, the need to be turned, and needing assistance with eating serve as flags for patients who need extra attention both in long term and acute care facilities. Diastolic blood pressure should be monitored. The association between method of feeding, and bladder incontinence and pressure ulcer development indicate that the subjects in this study needed more assistance in these areas than they received. Of the findings of this study, perhaps the most notable is the importance of tracking weight loss.

THE RELATIONSHIP BETWEEN FOOD INTAKE, DEMOGRAPHIC VARIABLES AND THE FORMATION OF PRESSURE ULCERS IN SOUTHEASTERN OKLAHOMA LONG TERM CARE FACILITY RESIDENTS.

Pressure ulcers are not a new problem. Evidence of the condition has been found on the mummies of ancient Egypt (1, p 235); pressure ulcers continue to constitute a major and ongoing problem for hospitals and long term care facilities across the United States. They are a source of concern not only in terms of pain and discomfort for the resident and anxiety for the family, but also they represent a financial burden to the facility. Patients with pressure ulcers require approximately 50% more nursing time, they remain hospitalized longer, and their hospital costs are higher than those without pressure ulcers (2).

The cost of pressure ulcer treatment in the United States is estimated to be greater than $5 billion dollars annually, with the cost per individual ulcer to be between $5,000 and $50,000 per year (3). The formation of pressure ulcers increases the use of supplies, equipment and nursing time, thereby increasing cost. Thus, pressure ulcers are a significant financial burden (4).

The presence or absence of pressure ulcers is acknowledged as an indicator of the quality of care given by a facility (5). The Secretary of Health and Human Services listed pressure ulcers as a parameter for evaluating the quality of care delivered by long term care facilities in the Omnibus Budget Reconciliation Act (OBRA) (6, p 273).

Pressure ulcers occur both prior to and following admission to long term care. Further, residents who have no skin breakdown but are hospitalized due to illness may return to the facility with pressure ulcers. The purpose of this study is to identify common characteristics among those residents of long term care facilities who develop pressure ulcers during hospitalization.

METHODS

This retrospective chart review was conducted in two long term care facilities in Southeastern Oklahoma. Data were collected on 123 residents who were admitted to acute care without pressure ulcers between January 1, 1997 and August 31, 1999. Residents who did not return to the long-term care facility following hospitalization were excluded. Eighty-three residents remained in the study. If a resident formed more than one pressure ulcer during hospitalization, the highest stage ulcer was used for analysis.

The study investigated demographic and other characteristics, diagnoses, medications and biochemical parameters. Statistical analyses performed were frequency distribution, general linear models procedure for unbalanced groups, and Chi square using the Statistical Analysis System (version 6.12, SAS Institute, Cary, NC). Significance level was set at $p < 0.05$.

RESULTS

Descriptive characteristics of the sample are included in Table 1. There were no significant differences in age, weight, food intake or serum albumin between males and females. The sites and stages of pressure ulcers formed during hospitalization are shown in Figure 1. No Stage III or IV ulcers were formed and no heel or trochanter ulcers developed.

The subject's demographic and other descriptive information is presented in Tables 2 and 3. There was a significant difference in activity, mobility, bladder continence, and diastolic blood pressure between those who did and did not develop pressure ulcers. Subjects with restricted mobility, who needed nursing assistance to turn and were bladder incontinent were more likely to develop a pressure ulcer while hospitalized. Subjects who developed pressure ulcers, however, had higher diastolic blood pressure prior to hospitalization than subjects who did not develop pressure ulcers.

Weight of the subjects was evaluated on admission, at hospitalization and upon return from the hospital (Table 4). Patients who developed pressure ulcers lost significantly more weight during hospitalization than patients who did not develop pressure ulcers. The mean BMI on admission for all subjects was 23.7 ± 0.4. There were no significant differences in BMI between groups on admission to long term care (data not shown).

Those patients who formed pressure ulcers and required assistance with eating lost the greatest amount of weight of any group of subjects. To examine the reasons for

Table 1.
Descriptive characteristics of male and female subjects.

Characteristics	Male	Female
Gender, n	20	63
Age at admission, y[1]	85 ± 7	87 ± 7
Weight at admission, lb[1]	166 ± 30	131 ± 21
Food intake, %[1]	86 ± 18	69 ± 26
Serum albumin, g/L[1]	32 ± 8	32 ± 5
Developed pressure ulcers while hospitalized, n	7	17

[1] Mean ± SD

Figure 1. Sites and Stages of pressure ulcers developed during hospitalization.

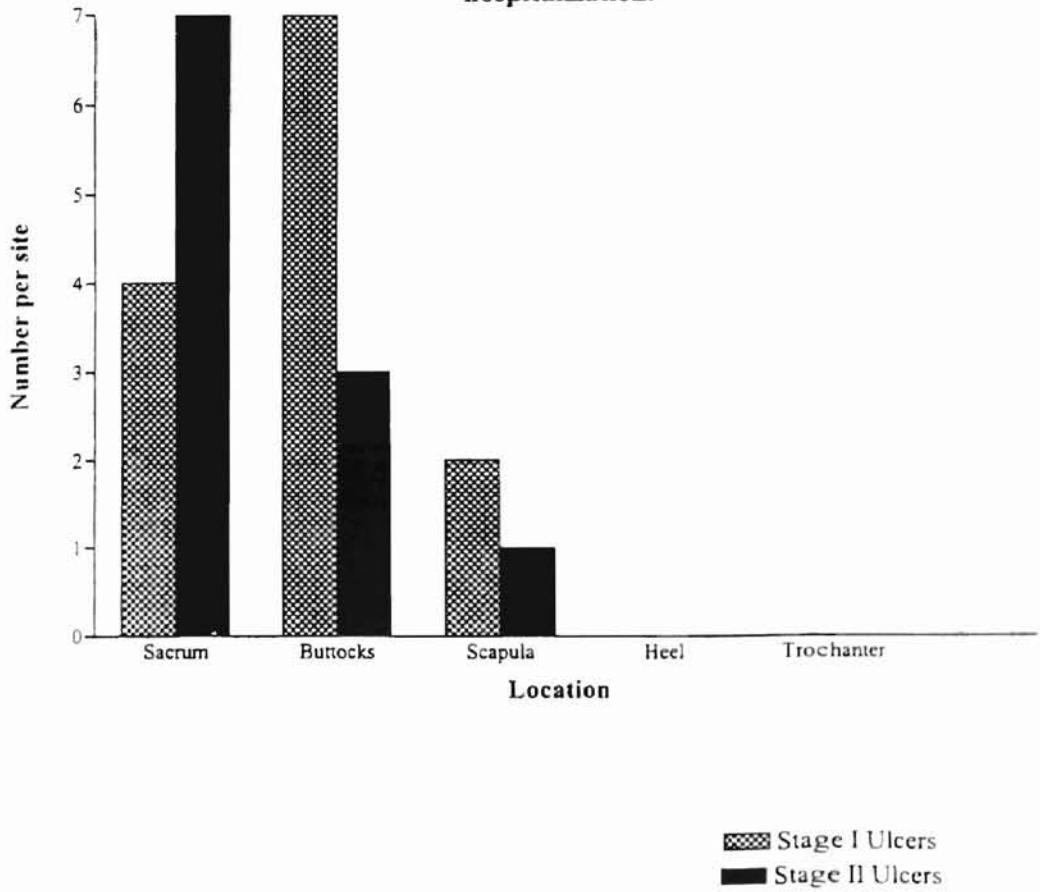


Table 2.
Frequencies of demographic and other descriptive measurements of all subjects and in those who did or did not develop pressure ulcers while hospitalized

Characteristic	All subjects	Developed pressure ulcer during hospitalization		Did not develop pressure ulcer during hospitalization	
	n	n	(%)	n	(%)
Gender					
Male	20	7	(35)	13	(65)
Female	63	17	(27)	46	(73)
Diet					
Modified	42	8	(19)	34	(80)
Regular or soft	41	16	(39)	25	(62)
Feeding Method					
Assisted	46	20	(43)	26	(56)
Self fed	36	4	(11)	32	(89)
Activity[1]					
Restricted	62	23	(37)	39	(63)
Up ad lib	20	1	(5)	19	(95)
Mobility[1]					
Turned	44	17	(39)	27	(61)
Turns self in bed	38	7	(18)	31	(82)
Consciousness					
Comatose	13	5	(38)	8	(62)
Alert	69	19	(28)	50	(72)
Continent-bladder[1]					
No or catheter	46	18	(39)	28	(61)
Yes or usually	36	6	(17)	30	(83)
Continent–bowel					
No or diaper	33	12	(36)	21	(64)
Yes or usually	49	12	(24)	37	(76)
Pressure reduction surface used					
No	14	2	(14	12	(86)
Yes	63	21	(33))	42	(67)
Length of hospital stay					
> 6 days	32	11	(34)	21	(66)
= < 6 days	51	13	(25)	38	(75)

[1] Significant differences between groups (Chi square, $p < 0.05$).

Table 3.
Means of demographic and other descriptive measurements of subjects who did and who did not develop pressure ulcers while hospitalized [1,2]

Characteristic	Developed pressure ulcer during hospitalization	Did not develop pressure ulcer during hospitalization
Age, y	86.6 ± 1.4	86.7 ± 0.9
Food intake prior to hospitalization, %	75.3 ± 5.6	72.6 ± 3.6
Length of hospital stay, days	9.5 ± 1.8	7.2 ± 1.1
Systolic blood pressure prior to hospitalization, mmHg	139.6 ± 5	130.3 ± 3
Diastolic blood pressure prior to hospitalization, mmHg	73^{a} ± 2	67^{b} ± 1
Total medications, n	6.9 ± 1.0	8.2 ± 0.6

[1] Variables in rows with different superscripts are significantly different ($P < 0.05$).
[2] LS Means ± SE

Table 4.
Means of weight from long term care admission to after hospitalization and amount of weight change for all subjects and for those who did or did not develop pressure ulcers while hospitalized [1,2]

Characteristic	All Subjects	Developed pressure ulcers during hospitalization	Did not develop pressure ulcers during hospitalization
Weight on admission, lb	140 ± 3.0	141 ± 5.7	139 ± 3.6
Weight at hospitalization, lb	137.6 ± 3.1	142.3 ± 6.9	135.6 ± 3.3
Wt on return from hospital, lb	134.3 ± 3.1	135.7 ± 5.9	133.6 ± 3.6
Weight change on return from hospital, lb	-0.4 ± 1.1	-7.4[a] ± 1.8	-1.6[b] ± 1.2

[1] Variables in rows with different superscripts are significantly different ($p < 0.05$).
[2] LS Means ± SE

weight loss, the researchers then looked at methods of feeding (Figure 2).

The method of feeding appeared to be a risk factor for pressure ulcer development. Patients who were assisted with eating in long-term care lost 1.2 ± 1.8 pounds while hospitalized and those who were hand fed in long-term care lost 9.2 ± 2.6 pounds. Interestingly, self-feeders lost 2.6 ± 1.6 pounds while hospitalized. Residents who had been assisted with eating, or were hand fed in long term care, formed the greatest number of pressure ulcers and lost the greatest amount of weight during hospitalization (Figure 3).

The most frequent disorder observed in this study was cardiovascular disease (Table 5). Urinary tract infection was the only disorder, however, that was significantly different between those who did or did not develop pressure ulcers. Patients with urinary tract infection were less likely to develop pressure ulcers than patients who did not have urinary tract infection. Trends were noted between those having skin disorders and osteoporosis and the development of pressure ulcers ($p < 0.10$).

A significant difference in pressure ulcer development was observed between subjects taking anti-ulcer medication and those who were not (Table 6). This was the only significant medication, and no significant differences were observed for the total number of medications taken daily between those who did or did not develop pressure ulcers (Table 3).

Serum albumin was the only nutritional status biochemical parameter that was significantly different between pressure ulcer groups (Table 7). Serum albumin for the pressure ulcer group was 29 ± 1 g/L and for the non-pressure ulcer group, 33 ± 1 g/L.

Figure 2. Frequency of pressure ulcer formation by method of feeding.

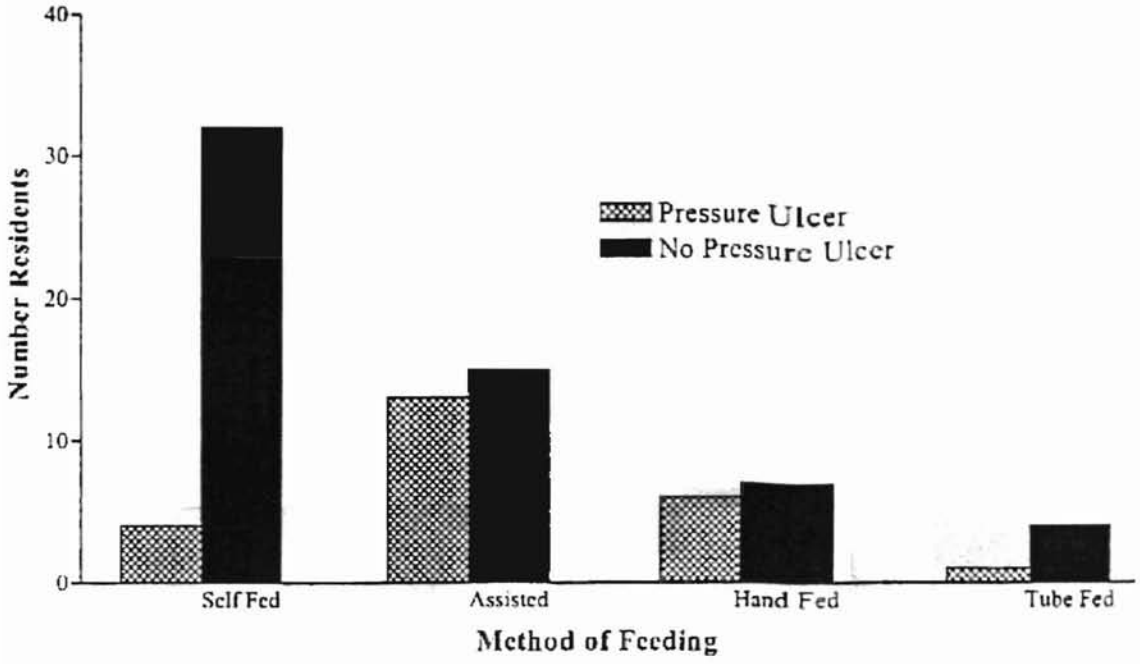
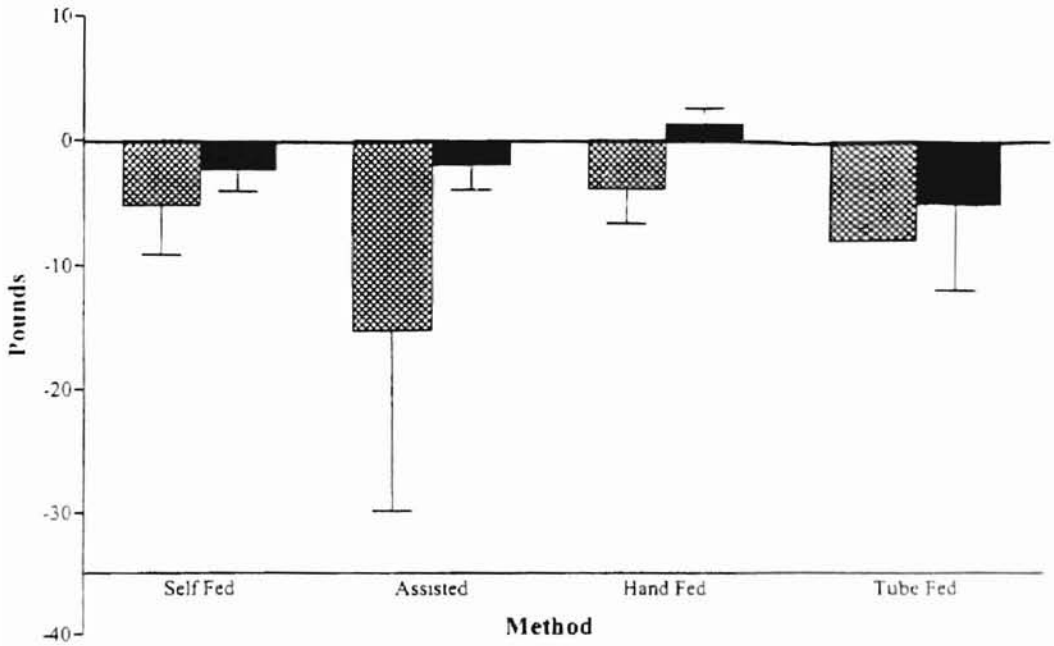


Figure 3. Means of weight change during hospitalization by feeding method and pressure ulcer development[1]



[1]Means +/- SD

Pressure Ulcer
No Pressure Ulcer

Table 5.
Frequency of diagnoses for all subjects and for those who did or did not develop pressure ulcers while hospitalized

Characteristic	All Subjects	Developed pressure ulcers while hospitalized		Did not develop pressure ulcers while hospitalized	
		n	(%)	n	(%)
Cardiovascular Disease	58	17	(29)	41	(71)
Hypertension	41	9	(22)	32	(78)
Dementia	40	14	(35)	26	(65)
Degenerative Joint Disease	39	11	(28)	28	(72)
Gastro Intestinal Disorders	31	6	(19)	25	(81)
Psychological Disorder	31	9	(29)	22	(71)
Cerebro Vascular Accident	25	8	(32)	17	(68)
Anemia	24	10	(42)	14	(58)
Diabetes Mellitus	23	9	(39)	14	(61)
Urinary Tract Infection[1]	14	1	(7)	13	(93)
Fracture	8	3	(38)	5	(68)
Chronic Obstructive Pulmonary Disease	7	2	(29)	5	(71)
Neurological Disorders	7	2	(29)	5	(71)
Osteoporosis	7	0	(0)	7	(100)
Skin Disorder	7	0	(0)	7	(100)
Eating Disorder	6	3	(50)	3	(50)
Abnormal Lab Results	5	1	(20)	4	(80)
Cancer	5	1	(20)	4	(80)
Thyroid Conditions	4	0	(0)	4	(100)
Dehydration	2	1	(50)	1	(50)
Infection	2	1	(50)	1	(50)
Hiatal Hernia	1	0	(0)	1	(100)

[1] Significant differences between groups ($p < 0.05$, Chi square analysis)

Table 6.
Frequency of medications for all subjects and those who did or did not develop pressure ulcers while hospitalized.

Medication	All subjects	Developed pressure ulcer while hospitalized n (%)	Did not develop pressure ulcer while hospitalized n (%)
Diuretic	51	16 (31)	35 (69)
Anti-inflammatory	45	13 (29)	32 (71
Anti-hypertensive	39	12 (31)	27 (69)
Anti-ulcer Medication[1]	22	2 (9)	20 (91)
Hypoglycemic agent	12	2 (17)	10 (83)
Thyroid	5	2 (40)	3 (60)

[1] Significant differences between groups ($p < 0.05$, Chi square analysis)

Table 7.

Mean biochemical parameters of all subjects and those who did or did not develop pressure ulcers while hospitalized[1,2]

Biochemical Parameters	All subjects	Developed pressure ulcer	Did not develop pressure ulcer
Glucose mmol/L	7.5 ± 2.1	8.4 ± 0.5	7.7 ± 0.4
Albumin g/L	32 ± 6	29[a] ± 1	33[b] ± 1
Cholesterol mmol/L	4.6 ± 1.1	3.4 ± 0.6	4.7 ± 0.3
BUN mmol/L	10.4 ± 6.1	1.3 ± 0.1	10.5 ± 1.0
Serum Creatinine μmol/L	114.9 ± 61.9	114.9 ± 8.8	114.9 ± 8.0
Sodium mmol/L	139.3 ± 6.2	141.5 ± 1.5	139.6 ± 1.08
Potassium mmol/L	4.2 ± 0.6	4.09 ± 0.1	4.2 ± 0.09
Chloride mmol/L	101.4 ± 9.6	104.6 ± 2.5	100.6 ± 1.8
Osmolality mmol/kg	293 ± 16	299.2 ± 4	293.0 ± 3
Carbon Dioxide mmol/L	30.6 ± 31.5	39.6 ± 9.0	26.1 ± 7.1
Hemoglobin g/dL	121 ± 18	123 ± 4	123 ± 3
Hematocrit	.41 ± 3.8	.37 ± 0.1	.46 ± 0.07
Total Lymphocyte Count mm^3	1700 ± 600	1500 ± 100	1700 ± 100

[1] Variables in rows with different superscripts are significantly different ($p < 0.05$).

[2] LS Means ± S E

There was a significant difference in serum osmolality for residents who did not develop a pressure ulcer and those who returned with Stage II ulcers ($p < 0.05$). A trend toward significance in serum osmolality was noted between those with Stage I and Stage II pressure ulcers ($p < 0.08$). Mean serum osmolality for those who did not develop pressure ulcers was 293.3 ± 2.8 mmol/kg, for those who developed Stage I, 292.8 ± 5.1 mmol/kg, and for those who developed Stage II, 306.2 ± 5.4 mmol/kg.

DISCUSSION

There was no significant difference in long-term care BMI between those who did and those who did not develop pressure ulcers in this study. The study did not reveal significant relationships with the formation of pressure ulcers and factors that had been identified in other studies such as total lymphocyte count and percent of food intake. Pinchcofsky-Devin and Kaminski (7) found that malnourished patients with pressure ulcers had a total lymphocyte count (TLC) of 1080 ± 362 mm^3 while the mean TLC of subjects in this study who developed pressure ulcers was 1500 ± 100 mm^3. Bergstrom and Braden (8) reported the subjects in their study who developed Stage I pressure ulcers consumed 52.8% of the RDA for calories. The information available for this study was that the subjects consumed an average of 71% of the food offered indicating they may have consumed more calories than the subjects in the Bergstrom and Braden (8) study, however, food intake in this study was estimated by staff with no food refusal measurements available.

The largest number of pressure ulcers formed were Stage I ulcers that, because of location on the buttocks and sacral area, may be due to bowel or bladder incontinence. No heel or trochanter pressure ulcers developed during the study in contrast to the results of the Tortural study (9). The average length of hospital stay in the Tortural study, however, was 21.4 ± 21.7 days compared to the 8.6 ± 8.4 days of this study. The average length of hospitalization in Oklahoma for 1997 was 5.7 days and in 1998, 5.5 days (10). In this study, 51 subjects were hospitalized less than six days and 32 were hospitalized more than six days. There was no significant difference in length of hospitalization between those who developed pressure ulcers and those who did not.

The fact that no heel ulcers were formed during this study (Figure 1), suggests the consistent use of heel protectors in at-risk residents both in the hospital and in the long term care facilities. In other studies, heel ulcers were among those most frequently formed (9,11).

Of the biochemical parameters evaluated, serum albumin and osmolality may be closely related to dietary intake. The mean serum albumin of those who developed pressure ulcers in this study was 29 ± 1 g/L (Table 7). Pinchcofsky-Devin and Kaminski (7) identified 30.3 g/L as being predictive for pressure ulcers. Serum osmolality is not always available in long term care settings but this study suggests that it would be useful. The mean serum osmolality for all subjects in this study was 293 mmol/kg (Table 7), which is in the high normal range of 285 to 295 mmol/kg. The significant difference in serum osmolality in this study was between those who did not develop a pressure ulcer

and those who developed Stage II. Thus, dehydration may have been an important factor in the development of Stage II pressure ulcers.

Weight loss while hospitalized was an important factor in pressure ulcer development. Significant differences were observed between those developing no pressure ulcer and those with Stage II ($p < 0.003$), and a trend between those developing Stage I and Stage II ($p < 0.10$). Subjects who did not develop pressure ulcers lost 1.6 lb ± 1.3, subjects who developed Stage I pressure ulcers lost 4.3 lb ± 2.5 and those who developed Stage II ulcers lost 11.15 lb ± 2.8. Weight loss was addressed in the HCFA mandated nutrition assessment (Appendix E). The present study supports the importance of preventing or controlling weight loss and endorses the HCFA recommendations.

Subjects who developed pressure ulcers had higher diastolic blood pressure than the no pressure ulcer group, although all were low. This illustrates the need to monitor blood pressure. Flags for patients who need extra attention are low serum albumin, requiring assistance with eating, and the need to be turned.

APPLICATIONS

- The significant variables in this study of restricted activity and mobility, albumin < 29 g/L, and weight loss while hospitalized may help identify the at-risk resident in acute and long term care.
- Tracking weight during hospitalization is important in reducing the incidence of pressure ulcer development.

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CHAPTER FIVE

SUMMARY AND CONCLUSIONS

This study investigated demographic and other characteristics, medical, and biochemical variables in an attempt to identify factors that were related to pressure ulcer development during hospitalization. The 83 subjects were residents of two long term care facilities and who did not have a pressure ulcer prior to hospitalization. During hospitalization, 24 developed at least one pressure ulcer.

Variables were examined using a retrospective chart review. Frequencies, the SAS general linear models procedure for unbalanced groups, and Chi-square were used to analyze data. Significance level was set at $p < 0.05$. Factors that were significantly associated with the formation of pressure ulcers were weight loss while hospitalized, mobility, method of feeding, activity level, bladder continence, restricted diet, diastolic blood pressure, urinary tract infection, anti-ulcer medication, serum albumin, and serum osmolality.

Test of Null Hypothesis

The null hypotheses were tested based on the results from this study.

Ho1: There will be no significant difference in anthropometric measurements of patients who develop pressure ulcers in the hospital.

Weight loss was demonstrated from the time of admission to long term care to hospitalization. Those who developed pressure ulcers during hospitalization lost significantly more weight than those who did not develop pressure ulcers. Therefore, hypothesis one is rejected.

Ho2: There will be no significant difference in any diagnoses of patients who develop pressure ulcers in the hospital.

A significant difference in pressure ulcer formation was noted in subjects diagnosed with urinary tract infection. No other diagnoses were associated with pressure ulcer development. Therefore, hypothesis two is rejected for urinary tract infection, but not for other conditions.

Ho3: There will be no significant difference in length of hospitalization of patients who develop pressure ulcers in the hospital.

Length of hospitalization was not significantly associated with pressure ulcer formation. Therefore, the researchers fail to reject hypothesis three.

Ho4: There will be no significant difference in any medication of patients who develop pressure ulcers in the hospital.

Anti-ulcer medication was significantly associated with pressure ulcer formation, however, no other medications nor the total number of medications were associated with pressure ulcer development. Therefore, hypothesis four is rejected only for anti-ulcer medication.

Ho5: There will be no significant difference in any biochemical parameters of patients who develop pressure ulcers in the hospital.

Serum albumin was significantly associated with the formation of pressure ulcers and osmolality was associated with stage II pressure ulcer development. Therefore, hypothesis five is rejected for these variables. However, no other biochemical variables support rejection of this hypothesis.

Implications

The results of this study indicate that the residents who developed pressure ulcers were less mobile than those who did not. The largest number of pressure ulcers formed, however, were Stage I ulcers that, because of location, may be due to bowel or bladder incontinence rather than inadequate turning. The fact that no heel ulcers were formed during this study may indicate the consistent use of heel protectors in at-risk residents both in the hospital and in these facilities. In other studies, heel ulcers were among those most frequently formed. The results of assessment for pressure ulcer risk as evaluated on admission to long term care would have been of interest but was not available.

The biochemical parameters evaluated that were statistically significant were serum albumin and osmolality. These may be closely tied to dietary intake. Adequate fluid and protein intake should be provided if medically feasible. Serum osmolality, a laboratory test that is not always available in long term care settings, would be useful in screening patients for risk. The significant difference in osmolality in this study was between those who did not develop a pressure ulcer and those who developed Stage II.

Of the findings in this study, perhaps the most notable is the importance of tracking weight loss. Significant differences were observed between weight loss during hospitalization and pressure ulcer development. Patients who developed pressure ulcers were hospitalized 9.5 ± 1.8 days and lost 7.4 ± 1.8 pounds. Those who did not develop pressure ulcers were hospitalized 7.2 ± 1.1 days and lost 1.6 ± 1.2 pounds (Tables 3 and 4). The weight loss issue coincides with the HCFA mandated nutrition assessment (Appendix E). The present study emphasizes the importance of preventing or controlling weight loss and coincides with the HCFA recommendations. There was no significant difference in long-term care BMI between those who did and those who did not develop pressure ulcers. This indicates all residents were of approximate equal weight status prior to hospitalization.

The finding of a relationship between feeding method, and bladder incontinence and the formation of pressure ulcers is of great interest. This information suggests that, in this study, long-term care residents who required assistance eating and are incontinent did not receive adequate assistance with these problems while hospitalized, resulting in skin breakdown. There are multiple reasons for decreased food intake while hospitalized such as food being withheld for tests or surgery, serious illness, or being unable to consume sufficient food. In the current health care climate, only the sickest individuals are hospitalized, and decreased appetite may be expected.

Weight loss while hospitalized, mobility, method of feeding, activity level, bladder incontinence, low serum albumin and abnormal serum osmolality may serve as flags for patients who need extra attention.

Recommendations

Future research might include a state wide pressure ulcer prevalence survey for long-term care facilities. Research projects, which are designed to include information taken directly from the Minimum Data Set (MDS), would be useful and more easily accomplished than this study. The Oklahoma State Health Department requires that MDS information be transmitted monthly via computer. If the cooperation of the Health Department could be obtained, this data could be easily accessed. Pressure ulcer risk assessment information could be included, if available.

The registered dietitian has the responsibility of identifying at-risk residents and recommending nutritional measures that will help prevent skin breakdown in addition to other standards of care. The researchers recommend that the Braden Scale be included in admission screening and reported periodically for all long term care residents.

The consultant dietitian in long-term care can use the variables that were significantly associated with pressure ulcer development in this study to help identify the at-risk resident. Hospital dietitians can use the information gained from this study to focus their efforts during the usually short hospital stay. Improved communication between the long-term care facility and the hospital would benefit the patient.

Further recommendations resulting from this study are that hospital clinical dietitians, long-term care consultants and certified dietary managers should be aware of the patient's serum albumin, percent food intake, and mode of feeding and track the weight records to identify those patients who are losing weight. Information could be sent

with the patient when they are dismissed from acute care to inform the long-term care facility of their progress while hospitalized.

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APPENDICES

APPENDIX A. BRADEN SCALE

Braden Scale for Predicting Pressure Sore Risk

Patient's Name _____	Evaluator's Name _____			Date of Assessment				
Sensory perception Ability to respond meaningfully to pressure-related discomfort	**1. Completely limited:** Unresponsive (does not moan, flinch, or grasp) to painful stimuli, due to diminished level of consciousness or sedation, OR limited ability to feel pain over most of body surface	**2. Very limited:** Responds only to painful stimuli. Cannot communicate discomfort except by moaning or restlessness, OR has a sensory impairment which limits the ability to feel pain or discomfort over 1/2 of body.	**3. Slightly limited:** Responds to verbal commands but cannot always communicate discomfort or need to be turned, OR has some sensory impairment which limits ability to feel pain or discomfort in 1 or 2 extremities.	**4. No impairment:** Responds to verbal commands. Has no sensory deficit which would limit ability to feel or voice pain or discomfort				
Moisture Degree to which skin is exposed to moisture	**1. Constantly moist:** Skin is kept moist almost constantly by perspiration, urine, etc. Dampness is detected every time patient is moved or turned.	**2. Moist:** Skin is often but not always moist. Linen must be changed at least once a shift.	**3. Occasionally moist:** Skin is occasionally moist, requiring an extra linen change approximately once a day.	**4. Rarely moist:** Skin is usually dry; linen requires changing only at routine intervals				
Activity Degree of physical activity	**1. Bedfast:** Confined to bed	**2. Chairfast:** Ability to walk severely limited or nonexistent. Cannot bear own weight and/or must be assisted into chair or wheel chair.	**3. Walks occasionally:** Walks occasionally during day but for very short distances, with or without assistance. Spends majority of each shift in bed or chair.	**4. Walks frequently:** Walks outside the room at least twice a day and inside room at least once every 2 hours during waking hours.				
Mobility Ability to change and control body position	**1. Completely immobile:** Does not make even slight changes in body or extremity position without assistance.	**2. Very limited:** Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently.	**3. Slightly limited:** Makes frequent though slight changes in body or extremity position independently.	**4. No limitations:** Makes major and frequent changes in position without assistance.				
Nutrition Usual food intake pattern	**1. Very poor:** Never eats a complete meal. Rarely eats more than 1/3 of any food offered. Eats 2 servings or less of protein (meat or dairy products) per day. Takes fluids poorly. Does not take a liquid dietary supplement, OR is NPO[1] and/or maintained on clear liquids or IV[2] for more than 5 days.	**2. Probably inadequate:** Rarely eats a complete meal and generally eats only about 1/2 of any food offered. Protein intake includes only 3 servings of meat or dairy products per day. Occasionally will take a dietary supplement, OR receives less than optimum amount of liquid diet or tube feeding.	**3. Adequate:** Eats over half of most meals. Eats a total of 4 servings of protein (meat, dairy products) each day. Occasionally will refuse a meal, but will usually take a supplement if offered, OR is on a tube feeding or TPN[3] regimen, which probably meets most of nutritional needs.	**4. Excellent:** Eats most of every meal. Never refuses a meal. Usually eats a total of 4 or more servings of meat and dairy products. Occasionally eats between meals. Does not require supplementation.				
Friction and shear	**1. Problem:** Requires moderate to maximum assistance in moving. Complete lifting without sliding against sheets is impossible. Frequently slides down in bed or chair, requiring frequent repositioning with maximum assistance. Spasticity, contractures, or agitation leads to almost constant friction.	**2. Potential problem:** Moves feebly or requires minimum assistance. During a move skin probably slides to some extent against sheets, chair, restraints, or other devices. Maintains relatively good position in chair or bed most of the time but occasionally slides down.	**3. No apparent problem:** Moves in bed and in chair independently and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair at all times.					
				Total score				

[1]NPO: Nothing by mouth
[2]IV: Intravenously.
[3]TPN: Total parenteral nutrition

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Read Message

Reply | Reply All | Forward | as attachment

Delete | Next | Download Attachments

Help | Back to Inbox | - Choose Folder - | Move | Add Addresses

From: nbergstr@UNMC.EDU | Block address
To: nicholp@yahoo.com
Date: Thu, 19 Aug 1999 08:04:03 -0500
Subject: Re: Your Letter

It is Ok for you to use the Braden Scale in your appendix. Have you read our 1992 study in the Journal of the American Geriatric Society. I believe it is the only prospective study of dietary intake and nutritional status. Interestingly, most chart reviews will find that there is a relationship between low serum albumin and pressure sores, but prospectively collected data find that dietary intake of protein is more important. It will be interesting to see if you find a relationship between the Braden Scale, nutrition subscale and presure ulcers...Only i suspect if Activity and Mobility are also compromised.

By the way, we now consider scores of 15 to 18 to be mild risk for older subjects. The form you have uses 15-16.

Please keep us posted on your progress and findings.

nicholp@yahoo.com on 08/19/99 12:52:35 AM

To: Nancy Bergstrom/CON/UNMC/UNEBR@University of Nebraska

cc:

Subject: Re: Your Letter

APPENDIX B. IRB APPROVAL FORM

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD

DATE: 12-01-98 **IRB #: HE-99-042**

Proposal Title: THE RELATIONSHIP BETWEEN NUTRIENT INTAKE, DEMOGRAPHIC VARIABLES AND THE FORMATION OF PRESSURE ULCERS IN SOUTHEASTERN OKLAHOMA LONG TERM CARE FACILITY RESIDENTS

Principal Investigator(s): Andrea Arquitt, Phyllis Nichols

Reviewed and Processed as: Expedited

Approval Status Recommended by Reviewer(s): Approved

Signature: Carol Olson (BC) Date: December 1, 1998

Carol Olson, Director of University Research Compliance
cc: Phyllis Nichols

Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modification to the research project approved by the IRB must be submitted for approval. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

APPENDIX C. CONSENT FORMS

HOSPITAL CONSENT FORM

Consent is granted to Phyllis Nichols, RD/LD, to obtain information from the medical records of the hospital known as McAlester Regional Health Center for use in a research project entitled **The relationship between nutrient intake, demographic variables and the formation of pressure ulcers in Southeastern Oklahoma long term care facility residents.** This study will partially fulfill the requirements for the Master of Science Degree in Nutritional Science from Oklahoma State University. It has the potential benefit of identifying factors which contribute to the formation of pressure ulcers in Long Term Care residents. Information will be collected on patients who are residents of a long term care facility and developed a pressure ulcer while hospitalized. Information collected will include:

Diagnosis	Days hospitalized	Lab results
Mobility status	Level of consciousness	Continence
Average food intake	Medications	Pressure reduction product used
Stage and site of pressure ulcer	Turning schedule orders/ documentation	

I understand no patient will be identified by name in any phase of the study. The patient names will be removed from any photocopies that are made and will be replaced with a unique code number. A master list identifying subjects will be kept in a secure location and destroyed at the conclusion of the project. The facility will be reimbursed for photocopies at the rate of $.10 per page. Pages copied from the chart will include physician's orders, laboratory reports, food intake record, and turning schedule.

The names and dates of hospitalization of patients whose records will be studied and copies of the signed consent forms will be provided to the Medical Record Librarian and appointments will be made for times when the data collection will be done. A qualified representative of the hospital will inspect all records and copies made by the researcher and will approve before they are removed from the hospital.

I understand that participation in this project is voluntary, that there is no penalty for refusal to participate, and that the hospital is free to withdraw consent and participation in this project at any time without penalty after notifying the project director.

I may contact Andrea Arquitt, PhD, RD/LD, at telephone number (405) 744 - 8285. I may also contact Gay Clarkson, IRB Executive Secretary, 203 Whitehurst, Oklahoma State University, Stillwater, OK 74078; telephone number (405) 744 - 5700.

I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me.

Date: 9/17/99 Time 1445 (a.m./p.m.)

Signed: Kathleen Collins Quality Services Director
Signature of Administrator or authorized representative

I certify that I have personally explained all elements of this form to the subject or his/her representative before requesting the subject or representative to sign it.

Signed: Phyllis Nichols
Project Director or authorized representative

LONG TERM CARE FACILITY CONSENT FORM

Consent is granted to Phyllis Nichols, RD/LD, to obtain information from the medical records of the long term care facility known as Owen City Nursing Home for use in a research project entitled **The relationship between nutrient intake, demographic variables and the formation of pressure ulcers in Southeastern Oklahoma long term care facility residents.** This study will partially fulfill the requirements for the Master of Science Degree in Nutritional Science from Oklahoma State University. It has the potential benefit of identifying factors which contribute to the formation of pressure ulcers in Long Term Care residents. Information will be collected on patients who are residents of a long term care facility and developed a pressure ulcer either in the facility or while hospitalized. Information collected will include:

Age	Sex	Weight
Braden Scale Score	Days hospitalized	Lab results
Diagnosis	Level of consciousness	Continence
Mobility status	Medications	Pressure reduction product used
Average food intake	Turning schedule orders/ documentation	Stage and site of pressure ulcer
		Where pressure ulcer was acquired

I understand no patient will be identified by name in any phase of the study. The patient names will be removed from any photocopies that are made and will be replaced with a unique code number. A master list identifying subjects will be kept in a secure location and destroyed at the conclusion of the project. The facility will be reimbursed for photocopies at the rate of $.10 per page and a representative will approve copies before they are removed from the facility. Pages copied from the chart will include physician's orders, laboratory reports, food intake record, and turning schedule.

All data collection will be done at times that are in addition to the regularly scheduled dietary consultation visits.

I understand that participation in this project is voluntary, that there is no penalty for refusal to participate, and that I am free to withdraw my consent and participation in this project at any time without penalty after notifying the project director.

I may contact Andrea Arquitt, PhD, RD/LD, at telephone number (405) 744 - 8285. I may also contact Gay Clarkson, IRB Executive Secretary, 203 Whitehurst, Oklahoma State University, Stillwater, OK 74078; telephone number: (405) 744 - 5700.

I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me.

Date: Feb 12, 1999 Time 11:45 (a.m./p.m.)

Signed: Frances M Dean
Signature of Administrator or authorized representative

I certify that I have personally explained all elements of this form to the subject or his/her representative before requesting the subject or representative to sign it.

Signed: Phyllis Nichols RD/LD
Project Director or authorized representative

LONG TERM CARE FACILITY CONSENT FORM

Consent is granted to Phyllis Nichols, RD/LD, to obtain information from the medical records of the long term care facility known as Latimer Nursing Home for use in a research project entitled **The relationship between nutrient intake, demographic variables and the formation of pressure ulcers in Southeastern Oklahoma long term care facility residents.** This study will partially fulfill the requirements for the Master of Science Degree in Nutritional Science from Oklahoma State University. It has the potential benefit of identifying factors which contribute to the formation of pressure ulcers in Long Term Care residents. Information will be collected on patients who are residents of a long term care facility and developed a pressure ulcer either in the facility or while hospitalized. Information collected will include:

Age	Sex	Weight
Braden Scale Score	Days hospitalized	Lab results
Diagnosis	Level of consciousness	Continence
Mobility status	Medications	Pressure reduction product used
Average food intake	Turning schedule orders/ documentation	Stage and site of pressure ulcer
		Where pressure ulcer was acquired

I understand no patient will be identified by name in any phase of the study. The patient names will be removed from any photocopies that are made and will be replaced with a unique code number. A master list identifying subjects will be kept in a secure location and destroyed at the conclusion of the project. The facility will be reimbursed for photocopies at the rate of $.10 per page and a representative will approve copies before they are removed from the facility. Pages copied from the chart will include physician's orders, laboratory reports, food intake record, and turning schedule.

All data collection will be done at times that are in addition to the regularly scheduled dietary consultation visits.

I understand that participation in this project is voluntary, that there is no penalty for refusal to participate, and that I am free to withdraw my consent and participation in this project at any time without penalty after notifying the project director.

I may contact Andrea Arquitt, PhD, RD/LD, at telephone number (405) 744 - 8285. I may also contact Gay Clarkson, IRB Executive Secretary, 203 Whitehurst, Oklahoma State University, Stillwater, OK 74078; telephone number: (405) 744 - 5700.

I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me.

Date: Feb 11, 1999 Time 9:00 (a.m./p.m.)

Signed: Robert Reagan
Signature of Administrator or authorized representative

I certify that I have personally explained all elements of this form to the subject or his/her representative before requesting the subject or representative to sign it.

Signed: Phyllis Nichols RD LD
Project Director or authorized representative

APPENDIX D. DATA COLLECTION FORMS

RECORD OF SUBJECTS-PRESSURE ULCER STUDY

ID	NAME	DATE LTC DATA	HX NAME	DATE HX STAY	DATE HX DATA	COMMENTS

LTC Demographics 1

SUBJ ID	SEX	DOB	LTC ADMIT DATE	HT INCHES	ADMIT WT	DIET	METHOD OF FDG	% AVG FOOD INTAKE	ACTIVITY	MOBILITY	LOC	CONTINENT-BLAD	CONTIN-BOWEL	PRES RED SURF USED	

LTC Demographics 2

SUB ID	BRADEN SCORE	DATE HOSPITALIZED	WT 1 YR AGO/OR ADMIT	WT WHEN HOSP	WT WHEN RETURN	RETURN W/PU?	SITE?	STAGE?	SOAP BATHING	SOAP LAUNDRY	SYSTOLIC BP	DIASTOLIC BP	

RECORD OF SUBJECTS-PRESSURE ULCER STUDY

ID	NAME	DATE LTC DATA	HX NAME	DATE HX STAY	DATE HX DATA	COMMENTS

LTC Demographics 1

SUBJ ID	SEX	DOB	LTC ADMIT DATE	HT INCHES	ADMIT WT	DIET	METHOD OF FDG	% AVG FOOD INTAKE	ACTIVITY	MOBILITY	LOC	CONTINENT-BLAD	CONTIN-BOWEL	PRES RED SURF USED

LTC Demographics 2

SUB ID	BRADEN SCORE	DATE HOSPITALIZED	WT 1 YR AGO/OR ADMIT	WT WHEN HOSP	WT WHEN RETURN	RETURN W/PU?	SITE?	STAGE?	SOAP BATHING	SOAP LAUNDRY	SYSTOLIC BP	DIASTOLIC BP	

LTC DIAGNOSIS 1

SUBJ ID	DM	CAD,ASCVD	DEMENTIA	CVA	HTN	ARTHRITIS, DJD	FX	ANEMIA	CA	THYROID	GI, PUD	NEUROLOGICAL	UTI	INFECTIONS	

LTC DIAGNOSIS 2

SUBJ ID	DEHYDRATION	ABNORMAL LABS	HIATAL HERNIA	COPD	EATING DISORDER	PSYCHOLOGICAL	SKIN DISORDER	OSTEOPOROSIS						

LTC MEDICATIONS

SUB ID	DIURETIC	ANTI-INFLAMMATORY	ANTI-HYPERTENSIVE	THYROID	ANTI-ULCER	HYPOGLYCEMIC	TOTAL MEDS		

LTC LABS

SUBJ ID	DATE	Glucose mg/dL	BUN mg/dL	Creatinine mg/dL	Na mEq/L	K mEq/L	Cl mEq/L	CO2 mEq/L	Hgb g/dL	Hct %	TLC 10 3	Calc Osmoloality	Albumin g/dL	Cholesterol mg/dL	

APPENDIX E. AMERICAN DIETETIC ASSOCIATION/HCFA NUTRITION ASSESSMENT FORM

Nutrition Risk Assessment

Name _____ Adm date _____ Rm _____ Assess type _____

DOB _____ Age _____ Sex: M F Advance directive _____ Physician _____

Diagnosis _____

Ht (in) _____ Wt (lb) _____ Wt (kg) _____ Usual body wt range _____ BMI _____

BEE _____ Activity factor _____ Injury factor _____ Total cal _____ Total protein _____ g (_____ g/kg)

Total fluids _____ cc (_____ cc/kg) Fluid restriction _____

Diet order _____ Food allergies/sensitivities _____

Supplement/snacks _____ Cultural/religious preferences _____

Risk Factor	No/Low Risk (0 pts)	Moderate Risk (1 pt)	High Risk (3 pts)	MDS Ref	Pts	Comments
Weight status; loss or gain	BMI 19-27 No weight change	<5% wt change in 30 days; <7.5% within 90 days; or <10% within 6 mo	BMI <19 or >27 ≥5% wt change in 30 days; ≥7.5% in 90 days; or ≥10% within 6 mo	J, K, E		
Oral/nutrition intake; food	Intake meets 76-100% of estimated needs	Intake meets 26-75% of estimated needs	Intake meets ≤25% of estimated needs	AC, J, K		
Oral/nutrition intake; fluids	Consumes 1,500-2,000 cc/day	Consumes 1,000-1,499 cc/day	Consumes < 1,000 cc/day	AC, J, K		
Medications; nutrition-related	0-1 drugs/day	2-4 drugs/day	5 or more drugs/day	O		
Relevant conditions and diagnoses	HTN, DM, heart disease, or other controlled diseases/ conditions	Anemia, infection, CVA (recent), fracture, UTI, alcohol abuse, drug abuse, COPD, edema, surgery (recent), osteoporosis, hx of GI bleed, food intolerances and allergies, poor circulation, constipation, diarrhea, GERD, anorexia, Parkinson's	Cancer (advanced), septicemia, liver failure, dialysis, ESRD, Alzheimer's, dementia, depression, dehydration, dysphagia, radiation/chemo, active GI bleed, chronic nausea, vomiting, ostomy, gastrectomy, focal impection, uncontrolled diseases or conditions	E, H, I, J, M, P		
Physical and mental functioning	Ambulatory, alert, able to feed self, no chewing or swallowing problems	Out of bed w/assistance, motor agitation (tremors, wandering), limited feeding assistance, supervision while eating, chewing or swallowing problems, teeth in poor repair, ill-fitting dentures or refusal to wear dentures, edentulous, taste and sensory changes, unable to communicate needs	Bedridden, inactive, total dependence, extensive or total assistance or dependence while eating, aspirates, tube feeding, TPN, mouth pain	A, B, E, G, L, P		
Lab values	Albumin and other nutrition-related lab values WNL	Albumin 3.0-3.4 g/dL, 1-2 other nutrition-related labs abnormal	Albumin less than 3.0 g/dL, 3-5 other nutrition-related labs abnormal	P		
Skin conditions	Skin intact	Stage I/II pressure ulcers or skin tears not healing, hx of pressure ulcers, stasis ulcer, fecal incontinence	Stage III/IV pressure ulcers or multiple impaired areas	M		
Overall Risk Category:	**0-2 points: NO/LOW RISK**	**3-7 points: MODERATE RISK**	**≥8 points: HIGH RISK**			

Total Points: _____ **Overall Risk Category:** _____

Signature: _____ **Date:** _____

VITA

Phyllis Nichols

Candidate for the Degree of

Master of Science

Thesis: THE RELATIONSHIP BETWEEN NUTRIENT INTAKE, DEMOGRAPHIC VARIABLES AND THE FORMATION OF PRESSURE ULCERS IN SOUTHEASTERN OKLAHOMA LONG TERM CARE FACILITY RESIDENTS

Major Field: Nutritional Sciences

Biographical:

Education: Graduated from Arkansas City High School, Arkansas City, Kansas, in May 1953; received Bachelor of Science degree in Dietetics and Institutional Management from Kansas State University, Manhattan, Kansas in May 1957; Completed the requirements for Master of Science Degree with a major in Nutritional Sciences at Oklahoma State University In May. 2000.

Experience: Graduate assistant in women's residence hall, Kansas State University, 1957-58 school year; Food service manager at McAlester General Hospital, 1958 to 1961; Assistant director Department of Dietetics, McAlester Regional Hospital, 1966 to 1976; Consultant dietitian to nursing homes, small hospitals and Department of Human Services clients, 1977 to present.

Professional Memberships: The American Dietetic Association; Consultant Dietitians in Health Care Facilities, a practice group of The American Dietetic Association; Oklahoma Dietetic Association; Oklahoma Consultant Dietitians in Health Care Facilities; Kappa Omicron Nu.