

An Educational Program on the Treatment and Prevention of Diabetic Foot Ulcers

in the Elderly for Novice Registered Nurses

in the Long Term Acute Care and Skilled Nursing Facility

by

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## TABLE OF CONTENTS

Chapter One: Introduction .....	1
Background .....	1
Significance of the Problem .....	3
Problem Statement .....	3
Purpose Statement .....	4
Chapter Two: Literature Review .....	5
Overview of Diabetes Mellitus .....	5
Neuropathy .....	6
Peripheral Arterial Disease (PAD) .....	6
Infection .....	7
Structural Changes in the Foot .....	7
Effects of Aging .....	8
Skin Ulceration .....	8
Quality of Life .....	9
Terms and Definitions .....	9
Clinical Practice Guidelines .....	11
RNAO Recommendations .....	12
ADA Recommendations .....	13
National Diabetes Education Program .....	13
National Guideline Clearinghouse .....	14
Diabetes Wound Care in Nursing Curriculum .....	14
Conceptual Framework .....	17

Summary .....	18
Chapter Three: Methods .....	19
Program Design .....	20
Participants .....	20
Program Description .....	21
Wound Assessment .....	21
Wound Bed Exudate .....	21
Wound Bed Tissue .....	21
Wound Dimensions, Wound Depth and Wound Edges .....	22
Undermining .....	23
Surrounding Tissues .....	23
Goals of Wound Care .....	23
Wound Care Plan .....	24
Interdisciplinary Consulting .....	25
Adjunct Therapies .....	25
Negative Pressure Wound Therapy .....	25
Hyperbaric Oxygen Treatment .....	25
Offloading .....	26
Program Instruments .....	26
Data Analysis .....	26
Chapter Four: Evaluation .....	27
Chapter Five: Discussion .....	29
Clinical Implications .....	29

Project Limitations .....	29
Future Research .....	30
Conclusions.....	30
References .....	31

## List of Appendices

Appendix A: Demographic Form .....	39
Appendix B: Lesson Plan .....	40
Appendix C: Conva Tec Solutions® Algorithms .....	43
Appendix D: Bates-Jensen Wound Assessment Tool .....	51
Appendix E: Advanced Wound Dressings .....	55
Appendix F: Wound Vacuum Therapy.....	56

## CHAPTER ONE

### **Introduction**

Diabetes is the 7<sup>th</sup> leading cause of death in the United States and affects 25.8 million people, or 8.3% of the country's total population. In 2010, 10.9 million (26.9%) US residents aged 65 years and older had diabetes (Centers for Disease Control and Prevention [CDC], 2011). This can be attributed to the fact that the growth rate of diabetes for the elderly has been greater than other age groups over the last 20 years (Deshpande, Harris-Hayes, & Schootman, 2008). In addition to being a leading cause of death in the US, diabetes is also the leading cause of nontraumatic lower leg amputations (CDC, 2011). Lower extremity amputations are 67% more likely to occur in a diabetic patient than a non-diabetic patient. Foot ulceration usually precedes the complications that result in amputation (Wilson, 2005).

### **Background**

The disease of diabetes allows three pathologies of neuropathy, ischemia, and infection to join forces and undermine the health of the diabetic foot (Wilson, 2005). Neuropathy is the most common problem and affects about half of all patients with diabetes. The peripheral nervous system of the feet is damaged and small nerve fiber damage causes numbness, burning, tingling, itching, and pain. Damage to large fibers causes a decreased ability to sense vibratory perception, proprioception, and deep tendon reflexes, loss of protective sensation, a muting of the usual response of aversion to feelings of pain. Therefore, when patients stub their toes or injure their feet, they are unaware of the damage until they see their soiled footwear (Sieggreen, 2005; Wilson, 2005).

With ischemia, or peripheral arterial disease (PAD), reduced blood flow to the feet restricts nutrients and oxygen needed for the healing of ulcers and the maintenance of healthy

tissue (Sieggreen, 2005). PAD is four times more likely to afflict diabetics than non-diabetics (Kannel & McGee, 1979). About 50% of patients who have had diabetes for 20 or more years have PAD from the knees down. The risk for PAD is increased with smoking, hypertension, and hyperlipidemia (Sieggreen, 2005; Wilson, 2005).

After ulceration, infection is the predominant factor for amputation and is the most common cause for hospital admission (Wilson, 2005). Once the skin has been broken, bacteria are introduced into the wound. The infection can be superficial, such as with cellulitis, osteomyelitis, or an abrasion; however, because diabetic patients' ability to heal is impaired, they have difficulty healing from such infections. A localized skin infection can quickly spread to the soft-tissue and then to the bone. Once osteomyelitis is diagnosed, the risk for amputation increases significantly (Medifocus Health, 2011).

The elderly have physiological impairments in wound healing. Decreased angiogenesis and synthesis of critical growth factors have been indicated as sources of impaired healing in clinical and experimental data. Research suggests that elderly patients' chronic wounds should heal with the same frequency of closure as those in younger populations, but slower. However, the elderly have a higher incidence of chronic wounds than the general population. Mortality is also higher in the elderly population, especially associated with sepsis and acute respiratory distress. These morbidities may have a direct link to the chronic wound (Brem et al., 2003).

Wounds also negatively affect quality of life. Chronic wound pain is the biggest issue for the elderly. Other problems that can manifest from foot ulcers are depression, loss of function, loss of mobility, isolation, psychological disturbances, nausea, fatigue, and personal financial cost (Moore, 2011).

### **Significance of the Problem**

The first of the baby boom population reached retirement age in 2011. Over the next 18 years, boomers will be turning 65 at a rate of about 8,000 per day (American Association of Retired Persons [AARP], 2011). This projected increase in the elderly population logically corresponds to an increase in wounds and diabetic foot ulcers (Moore, 2011) that will dramatically impact the US health system and economy as Medicare and Medicaid reimburse for the majority of lower leg amputations, meaning that Americans will be “footing” the bill (CDC, 2001). It is paramount for the sake of the physical and fiscal health of the nation that diabetic wound care treatment and prevention education occur at all levels of health care, from the undergraduate level to registered nurses in both skilled nursing and acute care settings.

### **Problem Statement**

Dunning cited the shortcomings of the traditional undergraduate nursing curriculum in preparing the registered nurse (RN) to competently practice wound care (Dunning, 1995). While the majority of nursing journals and textbooks deal with medical management of ketoacidosis, hypoglycemia, or other aspects of diabetes education, aspects of care such as foot care were not addressed (Sabco & Michael, 1989; Saments, Denham, Jowelt & Burden, 1986). In addition, wound management has changed significantly in the past 20 years, but the undergraduate nursing curriculum has not reflected these changes (Madsen & Reid-Searl, 2007). Undergraduate nursing curriculum typically only provides lecture and reading on wound care (Huff, 2011). Senior nurses close to graduation were tested and found to have a general lack of understanding about diabetes care (Etzwiler, 1967; Fuestel, 1976). Furthermore, reports in the literature point out a lack of knowledge about diabetes among -



nursing staff (Dunning, 1995). According to a study done by Clay (2007), there is limited evidence-based literature on diabetic foot care available for nurses to educate themselves in this field. Studies have shown that new educational approaches are needed even for advanced practice nurse roles (Doughty, 2000). Huff's study (2011) supported evidence that undergraduate nurses that received a two-hour lecture and laboratory class on wound care by a nurse wound specialist retained more knowledge about wound care two months following the educational intervention. An undergraduate curriculum including laboratory classes and lectures by nurse wound care specialists and clinical time with a wound care nurse would enhance any nursing program and undoubtedly produce improvement in the nursing students' knowledge of basic wound care.

### **Purpose Statement**

The purpose of this evidence-based project was to develop an education program on diabetic foot ulcer wound care treatment and prevention in the elderly for registered nurses in the long term acute care and skilled nursing settings. Not only are nurses professionally responsible for their competency, they must also acknowledge the limitations of their competency (An Bord Altranais [ABA], 2005). This innovative method of education will aid the registered nurse in bridging the gap between what was taught and what should have been taught to become competent in the evaluation, treatment, and prevention of diabetic foot ulcers in the elderly population.

## CHAPTER TWO

### **Literature Review**

Several research studies have concluded that undergraduate education in wound care, specifically diabetic foot ulcers, is lacking (Huff, 2011; Moore, 2011). This evidence-based education project is being developed to increase the novice registered nurses' knowledge, skills and competencies in diabetic wound care in the elderly population. Additionally, this project also yields itself well to utilizing Benner's theory of expert intuition in nursing as its' conceptual framework. Benner conceptualizes that an expert has nursing skills developed through experience (Nursing Theory, 2011). Wound care is a skill that is learned over time and builds upon many experiences of clinical experience.

A comprehensive review of the most current literature was performed. Several reputable computerized databases were utilized covering the years from 1985 – 2013, among which were CINAHL, RAO, National Guideline Clearinghouse, Cochrane Network, and PubMed. The keywords *nursing education, nursing curriculum diabetes, wound care, wounds, diabetic foot ulcers, elderly, geriatric* and *gerontology* were entered in various combinations and orders into the search engine.

There were limited studies and articles that focused on undergraduate education or curriculum and wound care. The few that surfaced supported the inadequacy of current nursing curriculum on wound care, suggesting innovative education and a transition into delivering changed expectations of wound care are needed (Dunning, 1995).

### **Overview of Diabetes Mellitus**

Diabetes mellitus is not a single disease but a group of clinically heterogeneous disorders with glucose intolerance or insulin availability in common. It includes many

causally unrelated diseases and many different etiologies of disturbed glucose intolerance (McCance & Huether, 2006). Vascular disease has been linked to several risk factors including hyperglycemia, insulin resistance, dyslipidemia, hypertension, tobacco use, and obesity. The resulting microvascular and macrovascular diseases affect several organs, including muscle, skin, heart, brain, and kidneys (Cade, 2008). Health complications include heart disease and stroke, high blood pressure, blindness, kidney disease, nervous system disease (neuropathy), and amputation. More than 60% of nontraumatic lower-limb amputations occur in diabetics and in 2006 there were over 65,700 nontraumatic lower limb amputations performed on people with diabetes (CDC, 2011).

**Neuropathy.** The American Diabetes Association (ADA) defines *diabetic neuropathy* as the presence of symptoms and/or signs of peripheral nerve dysfunction in people with diabetes after the exclusion of other causes (Koury, 2004). Diabetic neuropathy is the most common complication of diabetes, but is still not fully understood although the mechanism is thought to be vascular, metabolic, or a combination of both and is related to hyperglycemia (McCance & Huether, 2006). Peripheral loss is the most common deficit of diabetic neuropathy (McCance & Huether, 2006).

**Peripheral arterial disease (PAD).** An increase in incidence of peripheral arterial disease, gangrene, and amputation in diabetic persons has been documented in many studies (McCance & Huether, 2006). Vascular complications cause decreased oxygen supply to the tissues. Macrovascular and microvascular angiopathy as well as neuropathy can lead to diabetic foot lesions with delayed wound healing and subsequent amputation. Diabetic angiopathy on a macrovascular level can result in large-vessel occlusion, as in the case of thrombosis, and cause extensive gangrene.

**Infection.** Cultures often identify polymicrobial infections and early identification with antibiotic treatment help to ward off related morbidities such as cellulitis, abscesses, sepsis, and osteomyelitis. Parenteral rather than oral antibiotics are used due to poor vascularization. The colonizing flora of the skin becomes more complex with diabetes and virulent aerobic gram-positive cocci flourish, such as with *S. aureus* and beta-hemolytic streptococci. *S. aureus* is the most common pathogen in diabetic foot infections even though it may not be the sole isolate and can be part of a mixed infection. Both aerobes and anaerobes cause serious infections in hospitalized patients. Enterobacteriaceae and pseudomonas are common depending on the previous treatment or antibiotic used. MRSA and obligate aerobes occur in ischemic wounds. Osteomyelitis usually occurs from a contiguous spread of a deep soft tissue infection. Intravenous therapy should target the predominant bacterial species of the infection and often requires administration of more than one antibiotic in the case of a mixed infection (Karchmer, 2006).

**Structural changes in the foot.** Structural deformities and overuse contribute to ulceration (Guyton & Saltzman, 2001). Repetitive stress is usually offset by sweating, sebum secretion, and the skin's coefficient of friction as well as the sympathetic nervous system. When it is not, as in the case of the diabetic patient, ordinarily tolerable pressures can lead to ulceration (Guyton & Saltzman, 2001).

Neuropathic joints, or Charcot arthropathy, can occur in almost any joint but occurs most commonly in the foot. Charcot arthropathy is a progressive condition that is subject to joint dislocations, pathologic fractures, and deformities that debilitate at weight-bearing joints. It destroys both bone and soft tissues. The diabetic sensory impairment and autonomic neuropathy predispose diabetic patients to this disruption of the bony architecture

of the foot or ankle. A resultant change in gait leads to new pressure points, which can also cause ulceration (Karchmer, 2006; Mrugeshkumar & Calhoun, 2011)

### **Effects of Aging**

As the baby boomers age, there will be a corresponding increase in the elderly population such as our nation has never experienced before. Quality of life, health, and independence and increase in longevity will be affected by the results of research on aging (Wicke, Bachinger, Coerper, Beckert, & Witte, 2009). Aging has been shown to impact the healing rates of chronic wounds. According to a study done by Wicke et al. (2009), the difference in wound closure was the highest for people aged 70, producing a very significant statistical result.

Skin morphology changes with age. Atrophy occurs in the epidermis, dermis, skin appendages, and the subcutaneous tissue. Human skin dries, changes color, wrinkles, and loses firmness. There is also a corresponding decrease in hair, a decrease in the number of cells, flattening of the dermo-epidermal junction, a decline in melanocyte density and glandular activity. In addition, microcirculation becomes disorganized. The combination of all of these declines may make skin more susceptible to damage after trauma via modification of cellular responses to injury (Wicke et al., 2008).

### **Skin Ulceration**

Ulcers may be caused by a variety of conditions such as neuropathy, ischemia, venous hypertension, and pressure. Diabetic patients may develop ulcers secondary to neuropathy with or without biomechanical abnormalities, peripheral vascular disease with ischemia or both. In addition, diabetic ulceration may be caused by an increase in pressure on the foot because of foot deformity, limited joint mobility, and neuropathy (Steed, et al,

2007). Changes in aging skin as well as infection may play a role in ulceration. The triad of neuropathy, deformity, and trauma is present in almost two-thirds of patients with foot ulcers (Boulton, Kirsner & Vileikyte, 2004).

### **Quality of Life**

Hard-to-heal wounds affect the quality of life of the patient, the patient's family and the patient's friends (Pragnell & Nielson, 2010). Chronic wounds that require wound care over months or years affect the patient physically, socially, and psychologically and can be financial burdens (Benbow, 2008). Pain associated with the wound itself and from dressing changes has the largest impact on quality of life (Pragnell & Nielson, 2010). Malodor, exudate leakage, and negative reactions from the appearance of the wound or dressing can cause the patient to isolate. Dressing changes interfere with the flow of daily routines. The elderly are at a particularly high risk of having their quality of life reduced. It is possible that they already have difficulty with activities of daily living and ambulation. Chronic wounds can be disabling when compounded with existing limitations. The inability to sleep because of pain and further reduction in activity levels increase the likelihood of fatigue, depression, altered eating habits and social isolation (Benbow, 2008).

### **Terms and Definitions**

The terminology utilized in wound care by nurses and physicians can be confusing to the new RN. In addition, companies that market their products to the industry often use trade names that are interchangeable with a more basic description and can possibly cause errors in wound treatment. The algorithm selected for this education project includes a few basic terms that could possibly need elaboration for the new RN in order for the RN to utilize the information in wound treatment.

**Acute wounds versus chronic wounds.** Baronski and Ayello contend that there is little consensus among the industry regarding the definition of acute versus chronic wound etiologies. Acute wounds heal rapidly and in an uncomplicated, orderly or organized fashion. They are further defined as “a disruption in the integrity of the skin and underlying tissues that progress through the healing process in a timely manner (Baronski & Ayello, 2008). Acute wounds typically are surgical or traumatic wounds that heal by primary intention. Chronic wounds “are ones that deviate from the expected sequence of repair in terms of time, appearance and response to aggressive and appropriate treatment” (Baronski & Ayello, 2008). The Wound Healing Society uses Lazarus’ (1992) definition of chronic wounds as ones that “fail to progress through a normal, orderly and timely sequence of repair or wounds that pass through the repair process without restoring anatomic and functional results” (Lazarus et al., 1994). These types of wounds heal by secondary intention and are associated with pathology such as diabetes mellitus, ischemic disease, pressure damage and inflammatory processes (Baronski & Ayello, 2008).

**Exudate.** *Mosby’s Dictionary of Medicine, Nursing & Health Professionals* (2007) defines *exudate* as “fluid, cells or other substances that have been slowly exuded, or discharged, from cells or blood vessels through small pores or breaks in cell membranes.”

**Necrotic tissue.** Necrosis is defined as nonviable or dead tissue. The two main types of necrotic tissue are slough and eschar. Slough can be yellow to tan in color and mucinous or stringy, nonadherent or loosely attached to healthy tissue. Eschar may be brown, black or gray in color and can be soggy and soft or hard and leathery. It is usually firmly attached to the wound base. Eschar can at times be mistaken for scabs, but eschar is composed of dead tissue and coagulated blood products from within the wound (Baronski & Ayello, 2008).

**Wound debridement.** The therapeutic intervention for necrotic tissue is debridement. Debridement is defined as the removal of devitalized tissue (Sussman & Bates-Jensen, 2012). Although there are five different types of wound debridement, the Solutions® Wound Care Algorithm utilizes only three. The objective of enzymatic or chemical debridement is that the enzyme applied topically to the necrotic tissue will degrade the necroses by digesting devitalized tissue. Commercially available enzymes used are either collagenase or papain-urea with or without chlorophyllin. Autolysis uses the body's own white blood cells, specifically neutrophils, to breakdown necrotic tissue with the endogenous enzymes they produce. Therefore, to some extent, all wounds exhibit some level of autolytic debridement. This is accomplished with a moisture-retentive dressing (Sussman & Bates-Jensen, 2012). Surgical (sharp or instrumental) debridement is utilized when there are large amounts of non-viable tissue that is thick and adherent. Since it is the most rapid form of debridement, it is used when there are advancing signs of cellulitis or sepsis present (Sussman & Bates-Jensen, 2012).

### **Clinical Practice Guidelines**

The Registered Nurses' Association of Ontario (RNAO), the National Guideline Clearinghouse (NGC), and the American Diabetes Association (ADA) have clinical practice guidelines and recommendations that address diabetic ulcers, neuropathy, and foot care. RNAO's Assessment and Management of Foot Ulcers for People with Diabetes is specific for diabetic foot ulcers. The NGC guidelines cover a wound care algorithm as well as chronic wounds, diabetic foot disorders, and leg ulcer guidelines. The ADA's Clinical Practice Recommendations include practice guidelines for the prevention and management of diabetic ulcers located specifically on the foot. The National Diabetes Education Program



(NDEP) partnered with the National Institutes of Health (NIH), the CDC, and over 200 other organizations to produce their *Feet Can Last A Lifetime* kit. This kit contains a form for the annual comprehensive diabetes foot exam. There appears to be a need for a Guideline Synthesis for the treatment of diabetic wounds.

**RNAO recommendations.** The RNAO published a comprehensive best practice guideline entitled *The RNAO Summary of Recommendations for Reducing Foot Complications in People with Diabetes* that was published in 2004 and revised in 2007. These clinical practice guidelines were incorporated into the National Guideline Clearinghouse along with the 2007 revision. The following best practice recommendations apply directly to diabetic foot complications.

A physical examination of both feet to assess risk factors for foot ulceration/amputation should be performed by a health care professional. This examination should be at least annually and at more frequent intervals for those at higher risk. Nurses should assess foot risk for all clients with diabetes. This risk assessment includes the following five factors: history of previous foot ulcers, sensation, structural and biomechanical abnormalities, circulation, and self-care behavior and knowledge. Nurses in all practice settings should provide or reinforce basic foot care education tailored to client's current knowledge, individual needs, and risk factors. This education should include the following six elements: awareness of personal risk factors, importance of at least annual inspection of feet by a health care professional, daily self inspection, proper nail and skin care, injury prevention and when to seek help or specialized referral. High-risk individuals for ulceration and amputation should be referred to their primary care provider for further assessment or to specialized diabetes or foot care treatment (RNAO, 2004).

These best practice guidelines recommend education for nurses so that they are competent in both knowledge and skills to assess a patient's risk for foot ulcers and provide the appropriate education and referral. This basic knowledge includes skills in conducting an assessment of the five risk factors, knowledge and skill in educating clients, and knowledge of sources of local referral. Further education recommendations encourage educational institutions incorporating the RNAO's nursing best practice guideline, *Reducing Foot Complications for People with Diabetes*, into basic nursing education curriculum as well as providing continuing education programs regarding diabetic foot complications and assessment skills (RNAO, 2004).

**ADA recommendations.** The ADA recommends an annual comprehensive examination of the feet. The exam should include inspection of both feet with palpation of the dorsalis pedis and the posterior tibial pulses. Assessment should include the Achilles and patellar reflexes. In addition, proprioception should be evaluated. Loss of protective sensation should be conducted using the 10-g monofilament plus one of the following: vibration using 128 Hz tuning fork, pinprick sensation, ankle reflexes, or vibration perception threshold.

**National Diabetes Education Program.** NDEP's kit has tools and flow charts for diabetic foot exams as well as actual foot exam procedures and instructions. Their annual comprehensive diabetes foot exam form is an excellent tool for nurses and providers. Their recommendations for foot examinations are dependent on the patient's risk category. High-risk patients have one or more of the following: loss of protective sensation, absent pedal pulses, foot deformity, and history of foot ulcer or prior amputation. Low-risk patients have none of these five high-risk characteristics (National Diabetes Education Program, 1998).

**National Guideline Clearinghouse.** Conva Tec published Solutions® Wound Care Algorithm in 2001 with updates in 2005 and 2008 addressing acute and chronic wounds. Specific disease conditions included were arterial, diabetic, pressure, venous, or mixed arterial-venous ulcers. The guidelines were developed to assist health care professionals' management and evaluation of acute and chronic wounds. The goals of reducing patient risk factors for delayed healing and the prevention of wound complications were also considered.

### **Diabetes Wound Care in Nursing Curriculum**

There have been limited studies conducted that discuss wound care in undergraduate nursing curriculum and only two were found in the search. In 2011, a survey of the provision of education in wound management to undergraduate nursing students was conducted in Europe (Moore, 2011). A cross-sectional descriptive survey utilized a questionnaire mailed to nurses in 35 countries representing the cooperating organizations of the European Wound Management Association (EWMA). Eighty seven percent of respondents were not satisfied with their wound management education. The responses also included estimations of the amount of time allocated to wound care in their under-graduate program. The majority gave estimates of between two hours and one day in the total undergraduate curriculum set aside for wound management education. The consensus was that undergraduate nursing students did not receive enough education on wound management and that pressure ulcer prevention and diabetic foot ulceration needed greater emphasis. Furthermore, the programs were inconsistent in teaching the specific aspects of wound management in the curricula (Moore, 2011).

Curriculum delivery was described by the vast majority of the respondents to have been face-to-face lectures (82%) and practical demonstrations (52%). Simulation, hands-on interactive sessions, and role-play were infrequently used in the didactic or clinical environment. Some responses stated that teaching in the wound clinic and bedside teaching were included in their instruction. In addition, the majority of the nurses indicated that their competencies were not assessed during their undergraduate training. If competency was assessed, it was in the form of a written exam used to assess the students' knowledge. Assessment of student-patient interactions and practical demonstrations by the student were utilized in a small percentage of responses. The survey also solicited general comments about undergraduate education in wound management. Responses suggested a lack of a systematic approach in this aspect of the curriculum. The comments indicated that there was diversity in the approach to wound management education and that it was heavily dependent on the preferences of the instructor (Moore, 2011).

A quantitative, quasi-experimental, pre- and post-test study of undergraduate nursing students' knowledge of wound care, prevention, and documentation was conducted in the U.S. (Fuestel, 1976). Results from second year nursing students of a four-year public college and first year nursing students in a two-year community college program were compared. The intervention was a two-hour lecture and laboratory class on wound care by a nurse wound specialist. The intervention group completed a post-intervention questionnaire two months after the lecture and laboratory-based experience. The control group completed the questionnaire and based their answers on their assigned reading and class lectures at the end of the semester. The intervention group had significantly higher scores on 7 out of 10

questions when compared to the control group. Therefore, this intervention improved the nursing students' knowledge of basic wound care for a prolonged period of time.

The National League of Nurses (NLN) strongly recommends a complete paradigm shift in nursing education. The league has called for dramatic reform, with a challenge to rethink the emphasis on content and outdated teaching methods (NLN, 2005). The University of New Mexico Health Sciences Center responded to this call by creating a new curriculum to their nursing students. A conceptual approach has been incorporated into their platform and all concepts are presented on three continua across the lifespan: age, health, and environment. This approach allows for content to be deemphasized, which leads to content management and conceptual learning. Critical thinking is then fostered and the artificial boundaries that result from population-based or setting-based education are broken down. (Giddens, Brady, Brown, Wright, Smith, & Harris, 2008). This revamping of curriculum is exactly what the NLN feels is necessary to prepare today's nursing students for the workforce.

A major challenge in nursing undergraduate curricula today is to prepare nurses for practice in a dynamic healthcare environment with technology that is rapidly changing and knowledge that is expanding and exploding (Jayasekara, Schultz, & McCutcheon, 2006). It is imperative that undergraduate curricula keep pace with these demands so that the absolute measureable outcome, patient care, will be optimum. The systematic review by Jayasekara et al. (2006) was conducted to appraise and synthesize the best available evidence on the effectiveness and appropriateness of the undergraduate nursing curricula. Unfortunately, there was a lack of high quality research available and only lower level evidence studies were able to be included. Important outcome measures, such as patient care outcomes, were also a

scarcity in the research. Therefore, no strong conclusions can be made regarding the effectiveness and appropriateness of undergraduate nursing curriculum (Jayasekara et al., 2006). There was a scarcity of research completed that related to wound care specifically.

### **Conceptual Framework**

Benner's model of expert intuition in nursing was selected for the conceptual framework. It is also known as Benner's Stages of Clinical Competence and was adapted from the Dreyfus Model of Skill Acquisition. The five levels of nursing experience are: Novice, Advanced Beginner, Competent, Proficient, and Expert. They correlate with skill changes in performance (Nursing Theories, 2011). Beginners have no experience of the situation in which they are expected to perform. These nurses are usually new graduates or nurses returning to the workforce after a long absence. They are the ones that are labeled with an inability to make a theory to practice gap assimilation or able to make the connection between classroom lecture to individual patients. The advanced beginner can demonstrate acceptable performance and have often coped with real situations to be able to process meaningful situation components. They make the connection between didactic and clinical learning principles to individual patients, but lack experiences that support differentiation between individual patients. The competent nurse plans and cares for the patients individually following a plan of care or under the guidance of a more experienced nurse. When the nurse starts to develop actions in terms of long-range goals or plans, competence develops. This usually occurs with two to three years of experience on the floor. A proficient nurse typically is able to manage care for several patients without supervision. This nurse can assume charge nurse duties and is oftentimes called upon by the less experienced nurse to provide assistance. Formal leaders are frequently expert nurses. They

seem to perform their duties without thinking. Their responses to situations often seem automatic and are able to think ahead and anticipate problems during a situation (Benner, 1984). Wound care today is a skill that is developed over time through experience and a thorough educational base.

### **Summary**

This evidenced-based program will be developed to illuminate the need for an education program on ulcer wound care treatment and prevention in the elderly. The etiology and pathophysiology of foot ulcers are complex and sound education and clinical experience in assessment and treatment are paramount, especially when caring for the elderly population. The elderly typically have comorbidities and wounds can develop rapidly. The novice nurse needs a solid foundation in education and clinical experience prior to caring for an elderly patient with diabetes. This education program will aid the registered nurse in bridging education theory to practice gap and increase competency in the evaluation, treatment, and prevention of diabetic foot ulcers in the elderly population.

## CHAPTER THREE

### **Methods**

One major challenge in undergraduate nursing curricula today is to prepare nurses for practice in a dynamic healthcare environment with technology that is rapidly changing and knowledge that is expanding and exploding (Jayasekara, Schultz, & McCutcheon, 2006). It is imperative that undergraduate curricula keep pace with these demands so that the absolute measurable outcome, patient care, will be optimum. The National League of Nurses (NLN) strongly recommends a complete paradigm shift in nursing education. The league has called for dramatic reform, with a challenge to rethink the emphasis on content and outdated teaching methods (2005). Innovative teaching methods for helping students understand wound care needs in the clinical setting is needed for better wound care management. Such instructional strategies for this wound care program are listed in Appendix B.

There have been limited studies conducted that discuss wound care in undergraduate nursing curriculum. In 2011, a survey of the provision of education in wound management to undergraduate nursing students was conducted in Europe (Moore, 2011). Eighty-seven percent of respondents were not satisfied with their wound management education. The responses also included estimations of the amount of time allocated to wound care in their under-graduate program. The majority gave estimates of between two hours and one day in the total undergraduate curriculum set aside for wound management education. The consensus was that undergraduate nursing students did not receive enough education on wound management and that pressure ulcer prevention and diabetic foot ulceration needed greater emphasis. Furthermore, the programs were inconsistent in teaching the specific aspects of wound management in the curricula (Moore, 2011).



This education project was devised to help novice nurses transition into competent care of typical chronic nonhealing wounds seen in long-term acute care hospitals and skilled nursing facilities. The typical patient population is geriatric, therefore age-specific educational information will be addressed (Fletcher, 2002). Chronic wounds that do not heal well are often secondary to broader health disorders. Part of the didactic element of the course addresses the disease processes that contribute to the development of chronic wounds such as diabetes, venous blockage, arterial insufficiency, malnutrition, cigarette smoking and alcohol consumption (Katz & Kirr, 2012). The lesson plan for this project is in Appendix B.

### **Program Design**

This education project uses a quasi-experimental one-group pre-test-post-test design. This design is deemed appropriate because it will allow all new hires and new graduates to benefit from the education intervention and evaluation. No one will be excluded due to randomization (Garbee et al., 2013).

### **Participants**

This education program was created for the registered nurse in the long-term acute care hospital and skilled nursing facility settings. The program will cover the evaluation, treatment, and prevention of diabetic foot ulcers, specifically targeting the elderly population.

The Acute Long Term Hospital Association's (ALTHA) database was searched for LTACs in San Diego. ALTHA is a trade association whose mission is to protect patient access to the care provided at their hospital members. It also serves as an educational resource for their member facilities' clinicians and executives and is committed to improving the quality of care and best practices among the member hospitals. Vibra Hospital, Kindred Hospital and Promise Hospital are the three member hospitals in the 92103, 92104 and 92105

zip codes, respectively, selected as potential sites for this education project. Three skilled nursing homes from the same zip codes were selected from the California Advocates for Nursing Home Reform (CANHR) roster as potential sites for recruiting participants. Jacob Health Care Center in the 92105 and Balboa Nursing and Rehabilitation Center and Mission Hills Health Care Inc. in the 92103 zip codes were selected. Management at these facilities will be approached and the two-hour lecture and lab class will be offered to the first 50 of their hospital's registered nurses at no charge. A catered lunch will be provided to the attendees as an incentive. The program will be held at one of the hospital's conference rooms. Administration, management and educators at these facilities will be approached to offer the program as part of a mandatory orientation for new hires and new graduate RNs.

### **Program Description**

The program will address the following outcomes: Wound Assessments, Goals of Wound Care, Wound Care Plan, Interdisciplinary Counseling, and Adjunct Therapies.

### **Wound Assessment**

**Wound bed exudate.** Initially, the wound bed exudate should be assessed. The Solutions® Algorithm (Appendix C) suggests defining the exudate presenting as dry-minimal moisture, moist-lightly exudating, moist-moderately exudating, or wet-heavily exudating (U.S. Department of Health and Human Services [USDHHS], 2012). Participants will be shown how to determine assessment of exudate with power point examples.

**Wound bed tissue.** Assessment of the wound bed can give clues to the basic approach to the treatment of a chronic wound (Katz & Kirr, 2012). Shiny wound beds can indicate biofilm (a slimy layer of bacteria) that needs to be removed prior to treatment. A grey or pale wound bed can indicate lack of vital tissue and circulation. Debridement is often

indicated but the patient should be assessed for circulatory issues. Yellow stringy or clinging matter indicates slough, which should also be removed. Indications of eschar, such as black, brown or tan coloration of tissue, need to be removed prior to treatment as well. An exception for removal would be eschar on a heel, which should be off loaded if it is dry and intact. Gangrene manifests itself as black or dark brown tissue on an extremity, especially on toes. Gangrene should be reported immediately to the attending physician, as wet gangrene may need immediate surgery. Culture and biopsy may also have to be considered (Lipsky & Hoey, 2009). Participants will be instructed to clean the wound with normal saline or sterile water and pat dry. Normal skin flora is eliminated and exudate should be swabbed at the deepest area of the wound or where the majority of the exudate is located (Katz & Kirr, 2012). Power point photos of various tissue types will be presented and discussed.

The Solutions® Wound Care Algorithm utilizes a basic cutoff of 25% necrotic tissue/fibrin slough (Appendix C). The Bates-Jensen wound assessment tool suggest using a transparent metric measuring guide with concentric circles divided into 4 (25%) pie-shaped quadrants to help determine this figure (Appendix D). This information will be included in the lecture and utilized in the assessment portion of the program.

**Wound dimensions, wound depth and wound edges.** Wound dimensions will be discussed and a wound measurement demonstration will be utilized from the following website: <http://www.youtube.com/watch?v=ZWMaR-jheGY>. It discusses how to measure length, width, and depth. The Solutions ® Algorithm categorizes depth as superficial or partial thickness versus full-thickness. Undermining is an important aspect of the Solutions® Algorithm when assessing wound edges. Participants will also be told how to assess and measure undermining via the demonstration mentioned above. They will then have time to

practice these measurements on the SIM man and Halloween tattoos that depict exaggerated wounds. A nurse volunteer will be obtained prior to the class and will apply and paint a three-dimensional wound so that the participants can measure it. Later in the program, they will apply dressings to it. This novel idea was utilized by a nursing school in Tennessee and cited as a fairly realistic way to teach and practice wound care (Zachary, 2011). In addition, the Bates-Jensen wound assessment tool will be handed out as a reference (Appendix D).

**Undermining.** Often times the tissue is damaged under the intact skin along a wound margin. The students will be instructed to use a cotton tipped applicator to assess for undermining as well as how to document undermining.

**Surrounding tissues.** It is important to assess the surrounding tissues of a chronic wound to assess for unusual infections such as fungi or destructive processes such as carcinomas. Biopsies and cultures are often necessary (Katz & Kirr, 2012). Surrounding tissue should be examined for signs of infection, edema and ischemia. The Solutions® Algorithm specifically references purulent exudate, elevated temperature and peripheral induration or edema. The participants will be instructed to examine tissues within 4 cm. of the wound edge for redness, maceration, and white or gray discoloration (USDHHS, 2012). Additional information will be offered via Appendices B, C and D.

### **Goals of Wound Care**

The primary goals at this stage in the treatment are to obtain a clean wound bed and provide a moist environment (USDHHS, 2012). Wounds heal best in a moist environment (Atiyeh & Hayek, 2005). Technology and new research on wound healing have produced advanced products that help the body maintain the ideal moist, warm and protected wound healing environment (Appendix E; Murphy & Evans, 2012).

However, the goals of wound care are dependent upon the balance of excessive exudate and maintenance of a moist environment. Furthermore, prevention of premature wound closure is essential when undermining or tunneling is present (USDHHS, 2012). These goals will be covered in lecture and the nurses will have the Solutions® Algorithm handout as a reference.

### **Wound Care Plan**

Selection of proper wound care products is dependent upon proper assessment. Studies regarding the Solutions® Algorithm found qualitative themes that registered nurses felt insecure about assessing wounds and had difficulty with wound assessment and care issues. These studies showed that nurses selected the correct primary dressing 71-98% of the time. The percentages were lower when selecting wounds with necrotic tissues, often times incorrectly packing deep wounds, tunneling and undermining (Beitz & van Rigswijk, 2010). The algorithm calls for debridement of wounds with greater than 25% necrotic tissue or fibrin slough. The physician will order the type of debridement options, such as autolytic, enzymatic or surgical. The participants will be referred to Appendix E (Murphy & Evans, 2012). Part of the power point presentation will show photos of wounds before and after debridement.

Selection of the primary dressing is dependent upon whether the wound needs exudate management or needs to maintain moisture for healing. This will be based on assessment of the amount of exudate. The secondary dressing will be moisture retentive and placed over the primary when the wound is moderately or heavily exuding (USDHHS, 2012). A poster board with wound products will be displayed and the participants will have the

opportunity to review the products and then apply them to the SIM man or the senior volunteer with the Halloween tattoo.

### **Interdisciplinary Consulting**

There will be physician orders regarding wound care that the wound team and nurses will follow in the LTAC or SNF. There may be some ambiguity of dressing selection and wound treatment when assessing new patients during admissions and transfers. Most LTACs or SNFs have a wound nurse or team that assesses the patient within a short period of time after arrival. Referrals to infectious disease physicians, podiatrists and the wound team are common. Participants will be instructed to communicate to the wound team and primary care providers when instructions are unclear; there is a regression in healing or if the wound bed is not reduced in size after 2 to 4 weeks of care.

### **Adjunct Therapies**

**Negative pressure wound therapy (NPWT).** NPWT use controls pressure to accelerate and assist wound healing. By applying a vacuum through a special sealed dressing, NPWT promotes wound healing. The science behind the NPWT will be explained with the use of an Internet video by KCI, supplier of the V.A.C. Therapy unit (Appendix F).

Additionally, the students will have time to cut and fit the wound vacuum foam and apply the dressing to the SIM man.

**Hyperbaric oxygen treatment.** Physicians often recommend this adjunct therapy for injured tissue that requires more oxygen to survive. More randomized controlled studies are needed to determine the efficacy of hyperbaric oxygen treatment (HBO) in treating chronic wounds other than diabetic (Hunter, Langemo, Anderson, Hanson & Thompson, 2010). This portion of the instruction will be lecture with a power point slide of the HBO chamber.

**Offloading.** Offloading, or pressure reduction, is imperative to the healing of the diabetic foot ulcer and prevents further trauma. Diabetic patients may have decreased or absent sensation in the lower extremities. Acceptable methods of off loading include crutches, walkers, wheelchairs, custom shoes, shoe modifications, custom inserts, custom relief orthotic walkers, diabetic boots and total contact casts (Frykberg et al., 2006). This information will be conveyed in lecture format.

### **Program Instruments**

Participants will complete a demographic form (Appendix A) and a researcher developed pre-test and post-test utilizing 20 multiple choice and true-false questions from various wound care programs and websites referenced in the lesson plan, Appendix B. The initial pilot project will use the 4 multiple-choice questions for the pretest and post-test as listed in Appendix B and more questions may be added to at a later date. Existing instruments are adapted with the permission from the author of the original scale. A maximum of 4 to 5 response options will be used as to avoid confusing the novice nurses (Polit & Beck, 2012). The questions will be reviewed and validated by two different panels of 8 to 12 experts. These experts will consist of certified wound and ostomy care nurses and wound care nursing faculty throughout California.

### **Data Analysis**

Univariate and bivariate data will be collected from summary scores and analyzed using the Statistical Package for the Social Sciences (SPSS version 20).

## CHAPTER 4

### **Evaluation**

This evidence-based education project was developed to provide wound care education of diabetic foot ulcers with the typical geriatric patient population in mind. The etiology and pathophysiology of chronic nonhealing wounds are complex and sound education and clinical experience in assessment and treatment are paramount, especially when caring for the elderly population. The elderly typically have comorbidities and wounds that can develop rapidly. The novice nurse needs a solid foundation in education and clinical experience prior to caring for an elderly patient with a diabetic foot ulcer. This education program will aid the novice nurse in bridging the theory to practice gap and increase competency in the evaluation, treatment, and prevention of diabetic foot ulcers in the elderly population.

Success of this program will be evaluated by comparing the scores of the pretest and the post-test of the individual participants. Baseline knowledge data will be obtained immediately prior to the education intervention. Post-test knowledge data will be obtained immediately after the education intervention. If there is an increase in knowledge, it can be explained by the education intervention (Polit & Beck, 2012). Therefore, an increase in scores in the post-test is attributable to an increase in knowledge.

Additionally, the students will have an opportunity to demonstrate assessment and measurement of wounds as well as the proper selection and application of wound care products. The test questions would include an opportunity to demonstrate an increase in knowledge in these areas as well. Summative evidence of success of the program will also be



evaluated by assessing 6 month and yearly evaluations of diabetic wound data at the various sites.

## CHAPTER 5

### **Discussion**

It is estimated that in 2009, there was over \$25 billion annually spent on chronic wound treatment. This figure is expected to grow due to increasing health care costs, an aging population and an increase in worldwide incidence of obesity and diabetes. Wound science is being developed as an interdisciplinary field and wound-healing research deserves a higher level of prioritization (Sen et al. (2009).

### **Clinical Implications**

Nurses are responsible for their competence and must also acknowledge the limitations of their competency (An Bord Altranais [ABA], 2005). This evidence-based education project has been developed to increase the novice registered nurses' knowledge, skills and competencies in diabetic wound care in the elderly population. This innovative education project assists LTACs and SNFs in developing and maintaining competency in wound assessment and treatment. It has a variety of instructional methods that appeal to various learning styles.

### **Project Limitations**

With Benner's conceptualization that an expert has nursing skills developed through experience, the novice nurse will need to take what they learned from this educational project and practice it in the work place prior to achieving the next level of competence, the advanced beginner (Nursing Theory, 2011). The management of the LTACs and SNFs involved would be encouraged to start a mentor program. A proficient or expert nurse would be asked to assist the novice on admissions and transfers of patients with chronic wounds. In this way, wounds would be measured and assessed properly with selection of the proper

dressings. Patient care would be improved and this mentorship would enable the novice to advance to the competent nurse in wound care much more rapidly.

### **Future Research**

Continuing research in wound care and underlying complexities of chronic wounds is warranted due to the economic and social impact of wounds in our society. Additionally, at this point in time, the NIH Research Portfolio Online Reporting Tool (RePORT) does not list wounds. The RePORT provides access to estimates of funding but only lists wounds as part of a co-morbidity of another disease, *i.e.* foot ulcers as a complication of diabetes. If wounds were listed as a disease, perhaps there would be greater interest in the science of wound care and healing. Development of new technologies such as laser capture microdissection, the mathematical modeling of wound healing, tissue engineering and stem cell biology represent the backbone of the future of wound sciences (Sen et al., 2009).

### **Conclusions**

At present, undergraduate nursing students receive very little education on the science and care of wounds as evidenced by the studies of Huff (2011) and Moore (2011). The importance of undergraduate nursing curricula to include more in depth education cannot be disputed when given the current and projected burden that wound related complications may place on public health and the economy.

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## Appendix A

**Demographic Form**

Directions: As will all answers to this survey, your responses will be kept confidential. Please circle the appropriate number or fill in the blank. Your completion of the study packet indicates your consent to participate in this study.

1. What is your gender?
  - a. Male
  - b. Female
  
2. What is your age? \_\_\_\_\_ years old
  
3. What best describes your ethnic group?
  - a. Hispanic
  - b. Black (not Hispanic)
  - c. White (not Hispanic)
  - d. Asian/Pacific Islander
  - e. Multi-Ethnic
  - f. Other
  
4. What is your highest earned degree?
  - a. Associate degree or Diploma
  - b. Bachelor's degree
  - c. Master's degree
  - d. Doctoral degree
  
5. How many years of experience do you have as a Registered Nurse?  
\_\_\_\_\_ years
  
6. What best describes your present nursing position?
  - a. Clinical nurse
  - b. Lead nurse or Assistant manager
  - c. Nurse Manager
  - d. Clinical specialist
  - e. Clinical nurse educator
  - f. Other (please specify)
  
7. Have you ever thought of going back to school for a higher degree? Yes/No

## Appendix B

**Lesson Plan**

**Course:** Basic wound care of chronic or nonhealing wounds of the lower extremities for undergraduate baccalaureate nursing students and novice RNs in the SNF and LTAC settings with emphasis on physiological influences of the aging process.

**Unit:** N/A

**Date:** Spring Semester, 2013

**Time:** SIM Lab Dates

**Faculty:** June Franklin, RN, BSN, PHN

**Academic Goal:** How to assess typical wounds seen in the LTAC, SNF, clinics and home health care settings and to identify the proper wound care products needed to dress them.

**Short Term Objectives:** By the completion of this class, using lecture, demonstration, and hands on application of dressings, the participants will be able to:

- 1) Categorize basic wounds and dressings
- 2) Assess basic wounds
- 3) Identify the proper dressings for the care of basic wounds
- 4) Detect when to request interdisciplinary consults

**Content:**

- 1) Assessment of the whole person – disease and age related processes that contribute to chronic wounds and why they don't heal (5 minutes)
- 2) General overview of types of lower extremity ulcers commonly seen in, long-term acute care hospitals, skilled nursing facilities, clinics and home health settings. (5 minutes)
- 3) Assessment of the wound (20 minutes)
- 4) Types of debridement (5 minutes)
- 5) Basic primary and secondary dressings and their uses (20 minutes)
- 6) Use of NGC wound care algorithm (20 minutes)
- 7) Physiological influences of the Aging Process – Integumentary System (3 minutes)
- 8) Interdisciplinary consults (2 minutes)
- 9) Off loading and negative pressure wound therapy, hyperbaric oxygen therapy (20 minutes)

**Instructional Strategies/Learning Styles:**

- 1) Power point and lecture of lower extremity ulcers commonly seen. (Auditory and Visual Learners)
- 2) Demonstration of how to assess wounds using SIM man and Halloween injury tattoos. You tube video on measuring a wound:  
<http://www.youtube.com/watch?v=ZWMaR-jheGY>

- Participants will then assess wounds. (Visual and Tactile learners)
- 3) Poster board of typical primary and secondary dressings. (Visual Learners)
  - 4) Discussion on Solutions® Algorithm with handouts. (Auditory and Visual Learners)
  - 5) Hands on demonstration of wound dressing using Halloween injury tattoo and SIM man. Participants will then apply wound dressings. (Visual and Tactile Learners)
  - 6) Lecture and power point on types of debridement and adjunct therapies. (Auditory and Visual Learners)
  - 7) Video on science behind negative pressure wound therapy (NPWT).  
<http://www.kci1.com/KCI1/sciencebehindwoundtherapy#what>  
<http://www.kci1.com/KCI1/sciencebehindwoundtherapy#what>  
 Demonstration of negative pressure wound vacuum therapy (NPWT).  
 Participants will be able to cut foam and apply NPWT dressings to SIM model.  
 (Visual and Tactile Learners)

### **Anticipatory Set:**

Students and nurses will have basic education of the phases of healing of the integumentary system.

**Assessment:** (How will the instructor and student identify that learning occurred?):

1. Correct answers to test questions.
2. Demonstration of assessment and measurement of wounds.
3. Demonstration of proper selection and application of wound care products.

### **Faculty Reflection:**

To be determined after education project.

### **Evaluation:**

#### **Test Questions:**

1. Which colors are usually used when describing the appearance of a wound?
  - a) Red, yellow, pink and blue
  - b) Orange, purple and green
  - c) Black, blue, white, grey and brown
  - d) Black, yellow, red, pink, green
  - e) Black, red, pink, white

Answer: c
2. Give 3 reasons why wound assessment is important.  
 Answers: To act as a baseline; to identify factors which may delay healing; to identify proper wound treatment and dressings; to determine appropriate objectives, etc.

3. Aging changes in skin include

- a) Wrinkles
- b) Dryness
- c) Hyperpigmented spots
- d) Laxity
- e) All of the above

Answer: e

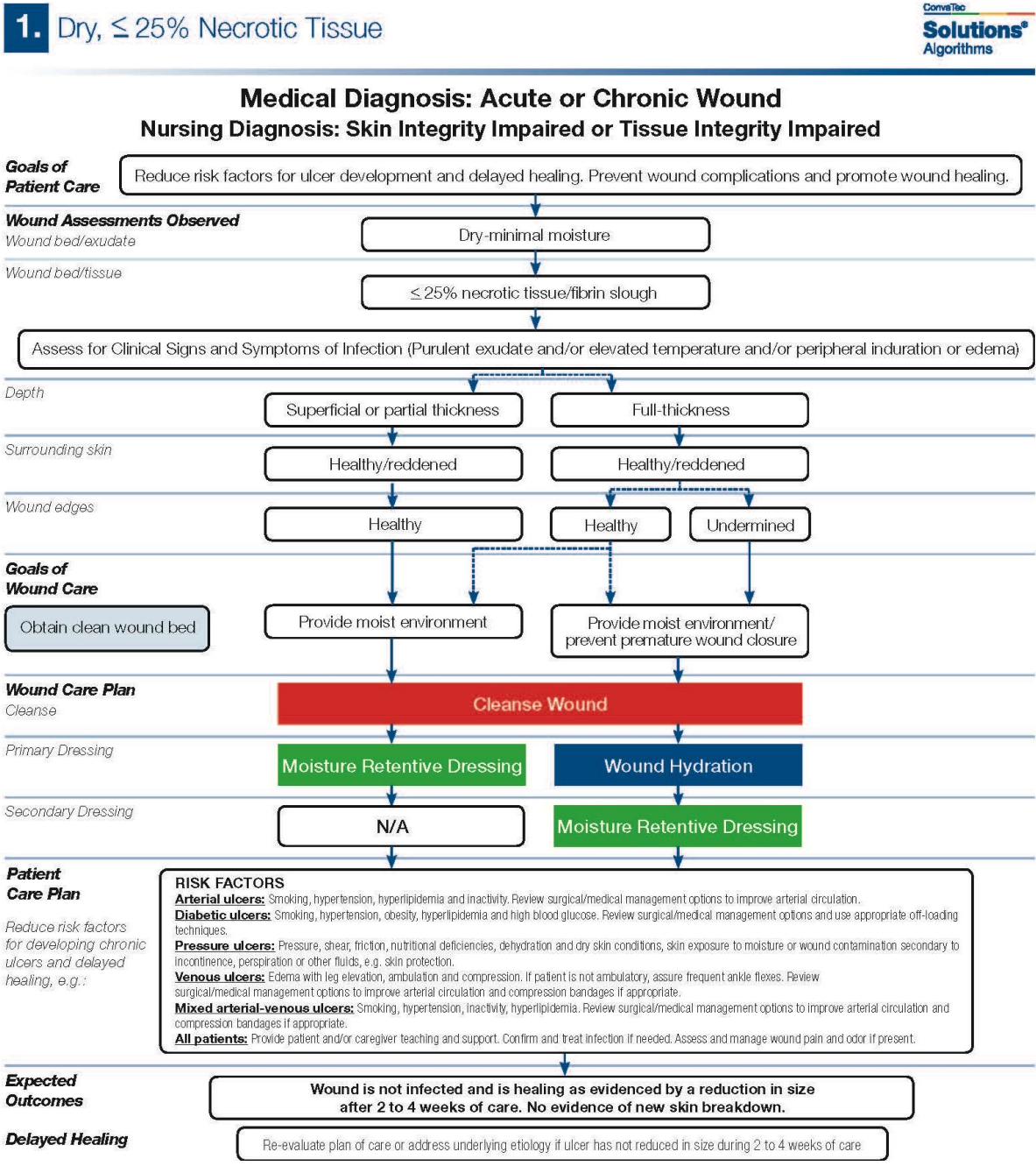
4. Which of the following extends from a wound under normal tissue and connects two structures, such as the wound and an organ?

- a) Undermining
- b) Fistula
- c) Tunneling
- d) Abscess

Answer: b

Appendix C

Conva Tec Solutions® Algorithms

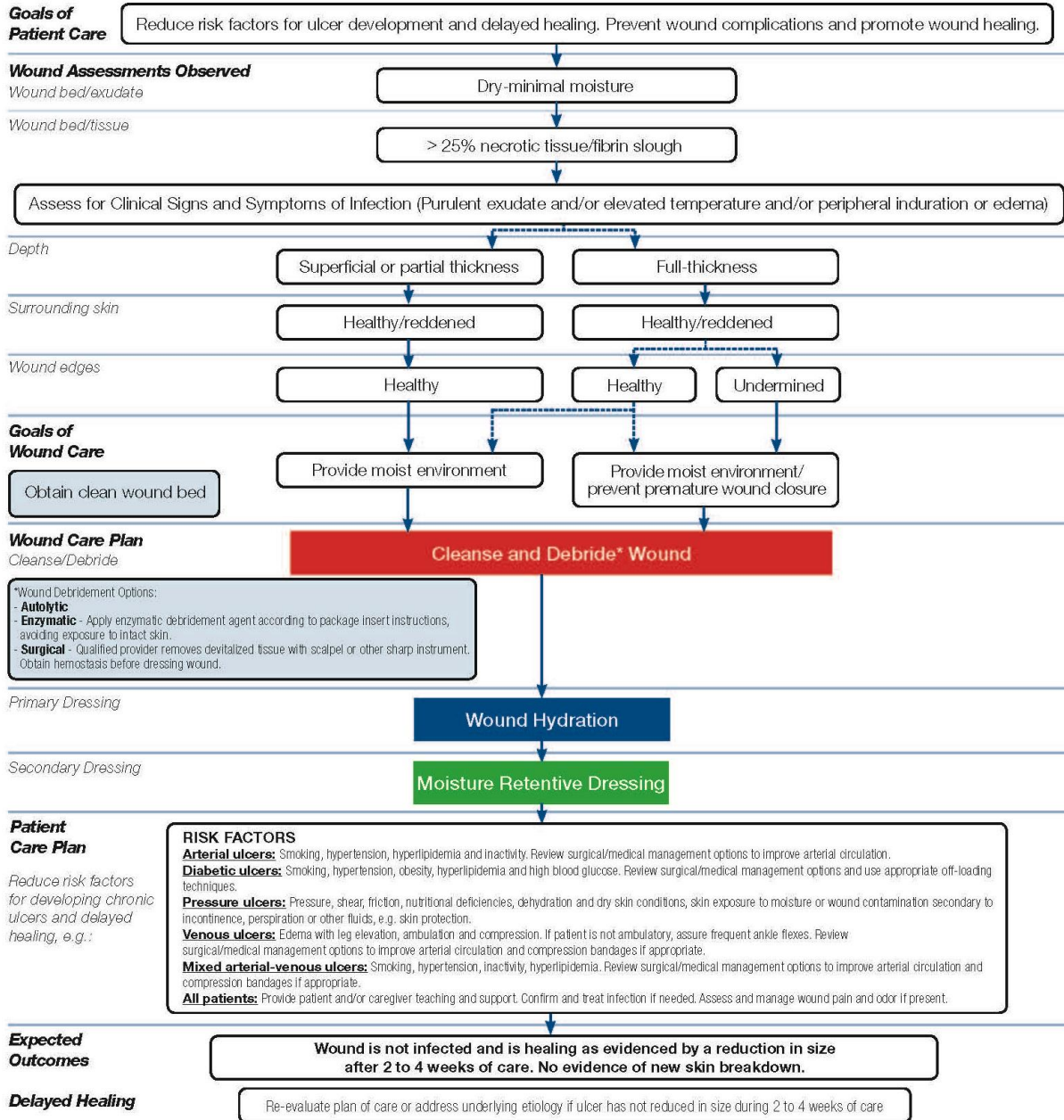




**2.** Dry, > 25% Necrotic Tissue



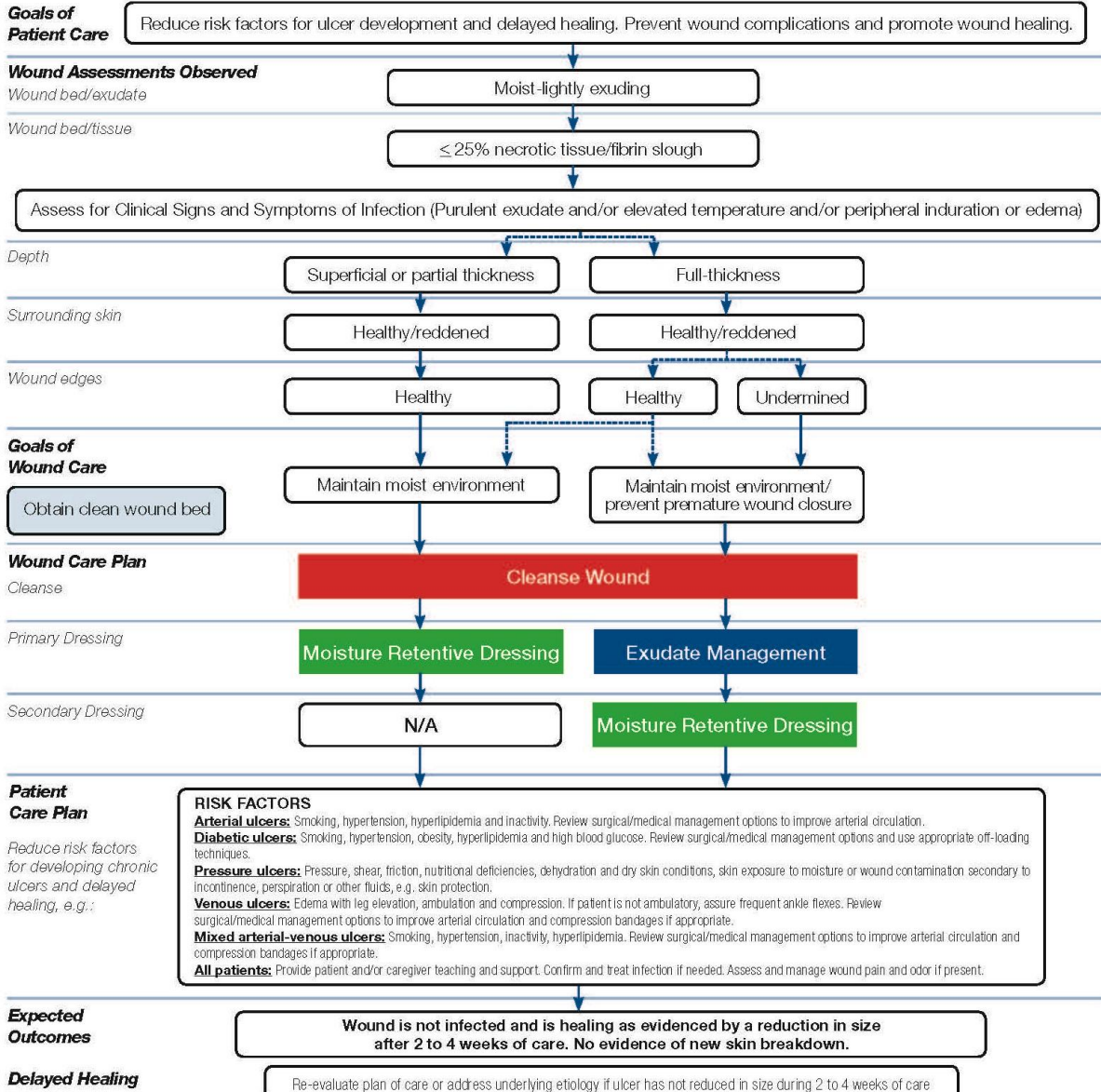
**Medical Diagnosis: Acute or Chronic Wound**  
**Nursing Diagnosis: Skin Integrity Impaired or Tissue Integrity Impaired**



**3. Moist, ≤ 25% Necrotic Tissue**



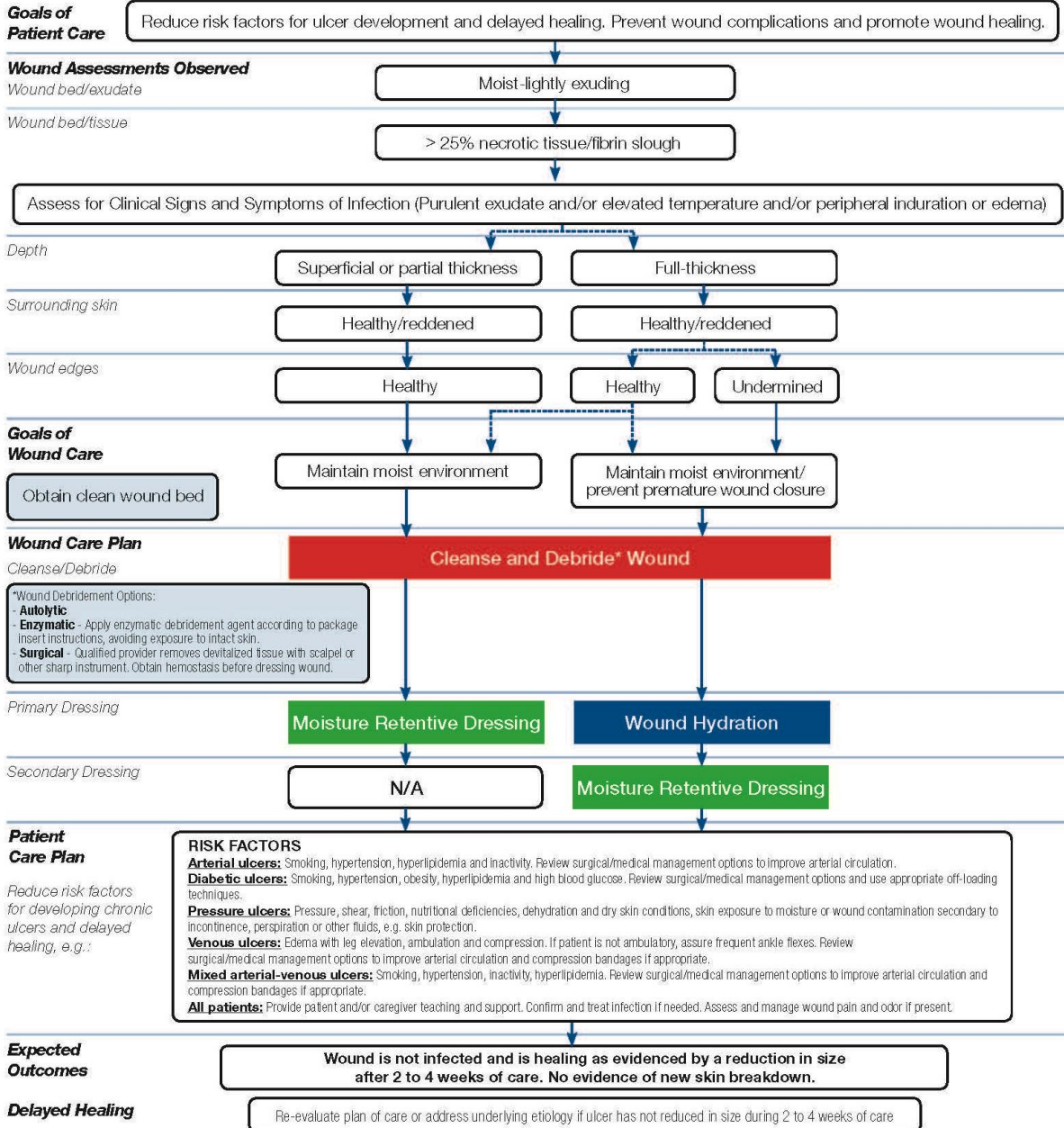
**Medical Diagnosis: Acute or Chronic Wound**  
**Nursing Diagnosis: Skin Integrity Impaired or Tissue Integrity Impaired**



4. Moist, > 25% Necrotic Tissue



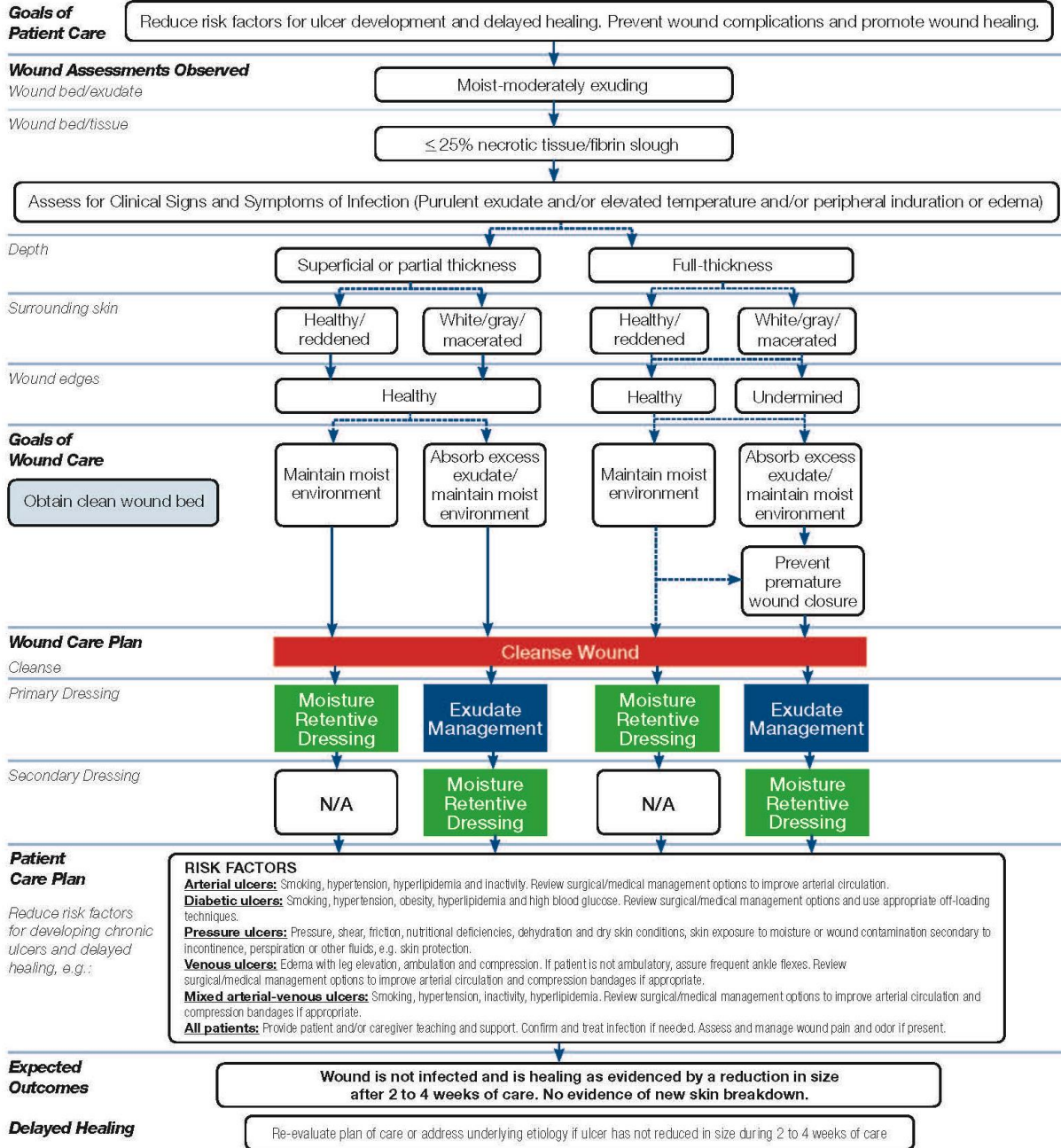
**Medical Diagnosis: Acute or Chronic Wound**  
**Nursing Diagnosis: Skin Integrity Impaired or Tissue Integrity Impaired**



**5.** Moist, ≤ 25% Necrotic Tissue



**Medical Diagnosis: Acute or Chronic Wound**  
**Nursing Diagnosis: Skin Integrity Impaired or Tissue Integrity Impaired**

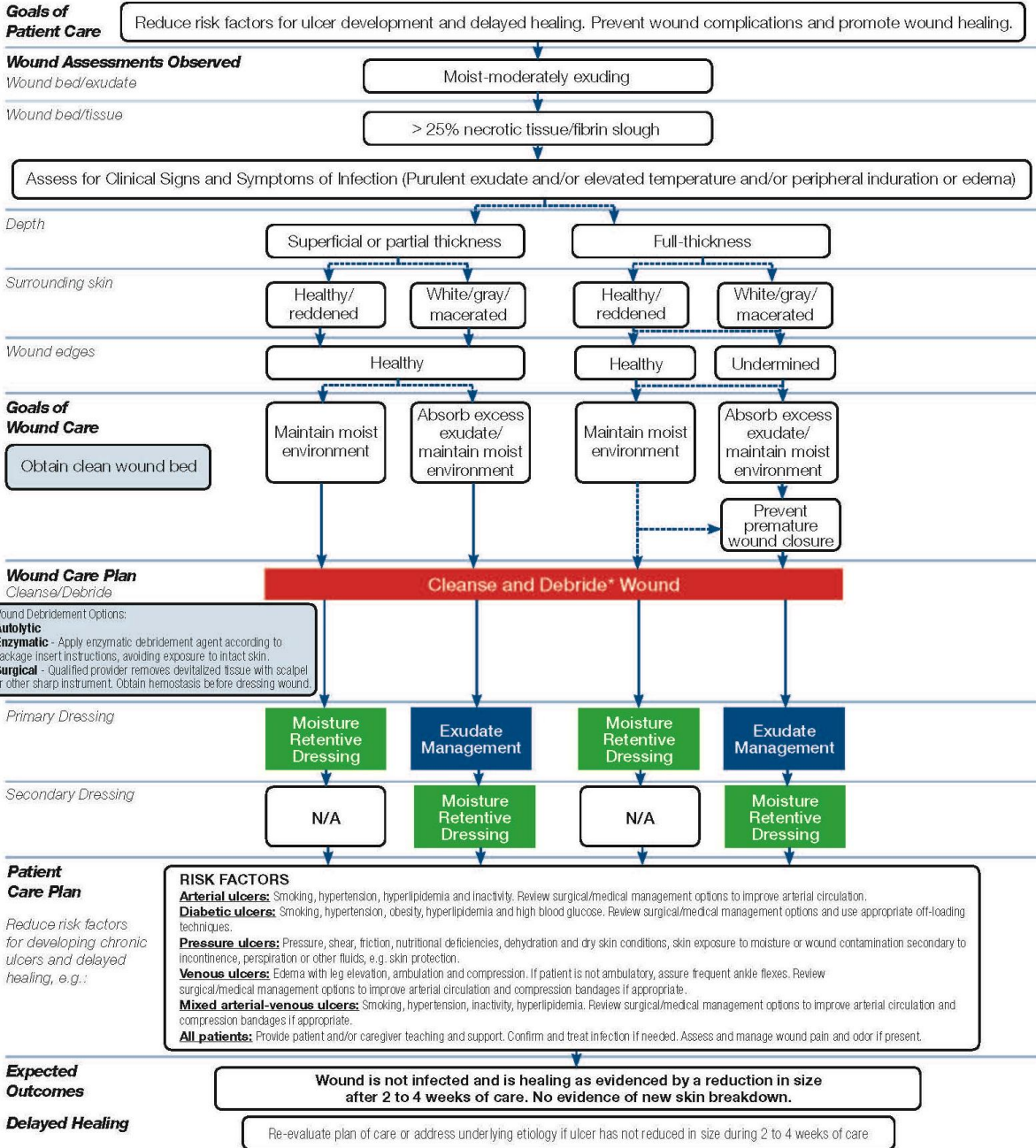


**6.** Moist, > 25% Necrotic Tissue



**Medical Diagnosis: Acute or Chronic Wound**

**Nursing Diagnosis: Skin Integrity Impaired or Tissue Integrity Impaired**

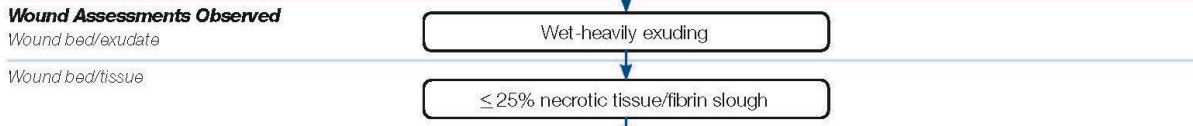


**7.** Wet, ≤ 25% Necrotic Tissue

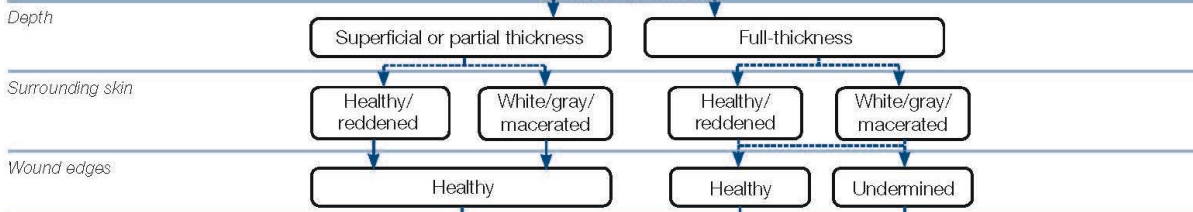


**Medical Diagnosis: Acute or Chronic Wound**  
**Nursing Diagnosis: Skin Integrity Impaired or Tissue Integrity Impaired**

**Goals of Patient Care** Reduce risk factors for ulcer development and delayed healing. Prevent wound complications and promote wound healing.



Assess for Clinical Signs and Symptoms of Infection (Purulent exudate and/or elevated temperature and/or peripheral induration or edema)



**Goals of Wound Care**

Obtain clean wound bed

Absorb excess exudate/maintain moist environment

Absorb excess exudate/maintain moist environment

Prevent premature wound closure

**Wound Care Plan**

Cleanse Wound

Exudate Management

Moisture Retentive Dressing

**Patient Care Plan**

Reduce risk factors for developing chronic ulcers and delayed healing, e.g.:

**RISK FACTORS**

**Arterial ulcers:** Smoking, hypertension, hyperlipidemia and inactivity. Review surgical/medical management options to improve arterial circulation.

**Diabetic ulcers:** Smoking, hypertension, obesity, hyperlipidemia and high blood glucose. Review surgical/medical management options and use appropriate off-loading techniques.

**Pressure ulcers:** Pressure, shear, friction, nutritional deficiencies, dehydration and dry skin conditions; skin exposure to moisture or wound contamination secondary to incontinence, perspiration or other fluids, e.g. skin protection.

**Venous ulcers:** Edema with leg elevation, ambulation and compression. If patient is not ambulatory, assure frequent ankle flexes. Review surgical/medical management options to improve arterial circulation and compression bandages if appropriate.

**Mixed arterial-venous ulcers:** Smoking, hypertension, inactivity, hyperlipidemia. Review surgical/medical management options to improve arterial circulation and compression bandages if appropriate.

**All patients:** Provide patient and/or caregiver teaching and support. Confirm and treat infection if needed. Assess and manage wound pain and odor if present.

**Expected Outcomes**

Wound is not infected and is healing as evidenced by a reduction in size after 2 to 4 weeks of care. No evidence of new skin breakdown.

**Delayed Healing**

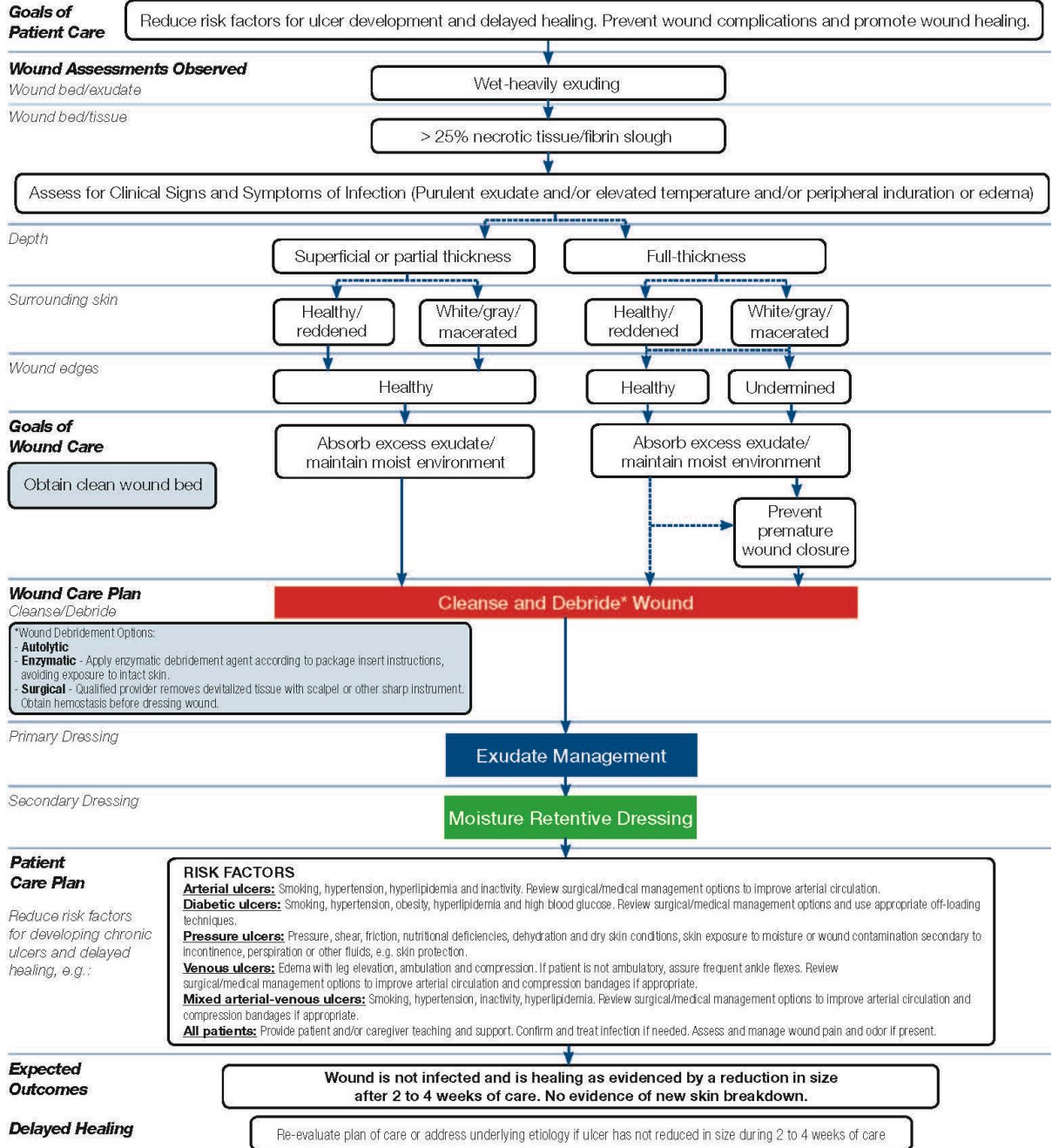
Re-evaluate plan of care or address underlying etiology if ulcer has not reduced in size during 2 to 4 weeks of care

**8.** Wet, > 25% Necrotic Tissue



**Medical Diagnosis: Acute or Chronic Wound**

**Nursing Diagnosis: Skin Integrity Impaired or Tissue Integrity Impaired**



## Appendix D

**BATES-JENSEN WOUND ASSESSMENT TOOL****Instructions for use**General Guidelines:

Fill out the attached rating sheet to assess a wound's status after reading the definitions and methods of assessment described below. Evaluate once a week and whenever a change occurs in the wound. Rate according to each item by picking the response that best describes the wound and entering that score in the item score column for the appropriate date. When you have rated the wound on all items, determine the total score by adding together the 13-item scores. The HIGHER the total score, the more severe the wound status. Plot total score on the Wound Status Continuum to determine progress.

Specific Instructions:

1. **Size:** Use ruler to measure the longest and widest aspect of the wound surface in centimeters; multiply length x width.
  
2. **Depth:** Pick the depth, thickness, most appropriate to the wound using these additional descriptions:
  - 1 = tissues damaged but no break in skin surface.
  - 2 = superficial, abrasion, blister or shallow crater. Even with, &/or elevated above skin surface (e.g., hyperplasia).
  - 3 = deep crater with or without undermining of adjacent tissue.
  - 4 = visualization of tissue layers not possible due to necrosis.
  - 5 = supporting structures include tendon, joint capsule.
  
3. **Edges:** Use this guide:
 

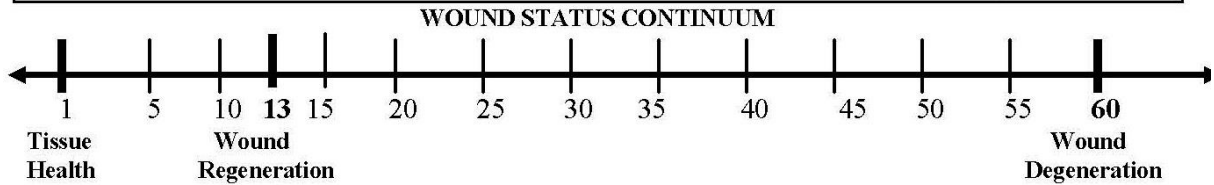
Indistinct, diffuse	=	unable to clearly distinguish wound outline.
Attached	=	even or flush with wound base, <u>no</u> sides or walls present; flat.
Not attached	=	sides or walls <u>are</u> present; floor or base of wound is deeper than edge.
Rolled under, thickened	=	soft to firm and flexible to touch.
Hyperkeratosis	=	callous-like tissue formation around wound & at edges.
Fibrotic, scarred	=	hard, rigid to touch.
  
4. **Undermining:** Assess by inserting a cotton tipped applicator under the wound edge; advance it as far as it will go without using undue force; raise the tip of the applicator so it may be seen or felt on the surface of the skin; mark the surface with a pen; measure the distance from the mark on the skin to the edge of the wound. Continue process around the wound. Then use a transparent metric measuring guide with concentric circles divided into 4 (25%) pie-shaped quadrants to help determine percent of wound involved.
  
5. **Necrotic Tissue Type:** Pick the type of necrotic tissue that is predominant in the wound according to color, consistency and adherence using this guide:
 

White/gray non-viable tissue	=	may appear prior to wound opening; skin surface is white or gray.
Non-adherent, yellow slough	=	thin, mucinous substance; scattered throughout wound bed; easily separated from wound tissue.
Loosely adherent, yellow slough	=	thick, stringy, clumps of debris; attached to wound tissue.
Adherent, soft, black eschar	=	soggy tissue; strongly attached to tissue in center or base of wound.
Firmly adherent, hard/black eschar	=	firm, crusty tissue; strongly attached to wound base <u>and</u> edges (like a hard scab).



6. **Necrotic Tissue Amount:** Use a transparent metric measuring guide with concentric circles divided into 4 (25%) pie-shaped quadrants to help determine percent of wound involved.
7. **Exudate Type:** Some dressings interact with wound drainage to produce a gel or trap liquid. Before assessing exudate type, gently cleanse wound with normal saline or water. Pick the exudate type that is predominant in the wound according to color and consistency, using this guide:
- |                 |   |   |
|-----------------|---|---|
| Bloody          | = | thin, bright red                                  |
| Serosanguineous | = | thin, watery pale red to pink                     |
| Serous          | = | thin, watery, clear                               |
| Purulent        | = | thin or thick, opaque tan to yellow               |
| Foul purulent   | = | thick, opaque yellow to green with offensive odor |
8. **Exudate Amount:** Use a transparent metric measuring guide with concentric circles divided into 4 (25%) pie-shaped quadrants to determine percent of dressing involved with exudate. Use this guide:
- |          |   |  |
|----------|---|--|
| None     | = | wound tissues dry.   |
| Scant    | = | wound tissues moist; no measurable exudate.  |
| Small    | = | wound tissues wet; moisture evenly distributed in wound; drainage involves $\leq 25\%$ dressing.   |
| Moderate | = | wound tissues saturated; drainage may or may not be evenly distributed in wound; drainage involves $> 25\%$ to $\leq 75\%$ dressing.             |
| Large    | = | wound tissues bathed in fluid; drainage freely expressed; may or may not be evenly distributed in wound; drainage involves $> 75\%$ of dressing. |
9. **Skin Color Surrounding Wound:** Assess tissues within 4cm of wound edge. Dark-skinned persons show the colors "bright red" and "dark red" as a deepening of normal ethnic skin color or a purple hue. As healing occurs in dark-skinned persons, the new skin is pink and may never darken.
10. **Peripheral Tissue Edema & Induration:** Assess tissues within 4cm of wound edge. Non-pitting edema appears as skin that is shiny and taut. Identify pitting edema by firmly pressing a finger down into the tissues and waiting for 5 seconds, on release of pressure, tissues fail to resume previous position and an indentation appears. Induration is abnormal firmness of tissues with margins. Assess by gently pinching the tissues. Induration results in an inability to pinch the tissues. Use a transparent metric measuring guide to determine how far edema or induration extends beyond wound.
11. **Granulation Tissue:** Granulation tissue is the growth of small blood vessels and connective tissue to fill in full thickness wounds. Tissue is healthy when bright, beefy red, shiny and granular with a velvety appearance. Poor vascular supply appears as pale pink or blanched to dull, dusky red color.
12. **Epithelialization:** Epithelialization is the process of epidermal resurfacing and appears as pink or red skin. In partial thickness wounds it can occur throughout the wound bed as well as from the wound edges. In full thickness wounds it occurs from the edges only. Use a transparent metric measuring guide with concentric circles divided into 4 (25%) pie-shaped quadrants to help determine percent of wound involved and to measure the distance the epithelial tissue extends into the wound.

Item	Assessment	Date Score	Date Score	Date Score
	2 = Bloody 3 = Serosanguineous: thin, watery, pale red/pink 4 = Serous: thin, watery, clear 5 = Purulent: thin or thick, opaque, tan/yellow, with or without odor			
<b>8. Exudate Amount</b>	1 = None, dry wound 2 = Scant, wound moist but no observable exudate 3 = Small 4 = Moderate 5 = Large			
<b>9. Skin Color Surrounding Wound</b>	1 = Pink or normal for ethnic group 2 = Bright red &/or blanches to touch 3 = White or grey pallor or hypopigmented 4 = Dark red or purple &/or non-blanchable 5 = Black or hyperpigmented			
<b>10. Peripheral Tissue Edema</b>	1 = No swelling or edema 2 = Non-pitting edema extends <4 cm around wound 3 = Non-pitting edema extends ≥4 cm around wound 4 = Pitting edema extends <4 cm around wound 5 = Crepitus and/or pitting edema extends ≥4 cm around wound			
<b>11. Peripheral Tissue Induration</b>	1 = None present 2 = Induration, <2 cm around wound 3 = Induration 2-4 cm extending <50% around wound 4 = Induration 2-4 cm extending ≥50% around wound 5 = Induration >4 cm in any area around wound			
<b>12. Granulation Tissue</b>	1 = Skin intact or partial thickness wound 2 = Bright, beefy red; 75% to 100% of wound filled &/or tissue overgrowth 3 = Bright, beefy red; <75% & >25% of wound filled 4 = Pink, &/or dull, dusky red &/or fills ≤25% of wound 5 = No granulation tissue present			
<b>13. Epithelialization</b>	1 = 100% wound covered, surface intact 2 = 75% to <100% wound covered &/or epithelial tissue extends >0.5cm into wound bed 3 = 50% to <75% wound covered &/or epithelial tissue extends to <0.5cm into wound bed 4 = 25% to <50% wound covered 5 = <25% wound covered			
<b>TOTAL SCORE</b>				
<b>SIGNATURE</b>				



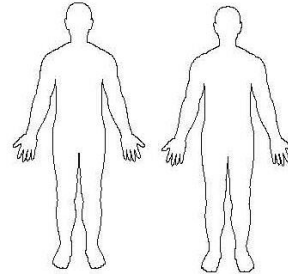
Plot the total score on the Wound Status Continuum by putting an "X" on the line and the date beneath the line. Plot multiple scores with their dates to see-at-a-glance regeneration or degeneration of the wound.

**BATES-JENSEN WOUND ASSESSMENT TOOL** NAME \_\_\_\_\_

Complete the rating sheet to assess wound status. Evaluate each item by picking the response that best describes the wound and entering the score in the item score column for the appropriate date.

**Location:** Anatomic site. Circle, identify right (**R**) or left (**L**) and use "X" to mark site on body diagrams:

- \_\_\_ Sacrum & coccyx                      \_\_\_ Lateral ankle
- \_\_\_ Trochanter                                \_\_\_ Medial ankle
- \_\_\_ Ischial tuberosity                      \_\_\_ Heel                      Other Site



**Shape:** Overall wound pattern; assess by observing perimeter and depth.

Circle and date appropriate description:

- \_\_\_ Irregular                      \_\_\_ Linear or elongated
- \_\_\_ Round/oval                      \_\_\_ Bowl/boat
- \_\_\_ Square/rectangle                      \_\_\_ Butterfly                      Other Shape

Item	Assessment	Date Score	Date Score	Date Score
<b>1. Size</b>	1 = Length x width <4 sq cm 2 = Length x width 4--<16 sq cm 3 = Length x width 16.1--<36 sq cm 4 = Length x width 36.1--<80 sq cm 5 = Length x width >80 sq cm			
<b>2. Depth</b>	1 = Non-blanchable erythema on intact skin 2 = Partial thickness skin loss involving epidermis &/or dermis 3 = Full thickness skin loss involving damage or necrosis of subcutaneous tissue; may extend down to but not through underlying fascia; &/or mixed partial & full thickness &/or tissue layers obscured by granulation tissue 4 = Obscured by necrosis 5 = Full thickness skin loss with extensive destruction, tissue necrosis or damage to muscle, bone or supporting structures			
<b>3. Edges</b>	1 = Indistinct, diffuse, none clearly visible 2 = Distinct, outline clearly visible, attached, even with wound base 3 = Well-defined, not attached to wound base 4 = Well-defined, not attached to base, rolled under, thickened 5 = Well-defined, fibrotic, scarred or hyperkeratotic			
<b>4. Undermining</b>	1 = None present 2 = Undermining < 2 cm in any area 3 = Undermining 2-4 cm involving < 50% wound margins 4 = Undermining 2-4 cm involving > 50% wound margins 5 = Undermining > 4 cm or Tunneling in any area			
<b>5. Necrotic Tissue Type</b>	1 = None visible 2 = White/grey non-viable tissue &/or non-adherent yellow slough 3 = Loosely adherent yellow slough 4 = Adherent, soft, black eschar 5 = Firmly adherent, hard, black eschar			
<b>6. Necrotic Tissue Amount</b>	1 = None visible 2 = < 25% of wound bed covered 3 = 25% to 50% of wound covered 4 = > 50% and < 75% of wound covered 5 = 75% to 100% of wound covered			
<b>7. Exudate Type</b>	1 = None			

## Appendix E

**Advanced Wound Dressings (Murphy & Evans, 2012)**

<b>Protective dressings</b>	<b>Notes</b>
Gauze	Inexpensive; readily available
Impregnated gauze	Nonadherent; preserves moisture
Antimicrobial dressings	
Antibacterial ointments	Reapply often to maintain moisture
Iodine based	Absorbent; not for use with thyroid disorders
Silver based	Many forms; broad spectrum; low resistance
Autolytic debridement	
Films	
Occlusive	Occlusive; allows exchange of gasses
Hydrocolloids	Not for exudative or infected wounds
Hydrogels	Rehydrates to soften dry wounds
Chemical debridement	
Papain/urea	Availability issues in U.S.
Collagenase	Selective debridement
Absorbent dressings	
Foam	Absorbs moderate exudate
Hydrogels	Absorbs minimal exudate
Hydrofibers	Absorbs heavy exudate
Alginates	Absorbs heavy exudate

## Appendix F

**Wound Vacuum Therapy (KCI Licensing, 2013)**

<b>Wound Healing Barrier</b>	<b>VAC Therapy Mechanism</b>
Excess bacterial burden	Removes infectious materials
Inadequate protection against infection	Provides protected wound healing environment
Excess exudate	Removes exudate
Excess edema (interstitial fluid)	Reduces edema (interstitial fluid)
Absence of moisture	Provides a moist wound healing environment
Lack of adequate blood flow	Provides a moist wound healing environment
Lack of adequate blood flow	Promotes perfusion