

1990

## The Use of a Three-Layered Air Cushion in Reducing the Incidence of Pressure Ulcers in the Nursing Home Patient

Ann H. Harris  
*Grand Valley State University*

Follow this and additional works at: <https://scholarworks.gvsu.edu/theses>



Part of the [Nursing Commons](#)

---

### ScholarWorks Citation

Harris, Ann H., "The Use of a Three-Layered Air Cushion in Reducing the Incidence of Pressure Ulcers in the Nursing Home Patient" (1990). *Masters Theses*. 127.  
<https://scholarworks.gvsu.edu/theses/127>

This Thesis is brought to you for free and open access by the Graduate Research and Creative Practice at ScholarWorks@GVSU. It has been accepted for inclusion in Masters Theses by an authorized administrator of ScholarWorks@GVSU. For more information, please contact [scholarworks@gvsu.edu](mailto:scholarworks@gvsu.edu).

THE USE OF A THREE-LAYERED AIR CUSHION IN REDUCING THE  
INCIDENCE OF PRESSURE ULCERS IN THE NURSING HOME PATIENT

By

Ann H. Harris

A THESIS

Submitted to

Grand Valley State University  
in partial fulfillment of the requirements  
for the degree of

MASTER OF SCIENCE IN NURSING

Kirkhof School of Nursing

1990

Thesis Committee Members:  
Emily Droste-Bielak, Ph.D., R.N.  
William C. Bell, Ph.D.  
Katherine Kim, Ph.D., R.N.

## ABSTRACT

### THE USE OF A THREE-LAYERED AIR CUSHION IN REDUCING THE INCIDENCE OF PRESSURE ULCERS IN THE NURSING HOME PATIENT

By

Ann H. Harris

The purpose of this investigation was to determine the effectiveness of a pressure relief mattress in reducing the number of pressure ulcers in high risk patients. The research design was experimental with random assignment of subjects who were identified as at risk for developing pressure ulcers into an experimental and control group. Every new admission entering two nursing homes in a Midwestern metropolitan area who met inclusion criteria was assessed using the Braden Scale for his/her risk for developing pressure ulcers. Twelve subjects determined at risk were assessed for skin breakdown for a period of two months, first weekly and then bi-weekly. The experimental group received the three-layered air cushion mattress. No subject developed a pressure ulcer. The results indicate that pressure ulcers can be prevented. Consciousness raising and promoting motivation of the staff involved in this serious problem may be factors that require future research.

### **Dedication**

**This study is dedicated to my understanding family. My daughters, Kristen and Tracey, were wonderful throughout the educational process and helped keep life in perspective. My husband, Pete, gave his support, encouragement, and help when I really needed it.**

## Acknowledgments

This thesis would not have been possible without the help of many others. I wish to express my appreciation to my thesis committee members. As Chairperson of my committee, Dr. Emily Droste-Bielak, kindly offered advice on numerous drafts. Her understanding and support went far beyond the call of duty. Dr. Katherine Kim always had time for a research question, day or night, and had a special talent for giving criticism in a gentle manner. Dr. William Bell also helped guide me towards a finished product.

I am thankful for the help of Mary Jane Wiegink, R.N. Without her thoroughness and commitment with data collection this project would not have been possible.

The expert help of Bob Harris in the area of computer problems and printing of the thesis are greatly appreciated.

A special thank you goes to Tracey Harris for the time she spent on typing the Skin Assessment and Data Collection Tool.

The donation by Gaymar Industries of the three-layered air cushion mattress made this study of early intervention in the prevention of pressure ulcers possible.

## Table of Contents

List of Tables.....	vii
List of Figures.....	viii
List of Appendices.....	ix

### CHAPTER

1 INTRODUCTION .....	1
Introduction.....	1
Purpose .....	3
2 REVIEW OF THE LITERATURE.....	4
Review of the Literature.....	4
Theoretical Framework.....	13
Implications for Study.....	19
Hypothesis.....	20
Operational Definitions.....	22
3 METHODOLOGY.....	25
Research Design.....	25
Setting and Sample.....	25
Instruments.....	28
Procedure.....	29
4 RESULTS.....	33
Characteristics of subjects.....	33
Hypothesis.....	36
Other Results of Interest.....	37

5 DISCUSSION.....	38
Discussion.....	38
Limitations.....	40
Strengths.....	41
Implications for Nursing Education & Pracice.....	41
Recommendations for Future Investigation.....	44
Summary.....	45
APPENDICES.....	47
REFERENCES.....	54

## List of Tables

TABLE	PAGE
1. Comparison of the Two Nursing Homes.....	27
2. Sample Distribution of At Risk Subjects by Age.....	34
3. Comparison of the Experimental and Control Groups.....	39
4. Nutritional Status of At Risk Subjects.....	36



## **List of Figures**

<b>FIGURE</b>	<b>PAGE</b>
1. The Conceptual Schema Depicting Factors in the Etiology of Pressure Ulcers.....	16
2. The Gaymar Sof-Care Plus Mattress Overlay.....	23

## List of Appendices

APPENDIX	PAGE
A. The Braden Scale .....	47
B. Written Permission to Use Braden Scale.....	48
C. Skin Assessment and Data Collection Tool.....	49
D. Verbal Script for Obtaining Consent Form.....	50
E. Informed Consent for Inclusion in a Study in Prevention of Bedsores.....	52
F. Hand Check Record.....	53

## CHAPTER 1

### INTRODUCTION

Pressure ulcers are painful, disabling, and sometimes a fatal condition affecting over one million people in the United States each year and causing an estimated 60,000 deaths a year (Brody, 1986). The patient, family, health team, and facility are all affected. When a patient develops a pressure ulcer the implications are great for that patient and those involved with his/her care .

The patient is affected both psychosocially and physiologically with the development of a pressure ulcer. Pain, suffering, increased nutritional needs, and change in body image are just a few of the negative effects. The psychosocial impact extends to the family as they see and may care for open sores on their loved one. Although it is well accepted that there is an increase in morbidity and mortality associated with pressure ulcers, not many studies have focused on the actual numbers of deaths that are attributable to pressure ulcers. Michocki (1976) found that the risk of death is increased four-fold in geriatric patients with pressure ulcers due to septicemia. In a more recent cross-sectional survey done in an acute hospital setting, Allman and associates found that the in-hospital death rate was 26% for patients with pressure ulcers and 19% for the patient identified as being at risk for pressure ulcer development. Both numbers were much higher

than the general adult admissions death rate of 4.3% during the same time frame (Allman et al., 1986).

The economic impact of the development of pressure ulcers is great. With the advent of Diagnosis Related Groups (DRG's) in 1983 and consequent pre-determined amounts of dollars reimbursed per diagnosis, there is a real problem in the area of reimbursement for pressure ulcers. All studies indicate that the cost of healing a pressure ulcer far exceeds the DRG rates. Currently, the prospective payment to the hospital for DRG # 271 (pressure sore) is \$3,511.00 when the primary admitting diagnosis is "pressure sore". Yet the National Pressure Ulcer Advisory Panel (NPUAP) in its 1989 session estimated that the cost of healing a pressure ulcer ranges from \$2,000 - \$30,000 per ulcer and some are never healed. There are others that state that the cost is much higher with the actual expense to the hospital being \$14,000.00 to \$25,000.00 for a stage I or II pressure ulcer and \$30,000 to \$65,000 for a stage III or IV (Jeeters, 1988). However, very few patients are admitted with the primary diagnosis of pressure ulcer and if the pressure ulcer develops after admission, there is virtually no additional reimbursement to the hospital for corrective therapy.

The economic impact nation-wide can be imagined when viewing an example of a single hospital. In an avoidable loss summary done by Donald F. Woodworth for an average 300 bed hospital a conservative 3% incidence rate was used. The incremental treatment costs added to the increased length of stay showed that the total avoidable loss in one year was \$229,515 (Woodworth, 1988).

Nurses are concerned about pressure ulcer development. They see the long-term and far-reaching effects on the family and the patient. The development of pressure ulcers has traditionally been viewed as a nursing problem and equated with poor nursing care. Fifty per cent or more of nursing time is spent with patients who have pressure ulcers versus those patients with equal illness that do not have pressure ulcers (Norton, 1962). With the increase in the acuity levels and the concurrent nursing shortage, the prevention of pressure ulcers must be addressed. The key to the pressure ulcer problem is two-fold: early and accurate identification of patients at risk and intervention toward prevention.

#### Purpose

The purpose of this research was to determine the effectiveness of a three-layered air cushion mattress in reducing the incidence of pressure ulcers in high risk patients. It was hoped that by adding to the knowledge base related to early nursing intervention to prevent pressure ulcer development, direction could be provided in alleviating this very serious problem.

## CHAPTER 2

### REVIEW OF LITERATURE AND CONCEPTUAL FRAMEWORK

#### Review of the Literature

The review of the literature for this study involved the scope of the pressure ulcer problem, research related to pressure ulcer development, assessment tools, and pressure relief devices.

#### Scope of Problem

An indication of the national scope of the pressure ulcer problem is the fact that in 1986 the Health Care Financing Administration (HCFA) proposed reviewing institution-acquired pressure ulcers as one of six quality of care screens. This has great impact on the long term care facilities where the incidence of pressure ulcers is estimated to be between 24-35% (Michocki, 1976; Shepard, 1987) and even on the acute care hospitals where the incidence is at least 3-10% (Linder, 1983; Allman et al., 1986).

The concern with this problem on the national level is also evident in the non-governmental sector. There are two publications devoted entirely to pressure ulcers: Decubitus, and Pressure Ulcer. Two years ago, the National Pressure Ulcer Advisory Panel (NPUAP) was formed. This national panel proposed nine tenets which should be adopted by all health care professionals (NPUAP, 1989). The first four tenets are primarily concerned with early identification of those at risk and early preventive measures, the primary

focus of this study.

Early and accurate identification of patients at risk is the necessary first step in solving the pressure ulcer problem. Because costs of prevention are high (increased nursing time, special beds, other devices, etc.), it is important to identify only those patients who are truly "at risk" for developing a pressure ulcer.

Screening of all patients to determine who are at high risk for developing pressure ulcers is essential. Many hospitals are already including pressure ulcer risk identification in the initial admission nursing assessment (Jeeters, 1988). Identification of the high risk patient is the necessary pre-requisite to good planning and appropriate interventions. Although prevention does cost money, cost of treatment, once a pressure ulcer develops, is even higher.

Research indicates that 80% of hospital-acquired pressure ulcers occur within eight to nine days of admission and 50% occur within five days of admission (Woodworth, 1988). Bergstrom (1990) found that 90% of the pressure ulcers develop in the first week of admission to nursing homes. Thus early identification, without over-identification, of the patient at high risk for the development of pressure ulcers is essential.

#### Related Research

Although pressure ulcers have always been a problem when caring for the ill, it is only in the last twenty five years that actual studies have dealt with the problem as a discrete entity. More recent studies in the area of prevention of pressure ulcers using more rigorous research methodology are being reported.

In the early 1960's studies were conducted to determine causative factors. Rudd (1962) identified four contributing factors: sustained pressure, reduction of bodily movements, devitalization of deep tissue, and reduced general resistance. It is possible that the "devitalization of deep tissue" was actually the beginning of the visualization of the actual pressure ulcer. In the United Kingdom work was also being done that concluded there was a high correlation between decreased movement and the development of pressure ulcers (Exton-Smith & Sherwin, 1961). The Exton-Smith and Sherwin's study also found that pressure ulcer occurrence increased with age and that those over 85 years of age had twice as many pressure ulcers as those under the age of 75.

As interest in pressure ulcers has increased so has the research. In the past most studies involving pressure ulcers were not extensive and were retrospective in nature. They focused on prevalence, the groups of patients that have a higher incidence of pressure ulcer development, or factors associated with pressure ulcers. Recently a cross-sectional survey examined the prevalence of pressure ulcers in the hospitalized patient and the factors associated with pressure ulcer development (Allman et al., 1986). In addition to finding that 14% to 17% of hospitalized patients have pressure ulcers or are at risk for developing them, the conclusion was that fecal incontinence, diarrhea, fractures, urinary catheter use, decreased weight, dementia, and hypoalbuminemia were associated with having pressure ulcers ( $p < .05$ ). When regression analysis was performed the significant factors were found to be hypoalbuminemia, fecal incontinence, and fractures.



More recently Goode and Allman (1989) studied the epidemiology of Stage II or greater pressure ulcers in the acute care hospital and the nursing home. They did not look at Stage I pressure ulcers (non-blanchable erythema). The incidence in the acute hospital during hospitalization was 1-3% and in the nursing homes was 12% during a six month length of stay (Goode & Allman, 1989).

### Assessment Tools

Over the past three decades assessment tools have been developed to aid the nurse in identification of patients at high risk for developing pressure ulcers. Some of the scales have been developed by nurses and others by producers of skin care products. However, until recently, none have been fully tested for reliability and validity.

Norton (1962) is credited with developing the first assessment tool (now called the Norton scale) in the United Kingdom. The pressure ulcer study was just one part of a three part, two year investigation studying basic nursing care of the elderly. As Norton states, "an implied criticism of the Norton Scale has been the absence of a nutritional element" (Norton, 1989, p. 30) since all scales developed since then have included a nutrition subscale. However, the data collecting form that she used for the two year study did have a place for recording the patient's weight, build, and appetite even though nutrition was not a subscale in obtaining the score.

The scale consists of the five following categories; physical condition, mental condition, mobility, activity, and incontinence. The scale had a maximum score of 20 and a minimum score of 5 with a lower score reflecting

the patient being more at risk. The study that utilized the tool showed an almost linear relationship between the initial score and the incidence of pressure ulcers; nearly 50% of pressure ulcer development in those with scores of less than 12; 32% for scores of 12-14; 21% for scores of 15-17; and 5% for scores of 18-20 (Norton, 1989).

A study done using the Norton Scale as a predictive tool (Goldstone & Goldstone, 1982) demonstrated a sensitivity of 89% (percentage of the subjects who developed pressure ulcers among those who were predicted to develop pressure ulcers). However, the specificity (the tendency to overpredict) was 64%. Overprediction means a large number of patients are identified as at risk who are truly not at risk, with consequent additional expense.

The Gosnell Scale (Gosnell, 1973) is another assessment tool utilized to measure risk of developing pressure ulcers. It resembles the Norton Scale in several ways. The most important difference is the nutrition category replacing Norton's general physical condition category. Gosnell evaluated the tool using only 30 subjects. Reliability and validity were not examined.

Recently the Gosnell scale has undergone revision and the instrumentation work now is focused on predictive validity studies, but has not yet been published (Gosnell, 1989). Perhaps the biggest problem with both of these scales is the value judgements that are made by the nurse who assigns the score. The descriptions are not well defined, i.e. "poor" to "good", leaving the interpretation to the subjectivity of the nurse.

The Braden Scale is the most recently developed assessment tool and has

been vigorously tested for reliability and validity, including specificity (Bergstrom, Braden, Laguzza, & Holman, 1987). It has been tested in general hospital populations, critical care units and nursing homes. It is viewed positively by clinicians and researchers alike and according to Taylor (1988) has demonstrated greater sensitivity and specificity than other scales.

The Braden Scale was developed to overcome problems with existing risk assessment scales. In the mid 1980's Braden and Bergstrom were having staff use the Gosnell Scale in a research project. Several difficulties were encountered (Braden & Bergstrom, 1989). The staff did not use the good, fair, poor ratings of nutritional intake with a high degree of accuracy. Often the staff wrote in clarifying statements in the subscales because they could not decide which rating to give. The Braden Scale was thus developed to overcome the above problems and was based on a conceptual schema of etiological factors in pressure sore formation. At the present time the Braden Scale is being further evaluated through a grant from the United States Federal Government.

#### Pressure Relief and Prevention

The etiology of pressure ulcers is multifactorial. It is generally accepted that the primary cause is pressure. There are many other factors that need to be addressed to irradicate or prevent ulcers, but if pressure is not relieved all other interventions will be of little value (Macklebust et al., 1986).

In 1930 Landis determined the pressure within the capillaries at the arterial outflow was approximately 32 mm Hg (Landis, 1930). This original research was not given adequate attention until the recent manufacturing of

pressure relief surfaces to aid in treatment and prevention of pressure ulcers. At the present time the "gold standard" that is used when discussing adequate pressure relief is the capillary closing pressure of 32 mm Hg. Later studies on pressure ulcer formation found that the interaction of the duration and intensity of pressure was crucial. Koziak (1959) conducted a scientific investigation in which ischemic ulcers were produced in dogs by both high pressures applied for short durations of time or low pressures applied for long durations of time.

In the last decade little new knowledge on the pathophysiology of pressure ulcers has been discovered. However, knowledge of the pathophysiology of pressure ulcer development has influenced advances in the area of tissue biomechanics (Maklebust, Mondoux, & Sieggreen, 1986). Many new products have been developed that claim to relieve pressure below the gold standard of 32 mm Hg. If the pressure readings at the bony prominences are above the capillary closing pressure (32 mm Hg), the product is more of a comfort measure than a product to prevent pressure ulcers. Therefore, it is important to use support surfaces which reduce the pressure at the interface of the body and the support surface to below 32 mm Hg. The pressure at this point is referred to as the tissue interface pressure. Many of the new pressure relief devices do not have data available on interface pressure readings. Of those that do, very few relieve pressure below 32 mm Hg and some of those that state that the interface pressure is 32 mm Hg have only used one reading on one healthy patient to verify the devices effectiveness.

In an independent study to evaluate the effectiveness of various support surfaces, six pressure relieving devices were evaluated using thirteen healthy subjects ranging in age from 23 to 55 years (Maklebust et al., 1986). Only three of the devices were found to relieve pressure below 32 mm Hg at the sacrum and the greater trochanter of the femur. Of these three, two were extremely expensive. One was the Clinitron<sup>®</sup>, an air fluidized bed that rents for approximately \$100 per day. The other was a Mediscus<sup>®</sup> bed which is a low air loss bed that rents for approximately \$65 per day. The Gaymar Sof-Care<sup>®</sup> mattress was the third device that was found effective. This is an air cushion that fits on top of a regular mattress and has a one time cost of approximately \$200. Due to the relatively high cost of the Clinitron<sup>®</sup> and the Mediscus<sup>®</sup> beds, a second phase of the study was undertaken. The second phase of the study compared a hospital mattress with three overlays on a hospital mattress: the Gaymar Sof-Care<sup>®</sup> mattress, two-inch foam, and Biogard (a special foam overlay). Interface pressures readings were taken between the overlays and the mattress surface at the pressure points of the sacrum, trochanter, and heel. The Gaymar Sof-Care<sup>®</sup> mattress was the only bed cushion that relieved pressure below 32 mm Hg at the trochanter. The investigators recommend further studies using a sample of patients rather than healthy subjects.

Another study examined the actual clinical effectiveness of the Gaymar Sof-Care<sup>®</sup> air cushion in the prevention of pressure ulcers. All randomly selected patients in an acute care facility that were identified as high risk using the Gosnell Pressure Sore Risk Assessment were placed on the

three-layered air cushion mattress (Makelbust et al., 1988). They remained on the special air cushion for the duration of their hospital stay with the average length of time in the study being 13 days. During transport periods a special operating-room table cushion was placed on the gurney. Patients were placed on a special wheelchair cushion when out of bed and in a chair. Of the 82 high risk subjects, 91% were free from pressure ulcers giving an incidence rate of 9%. Since the investigators state that other studies on the incidence rates in the same high risk populations report 13-40% incidence rates, the conclusion of the investigators was that the Gaymar Sof-Care<sup>®</sup> cushion provides effective pressure relief for most high risk patients. One of the recommendations was replication of the study with other high risk clinical groups.

In a similar clinical study both treatment and prevention were addressed. The use of an almost identical pressure relief device, the Gaymar Sof-Care Plus<sup>®</sup> was used to prevent and manage pressure ulcers (Brown-Etris, Meijers, Rideout, Roma, & Smith, 1989). The main purpose of the study was to demonstrate that more cost effective prevention and treatment of pressure ulcers could be realized through the utilization of consulting enterostomal therapy nurses and the use of Gaymar Sof-Care Plus<sup>®</sup> mattresses than through the use of the more expensive high-tech beds.

All residents of three metropolitan nursing homes that either had existing pressure ulcers or were identified as being at high risk, were placed on a Gaymar Sof-Care Plus<sup>®</sup> and managed by a consulting Enterostomal Therapy Nurse over a six week span of time. The investigators cited the need

to use "historical literature" in place of using a control group due to the fact that all three nursing homes had an identification process for the at-risk patient and also had standard prevention protocols. Therefore there could be no control group that did not receive the mattress. Since the general nursing home population incidence of pressure ulcers is 24-35% (Michocki, 1976; Shepard, 1987) an even higher rate would be expected in a high risk group. Yet only 10% of the high risk patient group of the Brown-Etris study developed a Stage I ulcer, a non-blanchable reddened area. The conclusion was that the combination of effective pressure relief and attentive wound management positively affected the prevention and healing of pressure ulcers in the high risk nursing home patient. The major weakness of the above two studies lies in using historical data in place of a control group.

#### Theoretical Framework

The theoretical framework that was utilized in this study was the conceptual schema depicting the etiology of pressure ulcers that was developed by Braden and Bergstrom (1987). This framework is concerned with the factors contributing to actual tissue breakdown. In order to view the nursing care that addresses the modification of the contributing factors, the theory of Levine provides a background for a more general conceptual framework. Levine's theory will be discussed followed by a more detailed description of the framework proposed by Braden and Bergstrom.

Several nursing theories could be utilized when examining the development of pressure ulcers since "all nursing frameworks specify optimal health as the goal of nursing" (Gordon, 1982, p. 64). However, the concepts

proposed by Levine may be the most appropriate as Braden and Bergstrom base their theory on scientific principles and research. Levine incorporates scientific principles in the use of the nursing process and bases her work on the natural law of the conservation of energy (Marriner-Tomey, 1989).

Although a thorough discussion of Levine's theory is beyond the scope of this manuscript, some major components will be stated followed by an example of how the theory would interface with the framework proposed by Braden and Bergstrom. According to the Nursing Theories Conference Group there are four major components to Levine's theory (George, 1980). These components are:

1. The patient is in a state of illness.
2. The nurse must recognize the organismic manifestation of the patient's adaptation to illness.
3. The patient's environment includes the nurse.
4. The nurse must make an intervention in the patient's environment and must evaluate the intervention as therapeutic or supportive.

Following the discussion of the framework proposed by Braden and Bergstrom, an example of each component in terms of the present study and nursing interventions will be given.

Braden and Bergstrom are very specific in terms of a framework for the development of pressure ulcers. For years health professionals have been taught that an increase in the intensity and duration of pressure would promote the development of pressure ulcers in the susceptible individual.



The definition of "susceptible individual" was left up to the health professional, but was generally regarded as the patient with poor nutrition that was relatively immobile. However, as the nursing profession has been growing over the years and establishing its own scientific body of knowledge, research has been done correlating risk factors and determinants in the development of pressure ulcers.

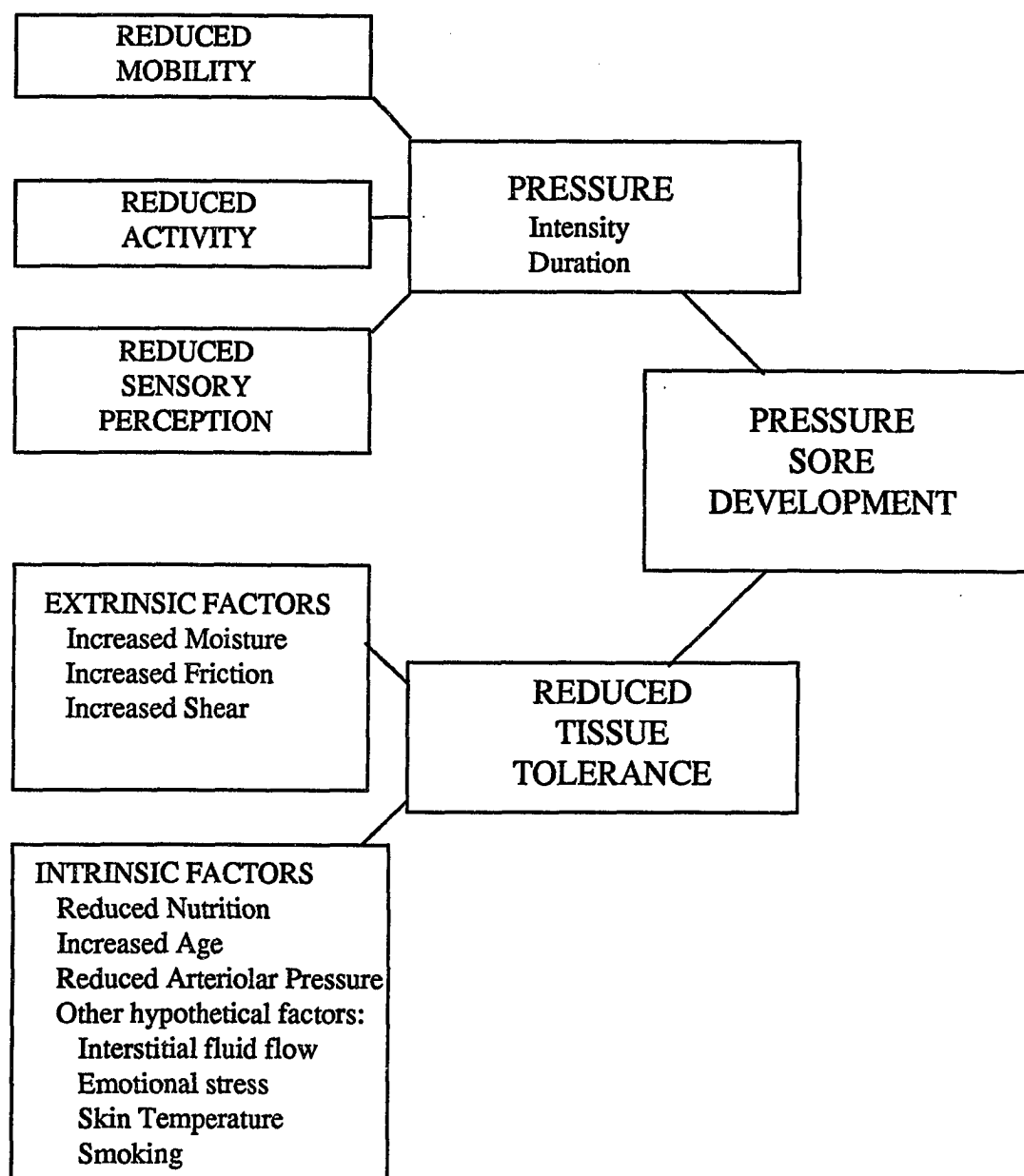
Retrospective research on common causative factors that were present in patients who developed pressure ulcers played a major role in the development of a theoretical framework for the etiology of pressure ulcers. However, until Braden developed the conceptual schema for the study of the etiology of pressure ulcers, there was no unifying concept or theoretical framework. Braden and Bergstrom assimilated what is known about pressure ulcer development and constructed a framework that would accommodate both past and future knowledge. The components of the diagram used in their conceptualization are grounded in past research.

The major determinants for developing pressure ulcers are the intensity and duration of the pressure and the individual's tissue tolerance. This is illustrated in Figure 1. To better understand the conceptual framework each of the main areas will be discussed: pressure, tissue tolerance, and pressure ulcer development.

### Pressure

Pressure is the force exerted on tissues and is a major component in tissue breakdown. When external pressure exceeds 32 mm Hg it causes occlusion of the underlying capillaries (Maklebust et al., 1986). The result is

**Figure 1.** The Conceptual Schema Depicting Factors in the Etiology of Pressure Ulcers.



By Braden and Bergstrom.  
Copyright 1987.

death of the tissue supplied by these capillaries, in other words, a pressure ulcer.

In a patient, the intensity and duration of pressure exerted on tissue are determined by how mobile the patient is, what his/her activity level is, and the level of his/her sensory perception.

### Tissue tolerance

Tissue tolerance is the ability of the tissue to withstand pressure. The tolerance of an individual to avoid skin breakdown is governed by both intrinsic and extrinsic factors. There are several intrinsic factors that have been researched and show a high correlation with the development of pressure ulcers. Old age is a common denominator found in those with pressure ulcers. Although a patient of any age can develop a pressure ulcer, they are most common in those over 65 years of age, probably due to the decrease in the quality of collagen and elastin and the effects of age on muscle mass (Bergstrom, 1989). Currently, the intrinsic factor undergoing the most research is the role that nutrition plays in the development of a pressure ulcer. Patients with poor or inadequate nutrition as evidenced by below normal levels of total protein and serum albumin have more pressure ulcers, and once pressure ulcers develop are very slow to heal (Maklebust et. al., 1988). Other intrinsic factors currently being studied by Bergstrom and Braden are diastolic pressure below 60 mm Hg and the effects of stress on the development of pressure ulcers as measured by cortisol levels.

The extrinsic factors influencing tissue tolerance include moisture, friction, and shear. Moisture can come from constant perspiration or from

urine, either of which causes the epidermis to macerate and makes it more prone to breakdown. Friction refers to the rubbing of two opposing surfaces, such as the skin of the agitated patient moving across the linen, and results in a more superficial abrasion. Shear occurs with greater levels of physical force and is the opposition of tissue layers caused by superficial external pressure exerted on the body during a change in position, as occurs when moving a patient up in bed without truly lifting him/her.

### Pressure ulcer

Bedsore, decubitus, decubitus ulcer, pressure sore, and pressure ulcer are all familiar terms meaning approximately the same thing to health professionals. The most accurate terminology is pressure ulcer (NPUAP, 1989), although pressure sore is used by some authors, including Braden and Bergstrom. The operational definition of pressure ulcer is actually done in staging according to the level of tissue damage. Pressure ulcer development is determined by the interplay of two major factors: pressure and tissue tolerance.

The development of a pressure ulcer is multifaceted and the result of many intervening variables. In utilizing the components of Levine's theory while viewing the framework proposed by Braden and Bergstrom, specific nursing implications are delineated. The following is an example of interfacing the components of Levine's theory with Braden and Bergstrom's conceptual schema in terms of nursing intervention (given in parentheses):

1. The patient is in a state of illness (the nurse identifies those in his/her care who are at risk for developing a pressure ulcer).

2. The nurse must recognize the organismic manifestation of the patient's adaptation to illness (the nurse looks at the intrinsic factors that are modifiable, such as nutrition, when planning care).
3. The patient's environment includes the nurse (the nurse realizes how he/she can impact on the patient, including adjusting extrinsic factors, i.e. the pressure factor, such as obtaining a pressure relief mattress).
4. The nurse must make an intervention in the patient's environment and must evaluate the intervention as therapeutic or supportive (in addition to providing pressure relief through turning and special mattresses, a scheduled skin assessment must be performed to evaluate treatment).

#### Implications for Study

The development of pressure ulcers is becoming recognized as a national problem. Until recently, there was no one schema that utilized past research, organized existing knowledge, and provided a vehicle for integration of new findings. The most comprehensive conceptual framework for understanding the etiology of pressure ulcers is that developed by Braden and Bergstrom (1987). Their conceptual framework addresses not only conditions contributing to prolonged intensity and duration of pressure, but also various factors influencing tissue tolerance.

Although the development of pressure ulcers is multifaceted, pressure is recognized as the main cause of pressure ulcers. Since increased intensity and duration of pressure are major factors in pressure ulcer development, it follows that reducing the amount of pressure at the interface site would be

beneficial in reducing the risk of developing a pressure ulcer. The Gaymar Sof-Care Plus<sup>®</sup> mattress has undergone both laboratory and clinical research (Macklebust et al., 1986). The clinical studies using the Gaymar Sof-Care<sup>®</sup> for prevention of pressure ulcers have demonstrated excellent results (Macklebust, 1988; Brown-Etris, 1989). Thus the Gaymar Sof-Care Plus was the pressure relieving device chosen for this study.

Although review of the literature indicated that there were several assessment tools available to detect the at risk patient, accurate assessment was considered essential. Therefore, the Braden Scale was used in this study since it has demonstrated greater sensitivity and specificity than other scales (Taylor, 1988).

Review of the literature also showed that two studies have been done utilizing pressure relief as early intervention. However, the investigations were not designed using an experimental and control group. It was felt that the hypothesis of preventing pressure ulcers through early intervention of a pressure relief mattress would be strengthened by having a strong research design utilizing randomization and an experimental group and a control group.

Research needs to be done in the area of prevention of pressure ulcers. The focus of this study was providing adequate pressure relief for the patient identified early and accurately as being at risk for pressure ulcer development.

### Hypothesis

The hypothesis that was tested was: patients identified as being at risk

for developing a pressure ulcer who were placed on a three-layered air cushion mattress would develop fewer pressure ulcers than those not placed on the three-layered air cushion mattress.

The independent variable was the use of the pressure relief device. The dependent variable was the presence or absence of a pressure ulcer.

The intervening variables identified in the literature as possible factors contributing to the development of pressure ulcers were numerous. Factors that have been found to have a high correlation with pressure ulcer development are age, medical diagnosis, nutrition, mobility, incontinence, and altered mental status. There are also less researched factors such as stress, arterial blood pressure, and smoking status.

The conceptual schema developed by Braden and Bergstrom (1987) organizes the above intervening variables into broad categories. See Figure 1. The critical determinants of pressure ulcers are duration and intensity of pressure and tissue tolerance. The reduction of pressure through the use of a three-layered air cushion is the main focus of this study.

Other intervening variables included are: sensory perception, moisture, activity, mobility, nutrition, friction, and shear. These variables are addressed in the Braden Scale score. See Appendix A. The score is actually a number derived from assigning numerical value to the intervening variables that affect the intensity and duration of pressure (mobility, activity, and sensory perception) and variables that affect tissue tolerance (moisture, friction, shear, and nutritional status). The total Braden Scale score was determined for each subject. The only subscale of the Braden Scale that was

considered in detail separately was nutritional status. Many investigators have found a high incidence of poor nutrition in those patients having pressure ulcers. In fact, nutritional status was the only factor found to have statistical association in the development of a pressure ulcer in the study by Macklebust et al. (1988). The intervening variable of age is listed under intrinsic factors in the conceptual framework of Braden and Bergstrom but is not included as a subscale of the Braden Scale.

Situational factors can also have an impact on the development of pressure ulcers, but have not been formally addressed in the literature. These are the awareness of the problem, the level of staffing, the general quality of care, the number of new employees, patient's having a significant other visit and assist with care, and motivated staff and patient.

### Operational Definitions

#### Patient at risk

A patient 65 years or older in a long term care facility who had been identified by a registered nurse as being at risk for developing a pressure ulcer by receiving a Braden Scale score of 17 or below. See Appendix A.

#### Braden Scale

An instrument developed by Braden and Bergstrom to identify the patient at risk for developing pressure ulcers (Braden & Bergstrom, 1987). See Appendix A.

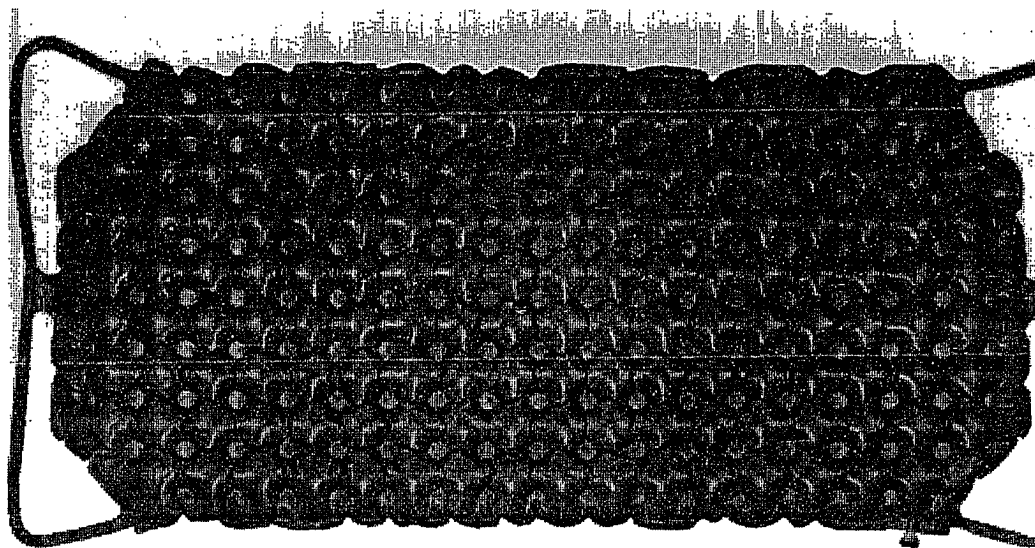
#### Three-layered air mattress

The Gaymar Sof-Care Plus<sup>®</sup> mattress was utilized as a pressure relief device. It is a three-layered air mattress that fits over a regular patient



mattress. See Figure 2. It is formed by three distinct polymer films and is composed of an array of over 300 equilibrating air cells that are interconnected through a series of channels. The air is allowed to transfer through the channels, thereby redistributing the patient's weight over the entire cushion. It reduces tissue interface pressure, on average, well below the critical 32 mm Hg (Macklebust et al., 1986). This air cushion automatically inflates in sixty seconds using an inflator. The mattress needs to be checked once a shift to insure adequate inflation. If the weight of the bony prominence can be felt by the investigator's flat hand placed below the mattress, air needs to be added.

Figure 2. The Gaymar Sof-Care Plus<sup>®</sup> Mattress Overlay



### Pressure ulcer

A localized area of tissue necrosis that develops when soft tissue is compressed between a bony prominence and an external surface for a prolonged period of time. Pressure ulcers are classified using the following system developed by NPUAP:

Stage I: Non-blanchable erythema of intact skin.

Stage II: Partial thickness skin loss involving epidermis and/or dermis. The ulcer is superficial and presents clinically as an abrasion, blister, or shallow crater.

Stage III: Full thickness skin loss involving damage or necrosis of subcutaneous tissue which may extend down to, but not through, underlying fascia. The ulcer presents clinically as a deep crater with or without undermining of adjacent tissue.

Stage IV: Full thickness skin loss with extensive destruction, tissue necrosis or damage to muscle, bone, or supporting structures (e.g., tendon, joint capsule, etc.).

The operational definition of pressure ulcer used in this study includes all stages.

## CHAPTER 3

### METHODOLOGY

#### Study Design

An experimental research design was determined to be appropriate to answer the research question. Each newly admitted patient entering the two nursing homes was considered a prospective subject. Subjects meeting admission criteria were evaluated for their risk status. Those determined to be at risk were randomly assigned to either the experimental or control group. The subjects in the experimental group were placed on a pressure relief mattress. The subjects in the control group received "care as usual" without a pressure relief mattress. The study was conducted over a three and one half month period of time with patients being monitored for pressure ulcer development.

#### Setting and Sample

The study sites were two long term care facilities in a Midwestern city with a population of 100,000. Both agencies admit patients who require skilled and basic care. Nursing home A is a private for-profit facility with 99 beds. It is certified for 31 skilled and 78 basic beds and is usually fully occupied. It is staffed with registered nurses, licensed practical nurses, and aides during the day shift, with no registered nurses on the other two shifts. Nursing home B is a county facility with a capacity for 218 patients and is

usually at 99% occupancy. It is licensed for 34 private beds, 44 skilled beds, and 138 basic beds with staffing comparable to nursing home A.

All patients who were 65 years of age or older, understood English, did not have an existing pressure ulcer or were not using a pressure relief mattress were approached at the time of admission for inclusion in the study. Every patient who voluntarily signed an informed consent form, or who had the consent form signed by his/her guardian or legal representative, was included.

There was a total of 67 new admissions with 37 that met the criteria for the first phase of the study, identifying who was at risk for developing a pressure ulcer. Thirty of the new admissions did not meet criteria for various reasons: pre-existing pressure ulcers ( $n = 21$ ), age ( $n = 3$ ), already had a pressure relief mattress ( $n = 2$ ), or refusal to enter study ( $n = 4$ ). None of the four that declined being in the study developed pressure ulcers.

Of the 37 who met the criteria, 21 were determined to be not at risk and exited the study. Of the 16 that were at risk, 10 were randomly placed in the experimental group (received the mattress) and 6 were randomly placed in the control group. The staff immediately placed one of the subjects in the control group on a pressure relief mattress. This subject then exited the study. Three other subjects died within one week of admission so they were not included. Three other subjects also expired but were followed for at least a week before they died. They were included in the study sample. Bergstrom (1990) found that 90% of the pressure ulcers develop in the first week of admission to nursing homes. Nine subjects were followed for two months

after admission to the study. The total sample of the study consisted of twelve subjects. Nine were in the experimental group and three were in the control group. See Table 1.

Table 1

Comparison of the Two Nursing Homes

	N.Home A	N.Home B	Total
Number of admissions	39	28	67
Criteria not met:			
Pre-existing ulcers	10	11	12
Other	5	4	9
Number assessed	24	13	37
Number at risk:	8	8	16
Experimental	5	5	10
Control	3	3	6
Subjects lost:			
Removed	0	1	1
Expired within 1 week	0	3	3
Final number in study:			
Experimental	5	4	9
Control	3	0	3

## Instruments

### The Braden Scale

The Braden Scale was derived from a theoretical framework for the etiology of pressure ulcers (Braden & Bergstrom, 1987) with the critical determinants of pressure sore development being pressure and tissue tolerance. It differs from other scales in its refinement, operational descriptors, and inclusion of a subscale concerning skin exposure to friction and shear. When used in a rehabilitation setting by registered nurses and a graduate student, the reliability was extremely high ( $r = .99$ ). Using a cut-off point of 16, the predictive validity was very high when two studies were done in a large teaching hospital. Sensitivity was 100% in both studies and specificity ranged from 64% to 94% (Bergstrom et al., 1987).

The Braden Scale is composed of six subscales: sensory perception, moisture, activity, mobility, nutrition, and friction and shear. See Appendix A. Each level of the subscale has a one or two sentence description and has been designed so that it is mutually exclusive. The first five subscales have an ordinal rating of 1 (least favorable) to 4 (most favorable). The sixth subscale (friction and shear) is rated from 1 to 3. There is a minimum total score of 6 points, being most at risk, and a maximum total of 23 points. Written permission to use the Braden Scale was obtained from the authors. See Appendix B.

### Skin Assessment and Data Collection Tool

The Skin Assessment and Data Collection Tool consisted of three major sections. See Appendix C. The first section contains demographic and other patient information that was gathered and recorded at time of admission.

The second section contained a chart on which the skin condition was recorded at various pressure points and the dates it was assessed. The list of sites to be examined was derived from a review of the literature wherein it was determined that almost 95% of all pressure ulcers occur over the sacrum, the greater trochanter, the ischial tuberosity, the calcaneus and the lateral malleolus. The scapula and vertebrae were also included since the investigator has observed occasional pressure ulcers in these areas. There was also a space for "other", should a pressure ulcer develop in an area not listed. Scoring was determined by the four stages recommended by the NPUAP.

The third section was a place for the staff to record changes or events that happened to the patient after admission to the study. It included space for information on intervening variables that might affect intrinsic, extrinsic, and pressure factors.

### Procedure

Following approval of the Human Subjects Review Committee of Grand Valley State University, the Directors of Nursing (D.O.N.) of Nursing Homes A and B were approached for inclusion in the study. Both institutions approved of the study and supported it. An In-Service was given to familiarize the staff with the research project and to encourage them to add

to the third section of the Skin Assessment and Data Collection Tool. The staff was instructed on the use of the Sof-Care Plus<sup>®</sup> mattress and on the importance of performing and documenting the hand check. "Care as usual" for all patients was stressed.

A pilot test of three patients was conducted. No major problems were encountered. Reliability and validity of the instruments used had already been determined.

Following the pilot test, every patient entering the nursing homes and meeting admission criteria was approached for inclusion in the study. A list was kept at each nursing home of all newly admitted patients, whether or not they had an existing pressure ulcer, and if the consent form had been signed. See Appendices D and E. Every Tuesday and Friday the nurse data collector evaluated each new patient, who met inclusion criteria, using the Braden Scale to determine if they were at risk for developing a pressure ulcer. See Appendix A. All patients were evaluated within 24-96 hours of admission. Those with a score of 18 or above were considered not at risk and exited from the study. Those with a score of 17 or below were determined to be at risk and were randomly assigned to either the control or experimental group. Randomization was accomplished through flip of a coin.

A blue dot was placed on the chart of every patient in the study who had been determined to be at risk. This served as a reminder to the staff to enter any pertinent data onto the Skin Assessment and Data Collection Tool. See Appendix C. The skin status of each at risk patient was assessed at the time the Braden Scale score was obtained to validate that there were no existing



ulcers. A skin assessment was performed each week for one month, and every two weeks for another month or until discharge or death. In other words, there were skin assessments at the time that the Braden Score was done, on weeks 1-4, and weeks 6 and 8. The staff was instructed to make entries on the Skin Assessment and Data Collection Tool if there were changes in status, nutrition, nursing care or medical orders.

Patients in both groups had "care as usual" according to agency policy. Neither agency had any skin care program or protocol in place. Both directors of the nursing homes stated that they leave the care plan up to the discretion of the nurse. They stated there was no official protocol, but that most nurses put the patient on a turning schedule if he/she was bedbound. If there was a large or deep pressure ulcer the consulting ET (Enterostomal Therapy) nurse is usually contacted, but again, there was no formal protocol. Neither nursing home had a mechanism to identify patients at high risk for developing pressure ulcers and did very little in the early treatment of pressure ulcers.

Each patient in the experimental group received a three-layered air cushion mattress within 8 hours of determination of risk and group status. Subjects in the control group did not receive a mattress. A hand check was done every shift to confirm the working of the mattress. A flow chart was kept for each patient who had an air cushion mattress. See Appendix F. The chart had a space for each shift to initial that the hand check had been performed.

Data were collected during a three and one half month period from April

10, 1990 until August 31, 1990. New subjects were admitted into the study from April 10, 1990 until July 6, 1990. Three subjects expired but were followed for at least a week before they died. The remaining nine subjects were followed for two months after admission to the study.

## CHAPTER 4

### RESULTS

The majority of the data were nominal and ordinal in nature so statistical analysis using ranges, percentages, and frequency distribution were employed. Means were calculated for interval data.

#### Characteristics of Subjects

It was estimated that the total admission number for the time period would be approximately 70. It was anticipated that half of the new admissions would be determined to be at risk (Dr. Thomas Stewart, personal communication, January 11, 1990) for a resultant N of 35. The number of actual admissions during the period of the study was 67. The characteristics of the twelve subjects who were included in the study were compiled from the information on the Skin Assessment and Data Collection Tool that was done at the time of admission into the study.

The ages of the subjects ranged from 67 to 89 years with the mean age of 78.75 years with a SD = 5.55. Half of the subjects in the study ranged in age from 65 to 79. The mean age of the experimental group was 78.6 years with a SD = 6.3. The mean age of the control group was 79.0 years with a SD = 1.96. See Table 2 for Sample Distribution of At Risk Subjects by Age. The Braden Scale scores of the two groups was quite comparable. The mean of the Braden Scale score for the experimental group was 13.3 (SD = 6.3) and the

mean for the control group was 13 (SD = 1.96).

Table 2

Sample Distribution of At Risk Subjects by Age

Age (years)	Number	Percentage*
65-69	2	16%
70-74	2	16%
75-79	2	16%
80-84	3	25%
85-89	3	25%

\*Rounded to the nearest whole number

The ratio of females to males was 2:1 with gender ratio remaining constant in the experimental and control groups. See Table 3. The number of medical diagnoses was numerous. There were a total of sixteen different diagnoses listed for the twelve patients, with most patients having at least three diagnoses listed. Eleven out of the twelve patients had at least one diagnosis that was classified as neurological or cardiovascular in nature. The diagnoses that occurred in three or more patients were congestive heart failure, cancer, cerebral vascular accident, confusion (including Alzheimer's and organic brain syndrome), hypertension, organic heart disease (listed on

patients other than those with congestive heart failure), and dehydration.

Table 3

Comparisons of the Experimental and Control Groups

	Experimental (n = 9)	Control (n = 3)
Age		
Mean	78.6	79
Standard Deviation	6.3	1.96
Gender		
Males	3	1
Females	6	2
Number expired prior to two months	2	1

In the present study eleven of the patients appeared to have adequate nutrition. See Table 4. Adequate nutrition was considered "Good" or "Average" appetites or having tube feedings. There was one patient who had a "poor" appetite who was not being tube fed. That subject died one and one half weeks after admission to the study.

Table 4

Nutritional Status of At Risk Subjects

	Experimental (n = 9)	Control (n = 3)
Adequate nutrition		
No tube feeding	4	1
Tube feeding	4	2
Poor	1	0

None of the admission blood pressures indicated a hypertensive state. All patients had temperatures within the normal range with the exception of one subject whose temperature was 100.4 degrees F. on admission. Unfortunately the staff did not make any additions to the third section of the Skin Assessment and Data Collection Tool that they had been requested to fill in. No information on other intervening variables is available.

Hypothesis

The research hypothesis: patients identified as being at risk for developing a pressure ulcer who are placed on a three-layered air cushion, will develop fewer pressure ulcers than those not placed on a three-layered

air cushion, was not supported since no pressure ulcers developed in either group.

#### Other Results of Interest

The two nursing homes varied in the composition of their admissions. 26% of Nursing Home A's admissions had pre-existing pressure ulcers and Nursing Home B had 39% of its new admissions present with pressure ulcers. Those who already had pressure ulcers were not evaluated for their risk status. Of those patients who met criteria and were evaluated for their risk status, 33% at Nursing Home A and 62% at Nursing Home B were determined to be at risk.

When combining the percentages, it was found that 54% of all admissions to the two long term facilities had, or were at risk of developing, a pressure ulcer. This number was derived by adding the total number of new admissions with pre-existing pressure ulcers (31%) to those that were assessed using the Braden Scale and determined to be at risk (23%). The most noteworthy fact is that not one high risk patient developed a pressure ulcer during the three and one half month study, in either the control or experimental group.

## CHAPTER 5

### DISCUSSION

No studies utilizing an experimental design have been published concerning pressure relief devices and development of pressure ulcers. The two studies mentioned in the review of literature placed all at risk patients on pressure relief devices. Etris-Brown et al.(1989) used the nursing home setting and utilized the historical literature rate of 24-35% as the control for comparison of rates. A development rate of 10% indicated low pressure ulcer development in a group identified as being at high risk. Macklebust et al. (1988) also had a low incidence rate of 9% in the hospital setting. It is difficult to compare the results of this study with previous research due to differences in design. When using the "historical literature" rate of 24-35% for pressure ulcer development in nursing homes that previous studies use, the results of 0% in the present study are very favorable.

Although the hypothesis regarding the use of pressure relief mattresses as the independent variable in the prevention of pressure ulcers was not supported, the fact that none of the high risk patients developed pressure ulcers has implications for this very serious problem. The factors underlying this unusual situation must be examined. The findings suggest that awareness of those at high risk by the nursing staff has an effect in the



prevention of pressure ulcers. The major finding of this study appears to support the influence that the Hawthorne or novelty effect can exhibit. Since the Hawthorne effect refers to the subjects, and it is probable that the results were due to staff rather than patient actions, novelty effect is the more accurate term.

Before the research study was conducted patients in the two facilities were only placed on pressure relief mattresses when they had a Stage II, III, or IV pressure ulcer, and then not routinely. Yet during the study, the investigator would arrive to find some patients with intact skin already on a pressure relief mattress. This may be attributed to one or a combination of factors. Before the study there was a paucity of pressure relief mattresses. Pressure relief devices were not a patient charged item, were non-reimbursible, and were paid for by the nursing home. During the study, pressure relief mattresses were provided to the experimental group at no cost to the facility. In addition, the awareness of early prevention and identifying those at risk had increased as evidenced by interest of the staff members comparing their personal evaluation of the at risk state of the patient with the Braden Scale score.

The previous rate of pressure ulcer development in the facilities is not known. A chart audit was initiated to determine past prevalence and incidence. However, it was discovered that there were inconsistencies in admission skin assessments and daily charting. Even when determining patient's eligibility for the study numerous errors were discovered. The patient would have a stage II pressure ulcer yet there was nothing charted

about it. It was determined that any data from a chart audit would be inaccurate, especially in relationship to the Stage I pressure ulcer.

### Limitations

Several threats to internal and external validity were present in this study. Polit and Hungler state that the "researcher can be confident in the validity of the results of a study if (1) the obtained findings are due only to the independent variable of interest and (2) the results are generalizable to situations outside of the research setting" (Polit & Hungler, 1987, p. 194).

The sample size was small ( $n = 12$ ) which limits the power to detect the effect of an independent variable on the dependent variable. However, the data suggest that the pressure relief mattress was not the only variable affecting the pressure ulcer incidence since both the control and experimental groups had no pressure ulcer development. It is possible that if the numbers had been larger the results would have been different. It is interesting to note the control group was one third the size of the experimental group. Had it been equal it is possible that the incidence of pressure ulcer development in the control group would have been larger.

The threats to internal validity such as rival hypotheses must be considered. Although many individual intervening variables were examined, the situational factors were not addressed. Some of the situational factors that may be present in the nursing home environment and may impact on the development of pressure ulcers are motivation of staff, knowledge base of staff, competitiveness, and staff morale.

External validity threats also need to be considered. It appears that the

novelty effect had great impact. Knowledge of being included in a study often changes behavior. By merely calling attention to pressure ulcer development risk, the intervening variable of nursing care was most likely different.

Although the staff had been instructed to give care as usual to all patients, it is possible that the blue dot on the spine of each chart on the patients in the study designated to the staff those patients that required special care. In addition, each nursing home was aware that another local nursing home was involved in the study. It is likely that they did not want to be the nursing home with more pressure ulcers.

### Strengths

Internal validity was strengthened in several ways. The threat of history was addressed by following all subjects over approximately the same time period. The threat of selection was minimized by approaching consecutive admissions for inclusion in the study instead of recruiting or asking for volunteers. The degree of internal validity was increased by using randomization.

The heterogeneity of the sample increased the generalizability by including patients with varying backgrounds. Inclusion in the study was not limited by diagnosis, gender, nutritional status, vital signs, etc. Conversely, the internal validity was strengthened by excluding those under the age of 65, thus making the sample homogeneous with respect to age.

### Implications for Nursing Education and Practice

This study has several implications for nursing education and nursing practice. Historically, skin care has been the responsibility of the nurse and

the development of pressure ulcers has been viewed as a result of poor nursing care. Yet, this investigator is aware of only one university based nursing program that devotes any class time to pressure ulcers. Part of the student's formal nursing education should be in the area of developing an awareness of the severity of the problem, realizing the benefits of early intervention, and understanding current techniques of proper wound and patient management. The information could be included in "Skin Integrity" or presented as part of a gerontology class. As graduates, students would then have an awareness of the scope of the problem and some tools that he/she could utilize to help alleviate the pressure ulcer problem.

Nursing practice is concerned with pressure ulcers in a variety of settings: the hospital, the nursing home, and home care. With the Health Care Financing Administration (HCFA) using pressure ulcers as a measurement of quality of care, it is reported that some nursing homes have had to close their doors due to the fact that funding is not available to correct the problems identified in the citations, especially in the area of high cost pressure relief and need for tube feedings to correct nutritional deficiencies.

However, it was evident from the data collected in this study that factors other than use of a pressure relief device enabled the rate of pressure ulcer development to be zero (in a population that would normally have a much higher incidence of pressure ulcers). Since the research did not support the pressure relief mattress as a method for reducing the incidence of pressure ulcer development, other factors must be considered. The following question needs to be examined: What are the other reasons that pressure ulcers did

not develop in this high risk group?

It is possible that situational factors may have great impact on the development of pressure ulcers. Specifically, the level of awareness of the problem by the staff, motivation, and continuity of care could all influence the daily care of the patient and subsequent pressure ulcer development. These areas could be addressed through in-services, employment of a Clinical Nurse Specialist, reward for low incidence rates of pressure ulcers, or contests between different teams or nursing homes.

For example, if the charge nurse admits a bedbound patient he/she might routinely add "turn Q. 2 h." (turn every two hours) to the care plan and forget about it. However, if he/she has also attended an in-service on the pressure relief mattress, knows another nursing home is using pressure relief devices, and has seen the Braden Scale, he/she may attach a greater importance to preventing pressure ulcer development in the patients. The nurse may also be more highly motivated to make sure that the staff is turning the patient as scheduled. He/she may even put the at risk patient on a pressure relief mattress.

The point is that awareness of the problem, motivation, and appropriate nursing care may do more to alleviate the problem than one specific nursing intervention. A recent article in Image concluded that the intervention studies of preventing falls seemed to reduce the rate of falls primarily through consciousness raising rather than any one specific intervention (Whedon & Shedd, 1989). A follow-up study to the above-mentioned research found a statistically significant decrease in falls following steps aimed at

increasing consciousness raising among nursing staff, such as in-services, signs, bulletins, and chart additions (B. Mudge, personal communication, August 7, 1990).

It is possible that increased education in the area of pressure ulcer development could have a great effect on reducing the number of pressure ulcers. The knowledge base of all staff could be increased in a variety of ways and motivation could be encouraged to prevent pressure ulcers.

#### Recommendations for Future Investigation

Two main areas deserve further investigation. The first area is pressure relief, the main focus of this study. Since pressure ulcers are caused by pressure, the relief of pressure is essential as an early intervention and needs to be evaluated using research methodology. The second area requiring research is the effect of situational factors, specifically consciousness raising among staff through education and awareness.

In regards to this specific study, several recommendations can be made. Replication using a larger sample size with equal groups is needed. Many potential subjects were lost due to having "no pre-existing ulcers" as one of the inclusion criteria. Perhaps future investigations should include the more minor Stage I pressure ulcer as it is possible that early intervention with pressure relief could prevent deeper tissue breakdown.

The evaluation of the pressure relief device would be enhanced if those with a poor nutritional status were not included in the study. Nutrition is a very important factor in the development of a pressure ulcer. It would not be an accurate evaluation of the pressure relief device if the nutrition status

were not addressed. Of the three subjects who were not included in the analysis of the data due to death within the first week, two of them had "poor" diets and were receiving no tube feeding. Had these subjects been included it is possible the results would have been skewed, since it is highly likely they would develop pressure ulcers. The one subject with "poor" diet who was in the experimental group and was included in analysis of the data did die within one and one half weeks without any pressure ulcers.

Generalizability of the study and applicability would increase if staff members, instead of investigators, identified the risk status of the patients. The investigation would also be strengthened by performing an on-site audit of pressure ulcers before beginning the study to determine prevalence and incidence rates and comparing those to the study results.

Findings from this study indicate that pressure relief mattresses may not be the only main factor in preventing pressure ulcers. Further research is also needed in evaluating the role of consciousness raising in decreasing the number of pressure ulcers. The independent variable could be general, such as increasing staff awareness through in-services and employment of a Clinical Nurse Specialist. There is also the possibility of testing a specific intervention (such as establishing a formal contest between two nursing homes) to evaluate a single motivational force.

### Summary

The goal of this investigator was to add to the body of knowledge in the area of the prevention of pressure ulcers. The purpose of this study was to determine the effectiveness of a pressure relief mattress in the high risk

patient. Although the hypothesis was not supported, the data indicate that pressure ulcers can be prevented. Further nursing research, especially in the area of prevention by raising the consciousness level of those caring for the at risk patient, is needed.



## **APPENDICES**

# RISK PREDICTORS FOR SKIN BREAKDOWN

Patients Name _____		Evaluators Name _____		Date of Assessment _____	
<b>SENSORY PERCEPTION</b> ability to respond to discomfort	1. Completely Limited: unresponsive to painful stimuli. OR limited ability to feel pain over most of body surface.	2. Very Limited: responds only to painful stimuli. Cannot communicate discomfort verbally. 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.	
<b>MOISTURE</b> 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. Very 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 only requires changing at routine intervals.	
<b>ACTIVITY</b> degree of physical activity	1. Bedfast: confined to bed	2. Chairfast: ability to walk severely limited or non-existent. Cannot bear own weight and/or must be assisted into chair or wheelchair.	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 a moderate distance at least once every 1-2 hours during waking hours.	
<b>MOBILITY</b> ability to change and control body position	1. Completely Immobile: unable to 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.	
<b>NUTRITION</b> usual food intake pattern	1. Very Poor: Never eats a complete meal. Rarely eats more than 1/2 of any food offered. Intake of protein is negligible. Takes even fluids poorly. Does not take a liquid dietary supplement. OR is NPO and/or maintained on clear liquids or IV's.	2. Probably Inadequate: Rarely eats a complete meal and generally eats only about 1/2 of any food offered. Protein intake is poor. Occasionally will take a liquid dietary supplement. OR receiving less than optimum amount of liquid diet supplement.	3. Adequate: Eats over half of most meals. Eats moderate amount of protein source 1-2 times daily. Occasionally will refuse a meal. Will usually take a liquid dietary supplement if offered. OR is on a tube feeding TPN regimen which probably meets most of nutritional needs.	4. Excellent: Eats most of every meal. Never refuses a meal. Occasionally eats between meals. Does not require a dietary supplementation.	
<b>FRICTION AND SHEAR</b>	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 deformities 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 _____

The Braden Scale

Appendix A

## Appendix B

### Written Permission to Use the Braden Scale

 University  
of Nebraska  
Medical Center  
College of Nursing

42nd and Dewey Avenue  
Omaha, NE 68105-1065  
102 Fairfield Hall  
Lincoln, NE 68588-0620  
Scottsbluff, NE 69361

July 11, 1989

Ann H. Harris, R.N.  
18092 Lovell Park Road  
Spring Lake, MI 49456

Dear Ms. Harris:

It was nice to meet you in Chicago. I will try to answer your questions of June 26 briefly before the next leg of my vacation.

1. You have our permission to use the Braden Scale for subject selection in your study.
2. I suggested that a score of 17 be used as the cut-off so you would have some subjects who were not at as great risk. This recommendation does not have anything to do with using LPN's.
3. Regardless of the level of staff you use to rate risk, be sure to take time to teach the use of the tool and to develop interrater reliability.
4. We do not have a brochure on our videos. They are both approximately 30 minutes in length. Each tape describes the use of the tool in a step-by-step manner. These videos should be viewed at least once by each data collector.
5. The report I gave stated that the majority of patients in our nursing home studies developed pressure sores in the first 2-3 weeks. This data is from our own work. The publication is pending so you would site "personal communication" for now.

Thank you for appraising me of your progress. Please keep in touch.

Sincerely,



Nancy Bergström, R.N., Ph.D.  
Professor and Principal Investigator  
Nursing Assessment of Pressure Sore Risk

NB/jb

University of Nebraska—Lincoln

University of Nebraska at Omaha

University of Nebraska Medical Center

## Appendix C

## Skin Assessment and Data Collection Tool

- Name \_\_\_\_\_ Room \_\_\_\_\_ Institution \_\_\_\_\_  
 Admission Date \_\_\_\_\_ Code Number \_\_\_\_\_  
 Date of Braden Score \_\_\_\_\_ Gaymar Score \_\_\_\_\_  
 Age \_\_\_\_\_ Sex \_\_\_\_\_ Admission B.P. & temp. \_\_\_\_\_  
 Height \_\_\_\_\_ Weight \_\_\_\_\_ Diet: Good \_\_\_\_\_ Average \_\_\_\_\_ Poor \_\_\_\_\_  
 Recent weight loss: Yes \_\_\_\_\_ Tube feedings \_\_\_\_\_  
                                     No \_\_\_\_\_ Supplements \_\_\_\_\_  
                                     Unknown \_\_\_\_\_  
 Primary diagnosis: \_\_\_\_\_  
 Secondary: \_\_\_\_\_  
 List of Protective Devices \_\_\_\_\_

## SKIN ASSESSMENT

[illegible]

### Stage Key

- |         |   |
|---------|---|
| Stage 1 | Non-blanchable erythema   |
| Stage 2 | Partial thickness loss of skin layers involving epidermis and possibly penetrating into but not through dermis. May present with erythema and/or induration; wound base moist and pink; painful; free of necrotic tissue. |
| Stage 3 | Full-thickness tissue loss extending through dermis to involve subcutaneous tissue.   |
| Stage 4 | Deep tissue destruction extending through subcutaneous tissue to fascia and may involve muscle layers, joint and/or bone.   |

Nutritional Status changes & date \_\_\_\_\_  
Change in general status & date \_\_\_\_\_  
Change in nursing care or medical orders & date \_\_\_\_\_  
\_\_\_\_\_  
Did patient have a temp over 100 degrees? Yes \_\_\_\_\_ No \_\_\_\_\_  
Change in continence status & date \_\_\_\_\_  
Mobility status \_\_\_\_\_  
Other pertinent information \_\_\_\_\_

## Appendix D

### Verbal Script for Obtaining Consent Form

Nurse: Hello. Welcome to ..(Nursing Home A). My name is (Ann Harris).....Currently we are studying ways to prevent bedsores and every patient entering our facility is being asked to be part of that study. Let me explain what it involves.

In the next few days a nurse will spend some time with you to determine if you are at risk for developing bedsores.

Being part of the study may involve six skin inspections that would not take more than one minute each. It is not anticipated that there will be any risks involved in, or any harmful consequences from this research. In fact, including you in this research project may benefit you by increasing your awareness of your skin status and factors that affect it, and by determining if you are at risk for developing bedsores

I do want to assure you that all information will be kept in strict confidence. The study is designed so that you will be known only by a code number. Your name will never be used and you will not be identified individually in any reporting of the findings.

I do need you to sign a consent form. You are free to withdraw from the study at any time, without any prejudice or repercussions, or change in your care. You are also free to ask questions at any time. At the conclusion of the study, the investigator would like to share

the results with you.

I do have some other things to talk to you about, but I wonder if you have any questions at this point.

Patient: Not really.

Nurse: Please feel free to stop me an any time if you have questions or don't understand what I'm saying.

Do you have any questions before I have you read the consent form?

Patient: No

Nurse: Here is the consent form. It basically covers what we've discussed, but in a more abbreviated form. Please ask me any questions, if you have any, before signing it.

Patient: (signs document).

Nurse: Thank you for your time.

## Appendix E

### Informed Consent for Inclusion in a Study in Prevention of Bedsores

I, \_\_\_\_\_ herewith agree to serve as a subject in the study to prevent development of bedsores. The study is through Grand Valley State University and is under the supervision of Ann Harris, R.N., B.S.N.

---

There are no expected risks. It will involve the time of having skin assessments done. I may benefit from these procedures by increasing my awareness of my skin status and factors that affect it.

I understand that confidentiality will be protected, that I am free to ask questions concerning the procedure, that I am free to withdraw from participation in the investigation at any time, and that any discontinuation in participation will not prejudice my care in any way. I have read and fully understand the foregoing information.

_____ Date	_____ Signature of patient, guardian, or legal representative
---------------	---

_____ Date	_____ Witness/investigator
---------------	-------------------------------

# Appendix F

## Hand Check Record

Patient Name \_\_\_\_\_ Starting Date \_\_\_\_/\_\_\_\_/90 Room Number \_\_\_\_\_

Shift/Date		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
(Month)	7-3																															
	Initials																															
	3-11																															
(Month)	Initials																															
	11-7																															
	Initials																															

Shift/Date		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
(Month)	7-3																															
	Initials																															
	3-11																															
(Month)	Initials																															
	11-7																															
	Initials																															

Shift/Date		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
(Month)	7-3																															
	Initials																															
	3-11																															
(Month)	Initials																															
	11-7																															
	Initials																															

Please initial entry and identify initials below with your signature.

	Initials	Signature	Initials	Signature
7-3				
3-11				
11-7				



## LIST OF REFERENCES

### List of References

- Allman, M., Laprade, C., Noel, L. B., Walke, J. M., Moorer, C. A., Dear, M. R., & Smith, C. R. (1986). Pressure sores among hospitalized patients, Annals of Internal Medicine, 105, 337-342.
- Bergstrom, N., Braden, B., Laguzza, A., & Holman, V. (1987). The Braden Scale for predicting pressure sore risk. Nursing Research, 36, 205-210.
- Bergstrom, N. (1989, May). Evaluation of assessment tools. Gerontological Nursing: Skin Care Problems of the Elderly. Rush-Presbyterian- St. Luke's Medical Center, Chicago, Illinois.
- Bergstrom, N. (1990). Predicting pressure sore risk: A strategy for prevention. Forum, 5, (3), p. 1.
- Braden, B., & Bergstrom, N. (1987). A conceptual schema for the study of the etiology of pressure sores. Rehabilitation Nursing, 12, 8-12.
- Braden, B., & Bergstrom, N. (1989). Clinical utility of the Braden Scale for predicting pressure sore risk. Decubitus, 2(3), 44-51.
- Brody, J. E. (1986, August 6). Personal Health. The Wall Street Journal, p. 14.
- Brown-Etris, M., Myers, R. B., Rideout, B., Roma, A. Smith, J. A. (1989). A strategy for the management of pressure ulcers in nursing homes. Ostomy/Wound Management, 22, 28-32.
- Exton-Smith, A. N., & Sherwin, R. W.. (1961). The prevention of pressure sores: Significance of spontaneous bodily movements. Lancet, 2, 1123-26.
- George, J. B. (1980). Nursing theories- the nursing theories conference group. Englewood Cliffs, New Jersey: Prentice-Hall.
- Goldstone, L. A., & Goldstone, J. (1982). The Norton score: An early warning of pressure sores? Journal of Advanced Nursing, 7, 419.
- Goode, P. S., & Allman, R. M. (1989). The prevention and management of pressure ulcers. Medical Clinics of North America, 73, 1511.
- Gordon, M. (1982). Nursing diagnosis process and application. New York: McGraw-Hill.
- Gosnell, D. J. (1989). Pressure sore risk assessments, Parts I and II. Decubitus, 2, (3), 32-41.

- Gosnell, D. J. (1973). An assessment tool to identify pressure sores. Nursing Research, 22, 55-59.
- Jeeters, K. (1988, March). Overview of pressure sore issues. Chicago Wound Care Conference. Hyatt Regency O'Hare, Chicago, Illinois.
- Kosiak, M. (1959). Etiology and pathology of ischemic ulcers. Archives of Physical Medicine, 40(2), 62-69.
- Landis, E. (1930). Studies of capillary blood pressure in human skin. Heart, 15, 209.
- Linder, R., & Upton, J. (1983). The prevention of pressure ulcers. Surgical Rounds, 6, 42-49.
- Maklebust, J. (1987). Pressure ulcers; etiology and prevention. Nursing Clinics of North America, 2(22), 359-377.
- Maklebust, J., Mondoux, L., & Sieggreen, M. (1986). Pressure relief characteristics of various support surfaces used in prevention of pressure ulcers. Journal of Enterostomal Therapy, 13(3), 85-89.
- Maklebust, J., Brunckhorst, L., Cracchiolo-Caraway, A., Ducharme, M. A., Dundon, R., Panfilli, R., Parzuchowski, J., Sieggreen, M., & Walthall, S. (1988). Pressure ulcer incidence in high-risk patients managed on a special three-layered air cushion. Decubitus, 1(2), 16-24.
- Marriner-Tomey, A. (1989). Nursing theorists and their works (2nd ed.). St. Louis: C.V. Mosby.
- Michocki, R. J., & Lamy, P. P. (1976). The Problem of pressure sores in a nursing home population: Statistical data. Journal of American Geriatric Society, 24, 323-326.
- National Pressure Ulcer Advisory Panel. (1989). National Pressure Ulcer Advisory Panel issues tenets. Pressure Ulcer, 3(1), 3.
- Norton, D., McLaren, R., & Exton-Smith, A. B. (1962). An Investigation of Geriatric Nursing Problems in Hospitals. London: Nuffield Lodge, Regent's Park.
- Norton, D. (1989). Calculating the risk: Reflections on the Norton Scale. Decubitus, 2(3), 24-31.
- Polit, D. F., & Hungler, B. P. (1987). Nursing research-principles and methods. Philadelphia: J. B. Lipincott Company.
- Rudd, T. N., (1962). Pathogenesis of decubitus ulcers. Journal of the American Geriatrics Society, 10, 48-53.
- Shepard, M. A., Parker, D., & DeClerque, N. (1987). The Under-reporting of pressure sores in patients transferred between hospital and nursing home. American Geriatrics Society, 35(2), 159-160.

- Taylor, K. T., (1988). Assessment tools for the identification of patients at risk for the development of pressure sores. Journal of Enterostomal Therapy, 15(5), 201-205.
- Whedon, M. B., & Shedd, P. (1989). Prediction and prevention of patient falls. Image, 21(2), 108-114.
- Woodworth, D. (1988). Diagnosis related groups (DRGS) and the pressure ulcer problem. Forum, 1(2), p. 1.
- Xakellis, G. C., & Garzone, P. (1987). Pressure ulcers. American Family Physician, 35(4), 159-164.