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Itch occurring with chronic wounds

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ITCH OCCURRING WITH CHRONIC WOUNDS

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DEDICATION

I dedicate this dissertation to Dr. Barbara Pieper, my advisor, my mentor, my "General." She believed in the value of my topic from the start, endured my frustrations, tolerated my distractions, found opportunities and resources at every turn, and kept me marching forward through a number of personal disasters that could have brought this study to a premature end. I have been so honored and so blessed to learn from such an accomplished nurse researcher, excellent wound care nurse practitioner, and amazing human being. I will forever thank you, Dr. Pieper.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

Introduction

Description of the Problem

Itch is an irritation of the skin, which can be as distressing as pain. Itch is as familiar as the wind and just as difficult to capture. There is no established treatment protocol for itch; and, even after nearly a century of investigation, "many mysteries, misconceptions, and controversies still haunt this rather neglected yet clinically important" sensation (Paus, Schmelz, Biro, & Steinhoff, 2006, p. 1174). Itch associated with wounds is recognized clinically, but is not described in the literature related to wounds commonly encountered in wound care practices. Patients seek measures to prevent, minimize, or eradicate itch related to wounds. Patients, who are nonverbal and cannot otherwise indicate the sensation of itch, are found scratching at open wounds. While measures are usually taken to treat pain associated with wounds, complaints of itch are frequently ignored. Few studies were found related to itch occurring with wounds commonly treated in wound care centers. Wounds commonly followed in wound care centers include vascular, neuropathic, traumatic, pressure-related, and wounds of mixed etiology. Patients frequently complain that their wounds itch, yet the frequency of wound itch is not known. Characteristics of wounds that itch, measures taken by persons with wounds to manage itch, and the effect that wound itch has on quality of life are not known.

Study Purpose

The purpose of this study was to examine itch associated with chronic wounds. Chronic wounds commonly followed in wound care practice include vascular (arterial and venous), neuropathic, traumatic, pressure-related, and wounds of mixed etiology. That these wounds are considered "chronic" wounds should not necessarily indicate lengthy duration. Wounds

commonly followed in wound care centers are considered chronic in that they "have failed to proceed through an orderly and timely process to produce anatomic and functional integrity, or proceeded through a repair process without sustaining an anatomic and functional result" as indicated by Lazarus and colleagues (1994, p. 490). For this study, persons with chronic wounds were interviewed about their experiences with wound itch and measures they had taken to relieve itching. Wound itch intensity, location, duration, and aggravating and alleviating factors were explored. Sensation in the area of the wound and wound characteristics were also assessed.

Rationale for the Study

Since itch is a clinical concern, motivation to learn more about wound itch comes from encounters with persons who are experiencing wound-associated itch. Persons with wound that itch describe their suffering and distress. Darsow and colleagues (2001) reported descriptors of itch chosen by 108 patients with atopic eczema ranged from *unpleasant* to *awful*. Itch can be so disturbing that the person with a wound succumbs to scratching, which can cause further wound and peri-wound deterioration. Since wound care practice emphasizes healing, prevention of wound deterioration is crucial.

This study was innovative in that it explored the phenomenon of wound itch, which is documented clinically, but is not described in the literature. Itch is a multifactorial problem involving the skin, nervous system, endocrine system, and immune system (Guarneri, Terranova, Terranova, & Guarneri, 2005). A greater understanding of itch must be gained before options for therapy can be determined. Nurses need to work collaboratively with other health care providers to manage the problem of wound itch.

Recent physiologic developments in itch research make this study timely. Andrew and Craig (2001) documented histamine-selective spinothalamic tract neurons specific for itch

sensation. They identified itch as a sensation distinct from pain. While pain and itch have many similarities, especially in intensity of resulting distress, they are, in fact, separate phenomena. Sun and Chen (2007) published information on an itch-specific mediator, gastrin-releasing peptide. Additionally, recent advances in neuroimaging techniques have enabled observation of centers of brain activity in response to induction of pruritus (Herde, Forster, Strumpf, & Handwerker, 2007; Yosipovitch, Greaves, & Schmelz, 2003). Yet, many questions about wound itch remain.

Significance to Nursing Theory. Levine's Conservation Model provides a theoretical basis for nurses to address the problem of wound itch to conserve the integrity of persons in their care. Levine contends: "It is the moral duty of the nurse to confront the suffering individual and bring all the skills of hand, heart, and mind to alleviate it," (Levine, 1989a, p. 126). Levine identified the need for nurses to work collaboratively with medicine and other disciplines to recognize and manage such a mysterious problem as wound itch. This study advances nursing science by providing an understanding of itch in chronic wounds so that itch might be assessed and treated to promote healing.

Significance to Nursing and Society. Chronic wounds affect 0.78 % of the population, with most of those affected being over 60 years of age (Hartoch, McManus, Knapp, & Buettner, 2007). The percentage of adults with chronic wounds is likely to increase with the aging of society; thus, the number of persons experiencing wound itch may also increase. Function, psychological state, social interaction, somatic sensation, and financial stability are impacted by a wound (Baharestani, 2008). Assessment of wound itch and identification of effective treatment and preventative strategies should improve quality of life for patients with chronic wounds. In addition, wound care may be less costly as trauma from scratching existing wounds and

development of new wounds due to scratching can be prevented.

Specific Aims

The specific aims of the study were to: (a) determine the frequency, timing, duration and intensity of wound itch as experienced by persons with chronic wounds, (b) determine which wound characteristics (including location, size, depth, type, color) were associated with itch, (c) identify measures used by persons with chronic wounds to prevent, minimize, or eradicate itch, (d) describe how wound itch impacts quality of life for persons with chronic wounds, and (e) distinguish between wound itch and pain.

Research Questions

The research questions answered by this study were: (a) What is the frequency, timing, duration and intensity of itch related to chronic wounds? (b) What is the relationship between wound characteristics and itch? (c) What measures do persons with wound itch use to manage wound itch? (d) How does wound itch affect quality of life for the participants? (e) What is the relationship between wound itch and pain?

Variable Definitions

Wound. A *wound* is defined as "a disruption of the integrity and function of tissues in the body" (Baharestani, 2008, p.3). Chronic wounds include vascular (arterial and venous), neuropathic, traumatic, and pressure-related wounds as well as wounds of mixed and other etiologies as may be found among people seeking treatment at wound care centers. An arterial wound results from tissue ischemia due to inadequate blood supply and typically presents as a painful, pale wound with well-defined wound edges (Doughty & Holbrook, 2007). A venous wound results from chronic venous insufficiency and typically presents as a ruddy wound with irregular wound edges (Doughty & Holbrook, 2007). Neuropathic wounds are often found on

feet of persons with diabetes mellitus and are often surrounded with callus (Driver, Landowski, & Madsen, 2007). A traumatic wound results from a traumatic event which causes injury to the skin and, possibly, deeper tissues and underlying structures. A pressure-related wound results from sustained pressure to an area to such a degree or length of time that injury to underlying skin occurs (Pieper, 2007). Pressure-related wounds of interest include those classified as Stage II through Stage IV (NPUAP, 2007). Stage II ulcers involve partial-thickness loss of dermis which presents as a shiny or dry shallow ulcer. Stage III ulcers involve full-thickness tissue loss without visible muscle, tendon, or bone. Stage IV ulcers involve full-thickness skin loss with exposed bone, tendon or muscle. Stage I pressure ulcers do not involve any open wounds in the skin and, so, are not included. Other types of wounds are burns (tissue trauma due to thermal injury), fungating wounds as develop with malignancies, and wounds with mixed etiology (as with concomitant arterial and venous disease). Extensive burns are usually not followed at wound care clinics as persons with extensive burns are typically referred to a burn center. Wounds are described by many defining characteristics including location, size (length, width, and depth), peri-wound descriptors (color, integrity, temperature, and texture), color, odor, moisture, drainage, base material (e.g., granulation tissue, eschar, slough, subcutaneous tissue, muscle, bone, and tendon). As previously described, wounds commonly followed in wound care practices are considered chronic in that they do not follow the normal and timely process of healing to return to a normal anatomic and functional result (Lazarus et al., 1994). This definition of chronic wounds has been accepted by the Wound Healing Society (Gottrup, Nix & Bryant, 2007). Acute wounds, such as surgical wounds which heal in an orderly and timely manner, are not typically followed in wound care practices.

Itch. More than 340 years ago a German physician, Samuel Hafenreffer, defined itch as

an unpleasant sensation that elicits the desire to scratch (Ikoma, Steinhoff, Stander, Yosipovitch, & Schmelz, 2006). Although the adjective "unpleasant" is very subjective, the definition has persisted. Greaves and Khalifa (2004) further clarified that itch is: "a complex, multidimensional experience involving a range of different qualities of sensation, such as pleasurable relief by local physical intervention, which leads to itch/scratch cycles and modulation by cognitive and psychological functions from higher centers" (p. 166). *Itch* can be defined as "1) an irritation of the skin, 2) an impatient desire: a hankering" (Hawkins & Allen, 1991, p. 755). *Stedman's Medical Dictionary* defines itch as "an irritating sensation in the skin that arouses the desire to scratch" (2006, p. 1008). Some distinctions have been made between *itch* and *pruritus*. Waxler and colleagues (2005) specify that pruritus is a condition in which itch is present without a specific cause. Often *pruritus* is used to indicate itch without visible skin lesions; however, arguments can be made for itchy conditions in which rubbing enables tolerance without visible skin lesions (Bernhard, 1994). *Itch* and *pruritus* are synonymous (Bernhard, 1994). Throughout this paper the two terms are used interchangeably. Itch is generally a sensation of the skin, but in this study, itch was related to wounds, which were often through the skin and deeper than the skin. *Wound itch*, then, is the irritating sensation or disturbing feeling related to an open wound, including the wound bed and the skin immediately surrounding the open wound. *Wound itch* is synonymous to *wound-related itch*. While wound itch might be impacted by systemic conditions which cause itch, steps were taken to distinguish wound itch from itch due to other causes.

Quality of Life. Weldon (2006) defined health-related *quality of life* as a person's assessment of current level of functioning and/or satisfaction with state of being as well as what the person perceives as ideal. Quality of life is a subjective phenomenon which encompasses

physical as well as psychological well-being. Aspects of quality of life which can be impacted by wound-related itch include physical/occupational functioning, psychological state, social interaction, somatic sensation, and financial stability (Baharestani, 2008). While chronic wounds impact quality of life, itch related to wounds may further impact quality of life.

Summary

Itch related to chronic wounds has not been described well in the literature. The purpose of this study was to explore wound itch to add to the current understanding of itch so that, ultimately, therapies can be developed to manage wound itch. Management of wound itch would promote wound healing for improved quality of life for persons with chronic wounds and cost saving related to wound care.

CHAPTER II

Background

In this chapter, a summary of what is known about itch, especially as it occurs with wounds, is presented as a background for the study. Topics include itch classification, physiology of itch, neuronal pathways, pathophysiological causes of itch, pruritogens, antipruritics, effects of itch on quality of life, and measurement of wound itch.

Review of Literature

Classification of Itch

The classification of itch based on duration or source has proven to be inadequate. Acute itch can last from seconds to a week (Yosipovitch & Greaves, 2004). Chronic itch is generally considered that itch which lasts longer than six weeks (Stander et al., 2007). Twycross and colleagues (2003) proposed a classification system for itch based on underlying mechanism; this has been used successfully. In this classification system, itch can be pruritoceptive (peripheral, cutaneous, dermatological), neurogenic (central, caused by systemic disorders), neuropathic (from diseased neurons as in multiple sclerosis), psychogenic (mind-related, as with parasitosis), and mixed (with overlapping causes). Pathophysiological conditions can trigger multiple types of itch.

Pruritoceptive itch. Pruritus classified as pruritoceptive (also referred to as cutaneous, dermatological, or peripheral) includes the itch of atopic dermatitis, psoriasis, drug reactions, mites, urticaria, xerosis, and other inflammatory dermatoses (Ikoma et al., 2006). This study of itch associated with wounds was concerned with pruritoceptive itch.

Neurogenic itch. Neurogenic itch is associated with systemic conditions, including chronic liver disease and chronic renal failure (Ikoma et al., 2006). With chronic liver disease,

the accumulation of bile salts has been studied as a cause of pruritus, but a central mechanism of endogenous opioid peptides produced by the liver has been proposed as the likely cause of pruritus (Greaves, 2005; Twycross et al., 2003). The cause of itch with renal failure remains unknown (Greaves, 2005). Pruritus with uremia (chronic renal failure) is not as severe when a more permeable dialysis membrane is used suggesting that a less permeable membrane causes an accumulation of pruritogens (Twycross et al., 2003). A multitude of underlying factors with uremia have been considered. The excessive skin dryness found with end-stage renal disease is usually part of the itch problem. Human immunodeficiency virus (HIV) often results in itch via multiple etiologies. Itch in HIV is likely related to disruption of normal immune function resulting in systemic and cutaneous causes (Duque, Yosipovitch, & Pegram, 2004). Many malignant and hematologic conditions present with pruritus (e.g., polycythemia vera, leukemia, multiple myeloma, and Hodgkin's lymphoma) (Greaves, 2005; Twycross et al., 2003). Generalized pruritus can precede the onset of Hodgkin's disease by up to five years (Weisshaar, Kucenic, & Fleischer, 2003). Nasal pruritus is an indicator of brain malignancy (Weisshaar et al., 2003; Yosipovitch, Goodkin, Wingard, & Bernhard, 2004). Hyper- and hypothyroidism often induce itch; dry skin is usually the problem in hypothyroidism (Greaves, 2005).

Neuropathic itch. The third type of pruritus, neuropathic pruritus, results from pathology along the afferent neuronal pathway as with post-herpetic pruritus, multiple sclerosis, and diabetic neuropathy (Ikoma et al., 2006). In these conditions, the neural pathways are affected by the disease process, and the result is the sensation of itch.

Psychogenic itch. Psychogenic itch is associated with psychological factors. Mind-related influence on the itch sensation is demonstrated in the fact that with distraction itch can be forgotten; with training, itch can be suppressed (Twycross et al., 2003). That itch is socially

contagious (similar to yawning) points to central rather than peripheral mechanisms.

Itch of mixed etiology. Itch may be classified as having mixed etiology when multiple factors may be causing it. For example, itch associated with eczema might be considered mixed in that it involves an auto-immune pathological process (as with neurogenic itch) and is exacerbated by stress (as with psychogenic itch).

Physiology of Itch

Until 1997, the sensation of itch was thought to follow the same pathways that painful stimuli followed, but with a less intense stimulus eliciting itch rather than pain. Subsequently, itch-selective neurons were found in humans (Stander & Schmelz, 2006). Itch can be inhibited by painful stimuli such as thermal (hot water), mechanical (scratching), or chemical (histamine) means. Analgesia (by reducing inhibition) may actually cause itch (Stander & Schmelz, 2006; Waxler et al., 2005). Slow-conducting C-fibers which originate in the skin (a subclass of C-nociceptors for pain) pass sensory information to the dorsal horn of the spinal cord and, via the spinothalamic tract, on to the thalamus in the somatosensory cortex (Heymann, 2006; Paus et al., 2006; Twycross et al., 2003; Waxler et al., 2005). The slow-conducting C-fibers (pruriceptors) account for approximately five percent of all afferent C-fibers in human skin (Heymann, 2006). These itch-sensing C-fibers are similar to, but functionally distinct from, pain fibers. The C-fibers are responsive to histamine and other pruritogens, but are insensitive to mechanical stimuli (Heymann, 2006). Pruritogens that are likely present in open wounds include histamine, which is released from granulation tissue and growth factors (Baker et al., 2001; Stander et al., 2003; Twycross et al., 2003). (These pruritogens will be discussed later in the paper.) When free nerve endings of the specialized C-fibers are stimulated by pruritogens, itch is induced.

Genetic Aspects of Itch

Sun and Chen (2007) examined thermal, mechanical, inflammatory, and neuropathic pain responses in gastrin-releasing peptide receptor (GRPR) mutant mice and found that there was no difference in response when compared to responses of unaltered wild mice to noxious stimuli. Scratching behavior was induced with injection of compound 48/80 (a mast cell degranulator), a PAR-2 agonist (a mediator of itch in human skin), and chloroquine into both groups of mice. PAR-2 and chloroquine are believed to act independently of histamine, and the reduction in scratching behavior was much more apparent with PAR-2 agonist ($p < .05$) and chloroquine ($p < .01$) than with compound 48/80. The number of scratches was significantly less in the GRPR mutant mice in response to injection of known pruritogens. Those differences were not found with pain-inducing agents. Intrathecal injection of GRPR agonist induced dose-dependent scratching behavior. Swain (2008) noted that gastrin-releasing peptide (GRP) participated in transmission of the itch sensation but not in the pain sensation. GRP was found in a small subset of dorsal root ganglion neurons with expression of its receptor restricted to lamina I of the dorsal spinal cord, consistent with the current model of itch sensation central processing.

Gastrin-releasing peptide (GRP) and GRPR are found throughout the central nervous system and gastrointestinal tract (Ischia, Patel, Shulkes, & Baldwin, 2009). GRP is a neuropeptide. The gene for GRP is located on chromosome 18. GRP and its receptor are involved in many physiological functions including exocrine and endocrine secretions, regulation of body temperature, maintenance of blood pressure, smooth muscle contraction, exocrine and endocrine secretions, pain transmission, satiety, and behavior (Ischia et al., 2009). Precursors of GRP have been found to function as biomarkers for small-cell lung cancer and prostate cancer.

Neuronal Pathways for Itch

Sensory receptors in the skin include free and corpuscular nerve endings. Corpuscular endings include both nonencapsulated Merkel's touch spots and encapsulated receptors (Metze, 2004). It has not yet been possible to morphologically differentiate nociceptors from pruriceptors (Schmelz, 2005). Neurophysiologic techniques for identifying specific sensory activity within individual terminal axons are not yet refined, so there is still speculation about specific sensory functions of nerve endings. The free nerve endings of unmyelinated C-fibers and small myelinated A-fibers are the sensory fibers in humans. These free nerve endings are found in the papillary dermis and epidermis (Stander et al., 2003). Interestingly, itch is not inducible where epidermis has been removed (Metze, 2004), so itch sensed within wounds is difficult to explain. Itch is specific to the skin, mucus membranes, and cornea (Yosipovitch & Papoiu, 2008).

In a breakthrough study, Schmelz and colleagues (1997) reported iontophoresis with histamine induces itch sensation. The study involved 53 healthy (human) volunteers. Iontophoresis was accomplished by delivery of current through an electrode which was within an applicator. The applicator contained histamine dihydrochloride dissolved in a gel. The current went to a reference electrode on the skin. Microneurography (a method involving electrical search stimuli) showed discharge patterns matching the time course of itch. These discharge patterns for the itch sensation were found in eight neuronal units which had three distinguishing characteristics: mechanical insensitivity, slow conduction velocities (average 0.5 m/s), and large innervation territories. These neuronal units were determined to be the afferent units responsible for mediating the itch sensation. Burning pain, heat, and itch are transmitted through these C-fibers (Stander et al., 2003). However, it is not likely that all types of itch sensation are transmitted through these C-fibers. Johanek and colleagues (2007) were interested in itch

induction by pruritogens which did not produce the characteristic flare that accompanies histamine. They looked for differences in reactions to histamine versus cowhage spicules. Doppler results showed large areas of vasodilation around histamine versus vasodilation only at the site of cowage application. Topical capsaicin abolished cowhage-induced itch but had no effect on histamine-induced itch; while pre-treatment of skin with an antihistamine prevented itch at the site of histamine application, but did not prevent cowhage-induced itch. Their findings implicate a group of afferent fibers that are separate from the histamine-sensitive, mechano-insensitive C-fibers for itch sensation.

The primary neurons (histamine-sensitive and mechano-insensitive) synapse via dorsal root ganglia with second-order neurons in the dorsal horn of the spinal cord (Waxler et al., 2005). At the spinal level, spinothalamic projection neurons transmit pruriceptive information via neuronal pathways which are likely specific for itch (Stander et al., 2003). Unlike pain, itch does not provoke a spinal reflex (Stander et al., 2003). The secondary neurons cross over to join the contralateral spinothalamic tract and ascend to the thalamus where they synapse with third-order neurons for transmission to the somatosensory cortex of the post-central cingulate gyrus (Stander et al., 2003; Twycross et al., 2003; Waxler et al., 2005). Scratching is controlled by an area of the medulla (Stander et al., 2003; Yosipovitch & Papoiu, 2008).

Andrew and Craig (2001) used histamine on the lumbosacral spinal cords of 33 anesthetized cats to categorize neurons into functional categories. They were able to demonstrate a functionally unique subset of histamine-selective lamina I spinothalamic tract neurons in the cats which match the response of human neurons to the itch sensation. The matched response supports the notion of itch as a specific sensation. The conduction velocities of the histamine-sensitive neurons were significantly slower than the conduction velocities of the

other neurons, and their electrical thresholds were higher.

No single "itch center" in the brain has been identified (Darsow, Drzezga, & Ring, 2004). Positron emission tomography (PET) has enabled the study of supraspinal processing of itch (Yosipovitch, Greaves, & Schmelz, 2003). The multidimensionality of itch is indicated as multiple areas of the brain are activated when itch is induced. Drzezga and colleagues (2001) used PET scanning to study the central processing of histamine-induced itch. They noted significant activation of contralateral somatosensory cortex, as well as contralateral and ipsilateral motor areas, but no thalamic activation. Yosipovitch and colleagues (2003) saw that with histamine skin pricks, the anterior cingulate cortex, supplementary motor area and inferior parietal lobe are activated. That the limbic and motor areas are activated supports the clinical observation that itch elicits the desire to scratch. Findings of these studies show that thalamic and somatosensory cortex activation is not seen when itch is induced as it is when pain is induced.

Itch Versus Pain

Pain and itch are difficult phenomena to separate. Although subjects in the studies described in this review reportedly denied it, some pain was surely sensed as microdialysis catheters or skin pinpricks were performed for itch induction. Thalamic activation was noted in the fMRI studies (discussion following), in contrast to findings of the PET studies as discussed previously. Differences between pain and itch processing are likely not related to activation of different areas of the brain, but, rather, to activation of the same areas with different activation patterns as in the Pattern Theory (Paus et al., 2006).

Two forms of central sensitization associated with pruritus are similar to pain sensitization: *punctate hyperkinesis* and *allokinesis*. Punctate hyperkinesis is an intense itch

sensation that occurs in an area surrounding itch induction and is similar to punctate hyperalgesia as found with chronic pain (Yosipovitch & Papoiu, 2008). Allokinesis is a phenomenon of intensely itchy skin, which is induced by touching an area around an itching site, and is similar to allodynia in which contact with skin causes pain in chronic pain conditions.

Phantom itch is a phenomenon recognized with pain which may have implications for wound itch. Phantom pain is a well-recognized phenomenon, but phantom itch is not (Yosipovitch et al., 2004). Lierman (1988) interviewed 27 women in a Reach for Recovery program during their first year post-mastectomy to describe phantom sensations experienced post-mastectomy and to describe women's responses to the experience. Sixty percent of the women interviewed had phantom sensations, with the most common sensation being itch. Four of seven women who experienced nipple sensations experienced itch. Jacome (1978), in a case study, described a patient with bilateral below-knee amputations who was only able to relieve severe phantom itching in the area where his feet would have been by scratching in that area: scratching the stumps provided no relief. Melzak (1992) proposed a neuromatrix, a network of neurons, which generates a characteristic pattern of impulses to indicate that the body is intact with its belonging parts creating what he called a neurosignature. The neuromatrix might signal in the absence of sensory inputs to create the phantom sensations. Bernhard (1992) adds that the brain must rely upon the skin for sensory input as the skin determines the boundaries of the self. Phantom itch might occur even where the body is intact and may explain senile pruritus (the common problem of unexplained itching in the elderly).

Functional magnetic resonance imaging (fMRI) studies have shown involvement of forebrain regions with itch induction including Brodman areas 10, 21, 22, and 40 and the cerebellum (Yosipovitch et al., 2003). Herde, et al. (2007) used fMRI to correlate blood-oxygen-

level dependent (BOLD) effects with 10 subjects' ratings of itch as a histamine-codeine mix was applied through microdialysis fibers. Codeine was added to promote histamine release from endogenous mast cells. BOLD effects were compared in response to itch induction and heat pain. Itch stimulated more areas of activation than pain, particularly on the contralateral side of the brain. Negative BOLD effects were noted in the anterior cingulate cortex and amygdala, likely related to the urge to scratch.

Studies of scratching have added further to the understanding of pruritus. For study purposes, scratching has been imitated by repetitively moving a cytology brush over an area with enough force to bend the skin-facing brush bristles (equivalent to 29 g of force on a digital scale) (Yosipovitch et al., 2008). Yosipovitch and colleagues (2008) used fMRI on 13 healthy human subjects who received scratching stimuli to the right lower leg. They determined that scratching may mediate inhibition of itch by deactivating the anterior cingulate cortex and posterior cingulate cortex, providing relief by suppressing the emotional components of itch. The cerebellum has been associated with motor and sensory coordination, and activation of this area as was seen in the scratch study may result from its sensory coordination activities (Yosipovitch et al., 2008). Davidson and colleagues (2009) examined whether responses to histamine in primate (monkey) spinothalamic tract (STT) neurons could be inhibited by scratching in the receptive field. They found that scratching provides relief of itch by reduction in the discharge rate of STT neurons, which are responding to an itch-producing stimulus. Yosipovitch and colleagues (2007) had 21 healthy subjects rate histamine-induced itch sensation with innocuous warmth, innocuous cool, noxious cold, and noxious heat applied distal to the area of histamine iontophoresis. Scratching, noxious heat, and noxious cold significantly reduced ratings of itch intensity. Additionally, their observations indicate that thermal and mechanical modulators of

histamine-induced itch do not require direct physical interaction with the area from which the itch originates: scratching distal to the site of origin relieved the itch (with implications for treatment of wound-related itch).

In contrast to pain, itching causes a nocifensive withdrawal response to remove the offending irritant and protect the skin and integrity of the body (Paus et al., 2006). The itch-scratch cycle is described in which itch elicits a scratch response (Stander et al., 2003; Yosipovitch & Hundley, 2004). The scratching causes inflammation and further stimulation of nerve fibers which results in the sensation of itch. The sensation of itch then prompts further scratching or rubbing. While scratching and rubbing can provide relief, both can also lead to lichenification (scratch marks) and further trauma (Davidson, Zhang, Khasabov, Simone, & Giesler, 2009; Yosipovitch & Hundley, 2004).

Summary of Itch Physiology

Recent scientific advances have greatly added to our understanding of itch: itch-specific neurons, spinothalamic tracts specific to itch processing, genetic mediators for the itch sensation, cerebral processing which is similar to, but distinct from, pain processing. These findings suggest the need to further explore itch clinically as a distinct phenomenon. This study attempted to distinguish wound-related itch from other wound-associated sensations.

Pruritogens

A number of endogenous and exogenous pruritogens (itch triggers) have been identified. These pruritogens may be found in the body of the itching person, even in the wound bed, or may be in the environment of the itching person. Individual itch response to the various pruritogens varies between individuals. The discussion of pruritogens which follows is not exhaustive, as it is possible for any stimulus to trigger itch.

Endogenous Pruritogens

Histamine. Histamine is released as degranulation of dermal mast cells occurs and directly stimulates histamine type 1 (H_1) receptors on itch-specific C-fibers (Twycross et al., 2003). Histamine is often used to elicit itch as the reaction to histamine is predictable. The reaction includes an itch which begins 30 to 45 seconds after histamine application and resolves over 10 to 15 minutes, a wheal which develops over eight minutes, and a surrounding flare. The wheal and flare are specifically histamine mediated.

Leknes and colleagues (2007) used fMRI to compare allergen- and histamine-induced itch in terms of skin blood flow changes and central processing. Responses to skin prick tests done with histamine and allergens on 14 healthy subjects were compared. Both types of itch correlated with activity in the anterior cingulate, striatum and thalamus. Additionally, itch elicited by allergens resulted in activation of orbito-frontal, supplementary motor, and posterior parietal areas. Histamine-induced itch resulted in activation of the insula bilaterally. Allergen induced itch was perceived as more intense and enduring ($p < .005$), while histamine-induced itch intensity faded more quickly. Perceived itch intensity and blood flow occurred significantly later in response to allergen-induced itch than to histamine-induced itch ($p < .001$).

Acetylcholine. Acetylcholine is a neurotransmitter which, via muscarinic and nicotinergic receptors, causes pain in non-atopic persons, but itch in atopic persons (Twycross et al., 2003). Apparently, the activation of itch units by acetylcholine does not provoke itch in non-atopic persons due to simultaneous activation of non-itch receptors which suppress the itch (Schmelz & Handwerker, 2004). A flare response to intradermal acetylcholine is less than, but similar to, that induced by histamine.

Serotonin. Serotonin induces itch via 5-HT3 receptors (Stander et al., 2003). Selective

serotonin reuptake inhibitors (SSRI) have antipruritic effects (Pogatzki-Zahn, Marziniak, Schneider, Luger, & Stander, 2008). Serotonin is a mediator in psychogenic itch (Ikoma et al., 2006).

Bradykinin. Bradykinin, with bradykinin receptors, lowers the receptor threshold and causes pain (Pogatzki-Zahn et al., 2008). However, bradykinin induces mast cell degranulation for the release of histamine and enhances histamine responses so contributes to the itch sensation (Stander et al., 2003).

Prostaglandins. Prostaglandins potentiate histamine-induced itch by lowering the receptor threshold to histamine and papain (Pogatzki-Zahn et al., 2008; Stander et al., 2003).

Interleukins. Interleukins (IL-2, IL-4, IL-6, and IL-31) are cytokines, which originate in t-cells and macrophages (Ikoma et al., 2006). Interleukins play a role in the elicitation of itch, similar to histamine, by activating the cutaneous C-fibers (Stander et al., 2003). Interleukin-31 induces pruritic dermatitis in mice (Ikoma et al., 2006). The role of interleukins in itch behavior is still being determined.

Nerve Growth Factor. The role of nerve growth factor is speculative, but may lead to sensitization of peripheral nerve fibers (Pogatzki-Zahn et al., 2008). A direct correlation between nerve growth factor and pruritus has not been found, but increased plasma levels of nerve growth factor have been found in patients with atopic dermatitis (Stander et al., 2003). Nerve growth factor is elevated in traumatized tissue (Schmelz, 2012).

Substance P. Substance P (neurokinin1) is a neuropeptide, released from sensory nerve fibers by type-2 proteinase-activated receptors (PAR-2) and appears to potentiate itch by releasing histamine from dermal mast cells (Greaves & Khalifa, 2004; Twycross et al., 2003). Topical capsaicin depletes substance P from cutaneous nerve terminals and destroys C-fibers to

relieve itch.

Stress. There is some understanding of neurogenic inflammation and the influence of stress on pruritic skin conditions (Gieler, Niemeier, Brosig, & Kupfer, 2002). Neurotrophic factors such as nerve growth factor, which can modify expression of inflammatory cytokines by mast cells, have been found to be stress-inducible. Also, there is evidence that, in stress states, keratinocytes influence non-myelinated nerve fibers in the epidermis through beta endorphin production by propiomelanocortin.

Exogenous Pruritogens

Chemical Stimuli. Botanicals including poison ivy, stinging nettles, and cowhage spicules induce itch. Latex, a plant derivative, can cause pruritus. Cosmetics and soaps can cause irritant and allergic reactions. Insect bites and parasite infestations (i.e. scabies) are familiar pruritogens. Many drugs, including opiates, aspirin, and beta blockers can induce pruritus without a rash (Yelverton & Yosipovitch, 2007).

Physical Stimuli. In addition to chemical pruritogens, there are numerous physical stimuli which can elicit itch. Light touch, pressure, suction, heat, and electrical stimulation can induce itch (McMahon & Koltzenberg, 1992). Wool fibers, fiberglass, and water ("aquagenic pruritus") can cause itching in some people (Yelverton & Yosipovitch, 2007).

Research Related to Itch Occurring with Chronic Wounds

Research related to xerosis (dry, rough skin commonly found in elderly persons), venous ulcers, and burns is sparse. Itch related to arterial, neuropathic, traumatic and pressure-related wounds could not be found.

Xerosis

Norman (2003) looked at diagnoses with ICD-9 codes of 1,556 nursing home residents to

determine common problems and found pruritus (n = 1002) and xerosis (n = 772) to be the two most common problems among those persons. Norman describes xerosis (dry skin) with pruritus in the elderly, most commonly in the legs, but also in the hands and trunk. Xerosis follows a pattern of flaking, fissuring inflammation, dermatitis, and infection. Methods and results were not well described, but pharmacologic treatment options are discussed.

Pacifico and colleagues (2005) conducted a quasi-experimental study to evaluate the effectiveness of a lotion containing menthol and colloidal oatmeal in treating itch associated with xerosis. Comparison of changes was made between baseline and post-treatment scoring of 54 patients who used Aveeno Skin Relief Moisturizing Lotion ® daily for three weeks. Improvement in itch was found in 52 of 54 patients.

Venous Ulcers

Shai and Halevy (2005) questioned, and reviewed medical records of, 91 persons who had a total of 110 venous ulcers to determine what actually causes ulceration in persons with venous insufficiency. The non-experimental study involved history taking and chart review. They concluded that 5.4% of the ulcers were triggered by dry skin with subsequent scratching. No trigger was identified in 26.3% of the ulcers.

Hareendran and colleagues (2005) interviewed 38 persons with venous ulcers to identify health-related quality of life issues in those persons. They found the ulcers resulted in pain (80.5%), itching (69.4%), altered appearance (66.7%), loss of sleep (66.6%), functional limitations (58.3%), and disappointment with treatment (50%). It is not known how much itch specifically impacted sleep or functional limitations.

Hareendran and colleagues (2007), in a separate study, conducted in-depth interviews and focus groups with 36 patients who had venous leg ulcers. Their goal was to develop and validate

a quality of life questionnaire. Symptom severity and bother were assessed. Bother included pain, smell, itching, sleep disturbance, and restrictions from daily activities. "Ulcer itches" was ranked fourth among 10 symptoms causing distress, after ulcer burns/stings, ulcer hurts, and skin irritated (Hareendran et al., 2007).

Duque and colleagues (2005) conducted a study among persons with mild to moderate venous insufficiency to estimate prevalence of itch, pain and burning sensations, to examine characteristics of the symptoms and their relation to severity of venous disease, to identify factors that aggravate or alleviate the symptoms, and to determine impact of itch on quality of life in these persons. The Clinical Signs, Etiology, Anatomic Distribution, Pathophysiologic Condition (CEAP) classification system was used for determining eligibility to participate and for grading venous disease. Sixty-six percent of subjects had itch at the time of the interview. Itch did not correlate with severity of venous disease, but there was a significant negative relationship between itch intensity and quality of life.

Paul, Pieper, and Templin (2010) conducted a pilot regarding itch by adding questions about itch during the data collection portion of Dr. Pieper's study, which was funded by the National Institute of Health, entitled "Effect of Drug Use on the Legs: Chronic Venous Insufficiency, Mobility and Pain" RO1 NR009264. The larger study explored chronic venous disease, mobility and pain in persons in methadone treatment. Results of the pilot, which included 161 persons, showed that itch increased significantly with an increase in severity of symptoms of chronic venous disease (r = .26, p = .025) (Paul et al., 2010). Fourteen of the participants had wounds; of the 14, five (41.7%) used antibiotic ointment, and four (33.3%) used petrolatum to manage itch.

Burns

Most of the wound itch studies found described itch associated with burns. Itching associated with acute burns as well as healed burns will be discussed. Burn associated itching usually peaks at two to six months post-burn and often resolves with scar maturation (often 12 to 18 months) (Demling & DeSanti, 2001).

Bell and colleagues (1988) administered a questionnaire to nurses who specialized in burn care (number not specified) to determine if they viewed itching as a problem for burn patients and to determine treatment regimens to decrease discomfort from itch. Most nurses in burn care believed itching was a significant problem for their patients. Antipruritic medications and lotions were the most frequently used therapies (approximately 94% and 88%, respectively).

Three studies were found which discussed itch in healed burns. Field and colleagues (2000) compared patients with burn injuries receiving standard therapy (including cocoa butter application by occupational therapists) to patients receiving massage therapy (cocoa butter applied with the massage). They used a visual analog scale to rate itch in 20 adult patients whose burns were in the remodeling phase of healing: massage therapy resulted in a significant reduction in itching ($p < .001$ first day of massage and $p < .005$ last day). Anxiety and depression were also reduced with massage therapy.

Kopecky and colleagues (2001) conducted a study to determine the safety and pharmacokinetics of EMLA (eutectic mixture of local anesthetics) for treatment of burn itch. The number of pruritic episodes and antihistamine breakthrough doses were compared between pre-treatment days and treatment day, and significant reduction was found ($p = .01$ and $p = .03$, respectively). Five children who had burns with newly formed skin experienced reduced itch with application of EMLA.

Demling and DeSanti (2001) tested the efficacy of doxepin cream for 20 adults with

resistant burn pruritus. A pain scale was used to determine that pruritus was significantly decreased by use of topical doxepin ($p < .05$). The study had a small sample size with no control group or randomization, and a placebo effect was possible.

In an experimental study by Hettrick and colleagues (2004), transcutaneous electrical nerve stimulation (TENS) therapy significantly decreased itch in healed burns of 20 adults ($p = .086$). This study had a small sample size. Reliability of subjects' method of TENS use or of the visual analog scale used to measure itch was not discussed.

Three studies were found concerning itch in acute burns. Baker and colleagues (2001) burns: the best response was found with the use of cetirizine with cimetidine. Matheson and colleagues (2001) were looking for a method to reduce itch as experienced with burns. They assessed itch rating of 35 acute burn patients who tried one of two bath oils: one with colloidal oatmeal and one without. Persons using the bath oil with colloidal oatmeal reported a daily mean itch value, which was half as much as the mean itch value reported by those using the oil without colloidal oatmeal.

Mendham (2004) was interested in seeing if itching would respond to medications as used for neuropathic pain and, so, observed episodes of itching in 35 children with acute burns. He found that a marked reduction in episodes of scratching was noted with gabapentin use. Ratcliff and colleagues (2006) reviewed charts of 286 children with acute burns and determined that their itch had been well controlled. Interventions taken to manage itch were not described.

Quality of Life as Impacted by Wounds and Itch

Studies which examined wound itch and quality of life were not found. Studies which looked at quality of life related to wounds and studies which looked at quality of life related to itch are reviewed. Most of the studies which had findings related to quality of life with itch were

conducted for instrument development. Few instruments have been developed related to itch, and the impact of wounds on quality of life is not thoroughly understood. The problems of wounds and itch both negatively affect quality of life as is seen in related literature.

Impact of Wounds on Quality of Life

Venous Ulcers. Walshe (1995) conducted a qualitative study among 13 persons with venous ulcers to describe the experience of living with a venous leg ulcer from the patient's perspective. A phenomenological approach to data collection and analysis was used. She found that these persons suffered with pain, wound leakage and smell, embarrassment, and difficulty maintaining dignity. Findings pointed to the importance of comfort and symptom management for persons with venous leg ulcers.

Pieper, Szczepaniak, and Templin (2000) were interested in psychosocial adjustment, coping, and quality of life in persons with venous ulcers and a history of intravenous drug use. They collected information on quality of life from 32 persons with venous ulcers and a history of intravenous drug use. The area of the wound was inversely related to quality of life (r = -.52). Interference from pain also negatively affected quality of life (r = -.65, p < .001). They found that both wound area and pain were associated with difficulties in the home.

Persoon and colleagues (2004) conducted a meta-analysis of studies concerning leg ulcers to gather information on patients' perspectives of the impact of leg ulcers on daily life. Thirty-seven qualitative and quantitative studies were included in the meta-analysis. Leg ulcers were found to pose a threat to physical and social function. Compared to healthy people, persons with leg ulcers had significantly poorer quality of life. Women had lower quality of life scores than men.

Neuropathic Ulcers. Armstrong and colleagues (2008) studied quality of life among 63

persons with neuropathic diabetic plantar foot ulcers. The participants were randomized to one of three offloading modalities. Quality of life questionnaires (SF-36) were administered before and after a 12-week study period. Quality of life seemed to be more dependent on whether or not the wound healed than on which treatment was used.

Pressure Ulcers. Spilsbury and colleagues (2007) interviewed 23 hospital inpatients to explore their perceptions and experiences associated pressure ulcers. They were interested in the impact of pressure ulcers and treatment on health and quality of life. Twenty-one participants (91%) indicated that the pressure ulcer and its treatment affected their lives emotionally, mentally, physically, and socially. The researchers pointed out the difficulty that was encountered in distinguishing the impact of pressure ulcers from the impact of the participants' multiple co-morbidities.

Essex and colleagues (2009) conducted a study to determine the impact of pressure ulcers on health-related quality of life. Data from 218 people with pressure ulcers was compared with data from 2,289 persons without pressure ulcers who had completed the Short-Form 36 (SF-36). Age, gender, and co-morbidities were controlled. Persons with pressure ulcers had lower scores for the physical ($p < .001$) and mental ($p = .04$) component summary scores. Analysis was limited in this study also related to categorization of co-morbidities. Consistency of methods for categorization of co-morbidities was recommended.

Impact of Itch on Quality of Life

Malignant Wounds. Maida and colleagues (2009) studied 67 cancer patients who demonstrated malignant wounds at the time of referral for palliative care. Patients' self-reports of up to three wound-related symptoms were studied. Of eight main symptoms, the point prevalence for pruritus was 6%. Interestingly, pruritus was reported within the wound itself as

well as in the peri-wound area. Other identified symptoms included pain, mass effect, esthetic distress, exudate, odor, bleeding, and crusting.

Skin Diseases. The Dermatology Life Quality Index (DLQI) was developed for persons with dermatological conditions to measure the impact of skin disease and its treatment on quality of life (Finlay & Khan, 1994). It consists of 10 items and is simple to administer. Outpatients (N = 120) with a variety of dermatologic conditions completed the DLQI. Different aspects of life affected by their skin diseases were explored. The areas of impairment caused by the skin condition included *self-conscious* (n = 24), *sore/painful/stinging* (n = 21), *itching* (n = 20), *embarrassment* (n = 20), *leisure activities affected or limited* (n = 14), and *difficulties making new relationships* (n =14). The scores for the persons with itchy conditions including atopic eczema (41.7%), generalized pruritus (30.2%), and psoriasis (29.7%) were higher than scores of persons with viral warts (22.2%) and acne (14.4%). These higher scores indicated a greater number and severity of perceived problems for the persons with itchy conditions.

Verhoeven and colleagues (2007) evaluated questionnaires from 492 persons with various skin diseases about itch, pain, and fatigue to evaluate the prevalence of physical symptoms. Itch (53.5%) and fatigue (52.4%) were more frequently occurring than pain (23.0%) among those persons with skin diseases.

Dawn and colleagues (2008) conducted a study in which 304 persons with atopic dermatitis completed the web-based Characteristics of Itch Questionnaire to examine the frequency, intensity, and perceived characteristics of itch. A statistically significant ($p < .001$) positive correlation between itch descriptors and itch intensity was found. Strong adjectives were selected by participants to depict the intense degree of suffering and unpleasantness they experienced (e.g., annoying and bothersome).

Uremic Pruritus. The short form of the McGill Pain Questionnaire was used by Yosipovitch and colleagues (2001) to develop and validate a pruritus questionnaire. Patients (*N* = 145) suffering from uremic pruritus and receiving dialysis completed the questionnaire. Sixty percent of respondents indicated that pruritus was aggravated during the night. Nervousness (36%) and depression (8%) were reported related to the pruritus. Thirty-three percent of respondents described the pruritus as unbearable.

Summary of Findings Related to Wound Itch

Itch related to chronic wounds is not well described in the literature, but is found clinically. The effects of wounds and itch on persons' quality of life have been described, but the significance of wound itch to persons with chronic wounds has not been explored. Wound itch and its ramifications were explored in this study.

Preventing and Treating Wound Itch

As more is understood about wound itch, more appropriate interventions can be made to manage wound itch. At the time this study was conducted, treatment options to prevent or minimize itch were available. While all methods for preventing and treating itch might not be appropriate for the various itchy wounds, options which might be considered are discussed.

Pharmacological Agents

Cooling Agents. Menthol, camphor, and icilin (a newly developed substance) activate channels of the TRP (vanilloid) family and induce cold sensation which temporarily masks the sensation of pruritus (Pogatzki-Zahn et al., 2008). Cold relieves pruritus by activating A-delta fibers which inhibit C-fiber activity (Bromm, 2005). Icilin is 400-800 times more active in bioassay endpoints than menthol and has proven to be effective against pruritus in a number of cases (Kamei & Hossen, 2005). Cooling of an itchy area provides only short-term relief.

Antidepressants. Several antidepressant drugs have proven to be effective antipruritics. Doxepin has potent antihistamine H1 receptor properties (Greaves, 2005). Mirtazapine has noradrenergic and serotonergic as well as H1-antihistaminic properties (Greaves, 2005). Paroxetine and sertraline, selective serotonin reuptake inhibitors, target sodium- and calcium-dependent transporters which inhibit uptake of neuromediators (i.e., serotonin) into presynaptic cell bodies, so there is increased serotonin acting on postsynaptic receptors, resulting in antipruritic effects (Pogatzki-Zahn et al., 2008).

Opioid and Cannibinoid Peptides. Cannibinoids originate from epidermal keratinocytes and neurons and have analgesic and antipruritic effects via cannabinoid receptors (Ikoma et al., 2006). Opioids also originate from neurons and keratinocytes and can be antipruritic in the skin. Systemic opioids induce pruritus as previously discussed. Naloxone and naltrexone, drugs that block opiate receptors, have been used to treat cholestatic pruritus (Carlson, 2010; Greaves & Khalifa, 2004).

Chemotherapy. Oral chemotherapy (i.e., azathioprine and cyclosporine) and topical immunosuppressants (i.e., tacrolimus and pimecrolimus) can be tried in cases of treatment-resistant pruritus (Pogatzki-Zahn et al., 2008; Yosipovitch et al., 2003). Photochemotherapy and phototherapy (UVB) have been effective in some cases (Yosipovitch et al, 2003).

Anticonvulsants. Gabapentin may act by blocking post-synaptic calcium channels or inhibiting neurotransmitter synthesis (Pogatzki-Zahn et al., 2008). Pregabalin acts similarly but with more tolerable adverse effects.

Capsaicin. Capsaicin acts via vanilloid (TRPV1) receptors to induce burning pain or pruritus (Stander et al., 2003). With topical application for several days, capsaicin desensitizes nerve fibers for relief of itch (Pogatzki-Zahn et al., 2008).

Zangrado. This red, blood-like sap is produced by cutting the bark of the sangre de grado tree, which is found in the jungles of the upper Amazon (Miller, Rueter, Wallace, Sharkey, & Bobrowski, 2004). The sap can be applied topically or taken orally for antipruritic therapy. It appears to act via vanilloid receptor antagonism (Weisshaar et al., 2003) and has shown unparalleled effectiveness against the itch of insect bites (Miller et al., 2004).

Refer to Table 1 for a summary of pharmacological measures that can be used against pruritus.

Table 1

Pharmacological Measures to Control Itch

Topical Agents	
Measure	Source
Cooling Agents	
Menthol	2,3,4,5,7
Phenol	3,7
Camphor	2,4,7
Icilin	2
Calamine	3
Antihistamines	3,4,7
Topical steroids	2,4,6,7
Local anesthetics	2,3,4,6,7
Tacrolimus	2,4,6,7
Emollients	4,7
Capsaicin	2,3,4,6,7
Zangrado	4,6,7
Systemic Agents	
Measure	Source
Aspirin	6
Histamine (H_1 and H_2 receptor) antagonists	2,3,4
Doxepin	2,3,4
Amitriptyline	2
Mirtazapine	2,3
Ondasitron	3,4
Paroxetine	2,3,4
Sertraline	2
Fluvoxamine	2
Naloxone	2,4
Naltrexone	2,4
Nalmetene	2,4
Azathioprine	6
Cyclosporine	2,4,6
Gabapentin	2,6
Pregabalin	2
Glucocorticosteroids	4

[1]Greaves, 2005
[2]Pogatzki-Zahn et al., 2008
[3]Heymann, 2006
[4]Weisshaar et al., 2003
[5]Sarvis, 2005
[6]Yosipovitch et al, 2003
[7]Yosipovitch & Hundley, 2004

Non-pharmacological Measures for Treatment of Pruritus

Most of the non-pharmacological measures listed in Table 2 are familiar and rather self-explanatory. Chronic rubbing and scratching result in secondary skin lesions including excoriations, lichenification and scars (Pogatzki-Zahn et al., 2008). Rubbing and scratching should be avoided, especially where there is already a wound. Refer to Table 2 for non-pharmacological measures for controlling itch.

Table 2

Non-pharmacological Measures to Control Itch

Measure	Source
Baths/showers in cool or lukewarm water	[1,2]
Hydrogel sheets	[4]
Low-pH cleansers and moisturizers	[2,4]
Use of humidifiers during dry, cold seasons	[2]
Lightweight, non-binding clothing	[1,2]
Avoidance of hot, spicy food and alcohol	[2]
Keeping fingernails short	[2]
Transcutaneous nerve stimulation	[2,3]
Cutaneous field stimulation	[3]
Broad-band ultraviolet B	[3]
Stress training	[1]
Social competence training	[1]
Relaxation techniques	[1]

[1]Weisshaar et al., 2003
[2]Sarvis, 2005
[3]Yosipovitch et al., 2003
[4]Yosipovitch & Hundley, 2004

Transcutaneous electrical nerve stimulation. Transcutaneous electrical nerve stimulation (TENS) involves central inhibition of nerve conduction at the level of the spinal cord. A stimulator generates alternating current through flat rubber electrode plates inducing pressure and vibration. Low frequency TENS has been found to reduce itch significantly in some cases (Wallengren, 2004).

Broad-band Ultraviolet B Radiation Therapy. Radiation therapy has proven to be effective in some cases (Greaves & Khalifa, 2004).

Cutaneous Field Stimulation. Cutaneous field stimulation is a newer technique, which involves a flexible rubber electrode plate covered with 16 needle-like electrodes. When the plate is pressed gently onto the skin, the electrode tips enter the epidermis and superficial layer of the dermis. A constant current is delivered to each electrode causing prickling and a slight burning pain so that itch is abolished for up to two hours after treatment (Wallengren, 2004).

Behavioral Programs. Psychological co-morbidities frequently accompany chronic pruritus so that behavioral programs including stress training, training in social competence and relaxation techniques are indicated (Pogatzki-Zahn et al., 2008). A nursing program intended to minimize itch and help the person cope with itch is described by van Os-Medendorp and colleagues (2007). The program was developed in the Netherlands for an outpatient dermatology department of a hospital. The program consists of educational and cognitive behavioral interventions including patient education, awareness training and habit reversal, relaxation exercises and ongoing patient support. A pretest-post-test design was used to examine the effectiveness of the intervention. No changes were found in quality of life, but frequency and intensity of itching and scratching, reduction in catastrophizing and helpless coping, and reduction in skin-related psychosocial morbidity was found.

Summary Regarding Itch Management

Pharmacological and non-pharmacological options for itch management are available and can be individualized based on wound-associated symptoms. As more is known about itch physiology, advances in itch therapy can be made.

Summary

Itch is a clinical problem impacting many individuals. In recent years itch has been studied with some success due to scientific advances including PET scanning, fMRI. Even more mysterious is the itch which persons with chronic wounds describe associated with, even *in*, their wounds. Results of this study add to the understanding of wound itch in terms of manifestations, quality of life, relationship to pain, and measures which are used to manage it. Findings of this study add to nursing knowledge about the clinical presentation of wound-related itch and how it can be managed.

CHAPTER III

Theoretical Framework

This study of wound itch was based on Levine's Conservation Model. In this chapter, Levine's Conservation Principles will be discussed as a conceptual framework from which the Theory of Wound Itch was developed for the conduct of this study.

Conceptual Framework

Levine's Conservation Model is applicable to the study of wound itch. The model is quite simple, and the concepts are well-defined. The Conservation Principles are easily applied to nursing practice, even to the study of wound itch. As wounds and itch are encountered in many settings, the Conservation Model can be generalized to nurse-patient interactions in many clinical settings. The model is empirically identifiable in that the concepts are scientifically based (as wound itch is physiologically based) and clinically evident. Finally, the model is important: it provides a time-tested "useful approach to bringing sound science to nursing knowledge" (Levine, 1996, p.41).

Levine's Conservation Model has ontological and epistemic claims consistent with the *reciprocal interaction world view*, a post-positivist perspective. In this perspective, reality is not just that which is observable, but is "multidimensional, context-dependent and relative" (Fawcett, 2005, p.13). Both subjective sensory information as well as objective physical reality is addressed (Jacox, Suppe, Campbell & Stashinko, 1999). Levine's Conservation Model is consistent with the Systems Category of Knowledge which has its origins in biology and physics. The human being is an open system, interacting with the environment "with fluidity and change" (Levine, 1969b, p.94).

Philosophical Assumptions

The following are philosophical assumptions in Levine's Conservation Model:

1. Reality is multidimensional with subjective and objective components (Fawcett, 2005).
2. A person is an open system in constant interaction with the environment (Levine, 1969a).
3. A person is dependent in a nursing relationship (Levine, 1989b, p. 128).
4. The goals of nursing are to promote life and alleviate suffering (Levine, 1989a).

Values Supported by Levine's Conservation Model

Levine's Conservation Model is based on values consistent with the values of the author and a description of nursing which accurately defines its scope and purpose. First, Levine (1989a) values the sanctity of life as stated:

> All efforts of the healing sciences are founded on the holiness and wholeness of the human being, and the special injunction this places upon the caregiver to bring dignity and compassion to the tasks of caring for another person . . . The sanctity of life . . . is the essence of the respectful relationship that one person must have for another. It is never more important than when a nurse-patient dyad is created whereby one individual enters dependency, willing or not, and places his trust in another person (p.125).

These words provide a beautiful statement of the essence of nursing. "The goal of all nursing care should be to promote wholeness, realizing that for every individual that requires a unique and separate cluster of activities" (Levine, 1971, p. 258).

The second value addressed by Levine is the "absolute moral duty to prevent or alleviate suffering" (Levine, 1989a, p.126). Levine uses the term "patient "as the recipient of nursing care as the word "patient " has its core in the Latin word for "suffering" (1989a). Levine contends: "It is the moral duty of the nurse to confront the suffering individual and bring all the skills of the hand, heart, and mind to alleviate it" (Levine, 1989a, p. 126). This value particularly addresses the obligation nurses have to alleviate suffering. Wound itch causes suffering.

Levine recognizes the contributions of other, adjunctive disciplines to nursing and

appreciates the "rich reservoir of knowledge in the many disciplines that contribute to understanding of human life" (1995, p. 13). A great emphasis is placed on physiologic functioning, and Levine depicts nursing working alongside medicine and other disciplines to meet patients' needs. This collaborative effort is necessary to address a multidimensional problem such as wound itch.

Concepts and Propositions of Levine's Conceptual Framework

Levine's model is based on the premise that *human beings* are "organismic", a combination of related, even redundant, systems that functions as one, integrated whole (Levine, 1969a, p.10). According to Levine, the expression of "wholeness" can "only be used if it can be converted to manageable parts" (1989b, p. 326). *Health* means whole (Levine, 1971). Illness occurs when positive feedback within the system runs without the usual controls that restore balance (Levine, 1973). Levine contends that the person cannot be studied separated from the environment which is the "predicament of time and place" (1989b, p. 326). *Environment* is both internal and external (Levine, 1973). The internal environment is described as having *homeostasis* (equilibrium, a stable state) and *homeorhesis* (a stabilized flow) (Levine, 1971, p.7). The external environment is at once perceptual (sensed), operational (not sensed, yet present and potentially threatening), and conceptual (interpreted based on beliefs and values). "*Nursing* is a human interaction. It is a discipline rooted in the organic dependency of the individual human being on his relationships with other human beings" (Levine, 1969a, p.1).

Conceptual Model Concepts

Five concepts from Levine's Conservation Model were used for development of the middle-range Theory of Wound Itch: *environment*, *organismic response*, *adaptation*, *conservation*, and *integrity*.

Environment. As described above, the internal environment has two dimensions: *homeostasis* and *homeorhesis*. *Homeostasis* is defined as the "remarkable equilibrium that is maintained in the internal environment in the face of constant change" (Levine, 1969a, p.7). *Homeorhesis* is defined as a stabilized flow within a person, which permits the body to sustain its well-being within the vast changes that encroach upon it from the environment (1973, p.7). The external environment has three dimensions: *perceptual environment*, *operational environment*, and *conceptual environment*. The *perceptual environment* is defined as that portion of the environment to which the individual responds with his sense organs (1973, p.12). The *operational environment* is defined as that portion of the environment, which is not directly perceived by the individual, including radiation, microorganisms and pollutants, but which is of vital concern to the individual because of its potential danger (1989b, p. 326). The *conceptual environment* is defined as the "exchange of language, the ability to think and experience emotion . . . value systems, religious beliefs, ethnic and cultural traditions, and the individual psychological patterns that come from life experiences" (1973, p.12). "The nurse participates actively in every patient's environment" (1969a, p.10). Levine (1973) further explains:

> Change is the essence of life . . . and adaptation is the method of change. The Organism retains its integrity in both the internal and external environment through its adaptive capability. Adaptation is the process of change whereby the individual retains his integrity within the realities of his environment" (pp. 10-11).

Organismic Response. Organismic responses encompass four "physiologically predetermined" dimensions (Levine, 1969, p. 95). The four levels are: *Fight or Flight Response*, *Inflammatory-Immune Response*, *Stress Response*, and *Perceptual Awareness*. The *Fight or Flight Response* is the most primitive level of organismic response and is defined as an adrenocortical-sympathetic reaction that is an instantaneous response to a real or imagined threat" (Levine, 1973). The *Inflammatory-Immune Response* is the second level of organismic

response and is defined as a "systematized concentration of available energy directed at the exclusion and removal an intruding irritant or pathogen"(Levine, 1969b, p. 95). The *Stress Response* is the third level of organismic response and is defined as a "long-term organismic reaction to the exigencies of life and the sum total of the individual's life experiences" (1969b, p. 95). The *Perceptual Awareness Response* is the fourth level of organismic response and is defined as "all the experiences of life . . . mediated through tissues of the living individual" (1969b, p. 96). The Perceptual Awareness Response encompasses five subdivisions, including the: (a) *Basic Orienting System*, (b) *Visual System*, (c) *Auditory System*, (d) *Haptic System*, and (e) *Taste-Smell System.* The *Basic Orienting System* provides general orientation in the environment. The *Visual System* enables the individual to see. The *Auditory System* enables the individual to hear. The *Haptic System* is especially relevant to wound itch and is described as responding to touch with information "received by the skin surfaces and body orifices as well as the joints and muscles and their associated tendons. It enables the individual to explore his environment, and establishes contact with the material nature of his environment" (1969b, p. 97). The *Taste-Smell System* provides information about chemical stimuli and facilitates safe nourishment.

Adaptation. Adaptation is defined as "the process of change whereby an individual retains his integrity within the realities of his environments" (Levine, 1969a, p. 9-10).

> "Change is characteristic of life, and adaptation is the method of change. The organism retains its integrity in both the internal and external environment through its adaptive capability" (1969a, p. 9).

Adaptation has dimensions of *historicity*, *specificity*, and *redundancy*.

Integrity. Integrity is defined as the "unique oneness of the whole person" (Levine, 1991, p. 3). The promotion of integrity is the goal of nursing (Levine, 1973). Conservation of

energy, structural integrity, personal integrity and social integrity to promote the unique oneness of the person are the basis of nursing interventions.

Conservation. Conservation is defined as "the guardian activity that defends and protects the [wholeness, which is] the universal target of selfhood" (Levine, 1991, p.4). Conservation describes the way complex systems are able to continue to function, even when severely challenged . . . This work is accomplished in the most economical way possible" (1990, p. 192). Levine's (1969a) Conservation Principles encompass four dimensions: (a) *Principle of Conservation of Energy*, (b) *Principle of Conservation of Structural Integrity*, (c) *Principle of Conservation of Personal Integrity*, and (d) *Principle of Conservation of Social Integrity*. The *Principle of Conservation of Energy* refers to balancing energy output and energy input to avoid excessive fatigue, that is, adequate rest, nutrition, and exercise. The *Principle of Conservation of Structural Integrity* refers to maintaining or restoring the structure of the body by preventing physical breakdown and restoring healing. The *Principle of Conservation of Personal Integrity* refers to the maintenance or restoration of the person's sense of identity, self-worth, and acknowledgement of uniqueness. The *Principle of Conservation of Social Integrity* refers to the acknowledgement of the patient as a social being.

Principles of Conservation

The nursing process is one of "conservation . . . keeping together" (1967, p. 46). According to Levine (1989b), conservation should be the major guideline of all nursing intervention. The problem of wound itch can be approached with each of the Conservation Principles.

The Principle of Conservation of Patient Energy and Wound Itch. Conservation of energy is essential to the patient with a wound because the body requires an energy expenditure

which is greater than usual during the healing process (Neswick, 1997). The problem of wound itch compounds the issue of conserving patient energy in that it: (a) causes the urge to act by scratching or rubbing and (b) causes a discomfort which can preclude sleep or rest as needed for healing and recovery. Levine described the body of the very sick person "in its wisdom, withdrawing into itself, spending its resources on the process of healing" (1989b, p. 332). Levine (1967) recognized that any insult to physiological function, even as minor as an infected toenail, alters the metabolism of the entire body if accompanied by an elevated temperature. In consideration of this principle, the nurse would assess for complaints of discomfort related to wound itch. The nurse would also look for energy-expending behaviors such as scratching, rubbing, and general restlessness. Nutritional status including protein and caloric intake would also be assessed. The nurse would intervene with pharmacological as well as non-pharmacological approaches to conserve energy by providing measures for comfort.

The Principle of Conservation of Structural Integrity and Wound Itch. Individual patients are "continuous with the rest of the natural world" in a relationship, which is characterized by an incessant and unrelieved exchange, which is absolutely necessary for survival" (Levine, 1971, p. 256). A person's internal and external environments are in constant interaction with each other. The internal environment is "captured within the integument of the human body" (Levine, 1973, p. 7). The perceptual aspect of the environment is divided into the basic orienting system, the auditory system, the haptic system, the taste-smell system and the visual system (Levine, 1969b). The haptic system responds to touch and relies on skin surfaces. Here the significance of the skin (integument) is clearly specified related to structural integrity. Nurses are directed to focus on the response of the entire organism and the adaptive pattern. In consideration of this principle, the nurse would make careful assessments of wounds, including

any indication of trauma or irritation related to rubbing or scratching. Nursing interventions would be those that conserve tissue integrity or promote healing of wounded tissue (i.e., pressure-relief measures, dressing changes). Rubbing and scratching in response to wound itch would likely aggravate wounds, so interventions to manage wound itch would be sought.

The Principle of Conservation of Personal Integrity and Wound Itch. Every person needs to be identified as a unique individual (Levine, 1973). Personal integrity is maintained by guarding patient privacy and allowing each patient to make decisions. Related to wound itch, nurses are directed to maintain privacy in discussions about wound itch and during wound assessments. In consideration of this principle, nurses would assess the patient's values and preferences related to wound care and wound itch management. Patients should be given options, whenever possible, about the timing of wound assessments, timing of wound-related discussions, and alternatives to try for the management of wound itch. Information shared by the patient should be kept confidential, even as a component of the plan of care, if possible, to protect the integrity of the person.

The Principle of Conservation of Social Integrity and Wound Itch. Selfhood needs definition beyond the individual to the identity of the person "in a family, a community, a cultural heritage, a religious belief, a socioeconomic slot, an educational background, a vocational choice" (Levine, 1989b, p. 335). Wound itch and related behaviors may have aspects which are not socially acceptable. Wounds may be unsightly, draining, and foul smelling. Itch may connote the socially undesirable conditions of uncleanliness and infestation. Scabies is, in fact, the third definition of itch in the *Oxford English Dictionary* (Hawkins and Allen, 1991, p. 755). Accordingly, the nurse must recognize the social implications of wounds and wound itch for each patient and intervene to help the patient manage the wound and its undesirable

characteristics.

Relational Propositions of Levine's Theory

The first relational proposition describes an association of *environment* to *organismic response*: "A person responds to changes that encroach upon it from the environment with an organismic response" (Levine, 1973, p. 7). The second relational statement links *organismic response* to *adaptation*: The capacity of the organismic response to adequately respond to the environment is determined by adaptation that is available to the organism (1969b, p. 95). Two relational propositions describe a reciprocal relationship between *adaptation* and *conservation*: "Integration is defended by adaptations that create the condition of conservation" (1989b, p. 330). Adaptation occurs when conservation measures effect change whereby the individual retains integrity within the realities of the environment. A fifth relational proposition links *conservation* with *integrity*: Conservation defends the wholeness of living systems by ensuring their ability to confront change appropriately and retain their unique identity (Levine, 1990, p. 192). These statements were difficult to find in Levine's works and the relationships are rather imbedded in the statements. There has been much thought over the location of *adaptation* as an antecedent to, or consequence of, *conservation.*

The Theory of Wound Itch

Assumptions of the Theory

Assumptions of the Theory of Wound Itch are those of Levine's Conservation Model as listed previously with several additional assumptions:

1. Wound itch is a subjective phenomenon, which can be constant or fleeting, annoying or deeply disturbing.

2. Wound itch is commonly experienced by persons with disruption in skin integrity.

3. Itch is a negative sensation.

4. Nurses are in a position to intervene for persons with wound itch.

Concepts and Definitional Propositions

Wound Itch. A *wound* is defined as "a disruption of the integrity and function of tissues in the body" (Baranoski & Ayello, 2008). Wounds commonly found in wound care practice include vascular (related to arterial disease or venous insufficiency), neuropathic, traumatic, pressure-related wounds and wounds of mixed etiology, as defined in Chapter I. An *organismic response* at the conceptual level is represented by *wound itch* at the theoretical level. *Wound itch* has fight/flight, inflammatory-immune (physiological), stress (psychological), and perceptual awareness (sensation) dimensions.

Disruption of Skin Integrity. *Disruption* is defined by the *Oxford-English Dictionary Online* (2009) as "dissolution of continuity." *Skin* is defined as "integument." *Integrity* is "material wholeness, completeness, entirety; unimpaired or uncorrupted condition." *Disruption of skin integrity* is defined as dissolution of completeness of the integument. [*Disruption of*] *the environment* at the conceptual level is represented by *disruption of skin integrity* at the theoretical level. Operationally, disruption of the environment is the wound.

Protection. *Protection* is defined as "shelter, defense, preservation from harm, danger, damage: care" (*Oxford-English Dictionary Online*, 2009). For the theory, *protection* is measures taken by the individual who has disruption of skin integrity or by the nurse to influence regulation. *Conservation* at the conceptual level is represented by *protection* at the theoretical level. Operationally, protection is all that is done to manage wound itch.

Regulation. *Regulation* is defined as "the property whereby a living organism can adapt the form of its body to accommodate for changes made or damage done to it, and whereby, in the

normal course of development, the nature and growth of the various parts are so inter-related as to produce an integrated whole" (*Oxford-English Dictionary Online*, 2009). *Adaptation* at the conceptual level is represented by *regulation* at the theoretical level. *Adaptation* can be positive (effective) or negative (ineffective), as *regulation* can be positive (e.g. tissue growth) or negative (e.g. eschar development or further deterioration of the wound). At the operational level, adaptation is the physiological response to the wound itch, conscious or unconscious.

Continuity. *Continuity* is defined as a "state or quality of being uninterrupted" (*Oxford-English Dictionary Online*, 2009). *Integrity* at the conceptual level is represented by *continuity* at the theoretical level. Operationally, quality of life is an indicator of continuity.

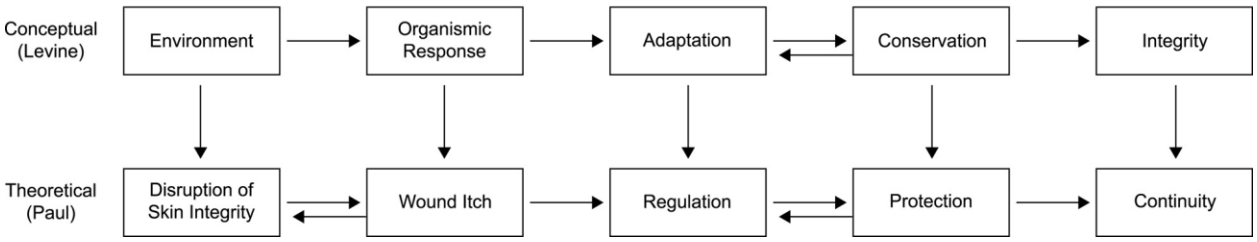


Figure 1. Concepts and relationships of Levine's Conservation Model and the Theory of Wound Itch as substructed from Levine's conceptual framework.

Relational Propositions of the Theory of Wound Itch

Refer to Figure 1 for a depiction of the relationships between the concepts of the theory. There is a reciprocal relationship between *disruption in skin integrity* and *wound itch*. The itch-scratch cycle is described in which itch elicits a scratch response (Stander et al., 2003; Yosipovitch & Hundley, 2004). The scratching causes inflammation and further stimulation of nerve fibers, which results in the sensation of itch. The sensation of itch then prompts further scratching or rubbing. *Regulation* is associated with *wound itch* as the systems of the person

with wound itch adjust in response to the itch. A reciprocal relationship exists between *regulation* and *protection* as protective measures are taken by the person and, as indicated, by the nurse, to respond with most economical means when regulation is ineffective. Those measures can, in return, impact the sensation of itch (i.e., acetic acid solution as a pruritogen). *Protection* is associated with *continuity* as disruption in skin integrity resolves when effective protective measures are taken to prevent further disruption. A model of the Theory of Wound Itch is depicted in Figure 2.

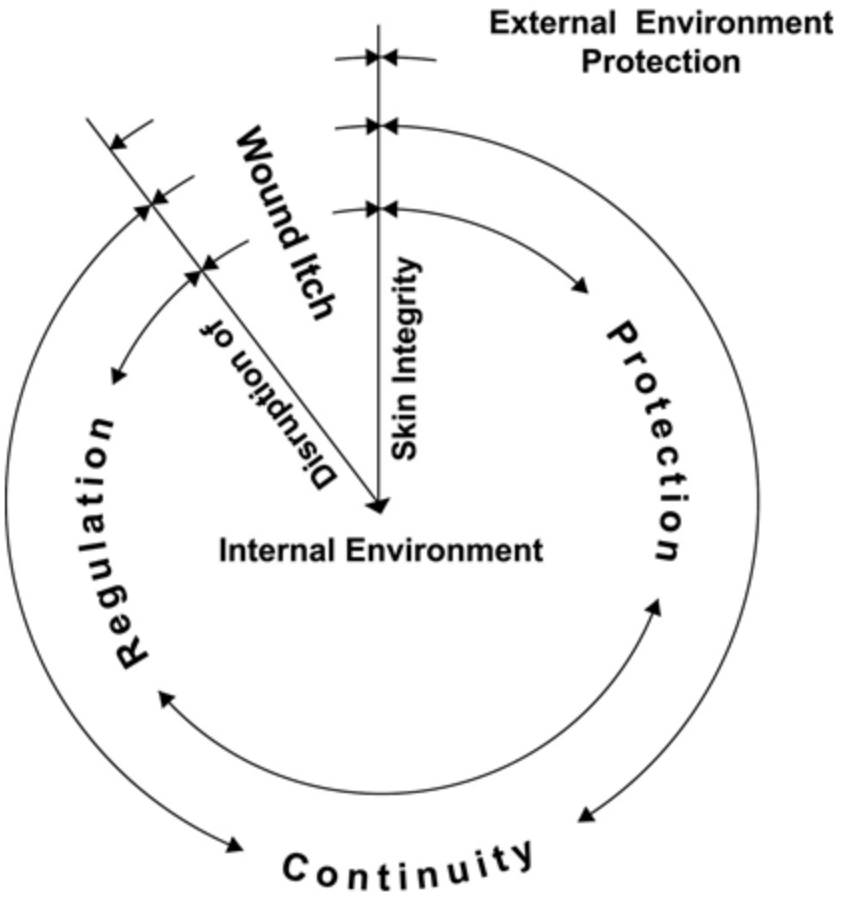


Figure 2. Model of the Theory of Wound Itch. The model illustrates concepts and relationships (arrows) of the Theory of Wound Itch.

Operationalizing the Theory of Wound Itch

As previously described, a disruption of skin integrity operationally was the wound. Wounds were assessed and wound characteristics documented according to components of the Bates-Jensen Wound Assessment Tool (Bolton et al., 2004). *Wound itch*, the sensation and how it is perceived was captured on the Paul-Pieper Itching Questionnaire and the Characteristics of Itch Questionnaire (Dawn et al., 2008). The Brief Pain Inventory was used to further define wound sensations. *Regulation* was indicated by response to wound itch: it was represented

operationally with the Paul-Pieper Itching Questionnaire and the Characteristics of Itch Questionnaire. *Protection*, measures taken to manage wound itch, were captured on the Paul-Pieper Itching Questionnaire. *Continuity*, was captured with the Characteristics of Itch Questionnaire and the RAND-12 (Hays et al., 1998). These instruments will be further discussed in Chapter 4.

CHAPTER IV

Method

Design

In this chapter, the design, setting, sample, data collection procedures, instruments, and data analysis for this study are described. The study used an observational design, as that is appropriate for the state of the science; although itch is a familiar phenomenon, little is known about itch as it occurs with chronic wounds. The research questions were: (a) What is the frequency, timing, duration, and intensity of itch related to chronic wounds? (b) What is the relationship between wound characteristics and itch? (c) What treatments do participants use to manage wound itch? (d) How does wound itch affect quality of life for these participants? and (e) What is the relationship between wound itch and pain?

Setting

The study was conducted at the Beaumont Wound Care Center, which is affiliated with William Beaumont Hospital in Royal Oak, Michigan. William Beaumont Hospital, Royal Oak, is a large teaching institution located in Southeastern Michigan. The primary investigator is a plastic surgery/wound care nurse practitioner for inpatients at the hospital and has a good relationship with the physicians and staff of the wound care center. The wound care center is staffed with plastic surgeons, peripheral vascular surgeons, general surgeons, podiatrists, a nurse practitioner, and staff nurses. The wound care center manages approximately 800 patient visits per month with 420 charts open at any time. The wounds of patients followed at the wound care center are approximately 30% vascular, 30% neuropathic, 30% pressure-related, and 10% related to other causes.

Plans were also made to conduct the study at the private office of a podiatrist on staff at

the Beaumont Wound Care Center, as the podiatrist offered his office as an additional site. The podiatrist's private office is located approximately five miles north of the hospital-affiliated wound care center. Wound of patients followed at the podiatrist's office include vascular, neuropathic, pressure-related and other types, similar to those found at the wound care center. Data collection at the podiatrist's office was not included as the sample was entirely recruited at the wound care center.

Sample

The sample included 200 outpatients with wounds who were visiting the hospital-affiliated wound care center for wound treatment. Consecutive sampling involved recruiting persons two to three days each week who were visiting the wound care center those days. Since the wound care center has 420 charts open at any time, obtaining 200 participants was possible. A podiatrist on staff at the wound care center offered that his private office be used as a data collection site to expedite the data collection process. Patients were screened until a total of 200 participants were recruited. The screening information was retained for comparison to interview responses. The number of patients who needed to be screened depended on the actual prevalence of wound itch. It became apparent once 100 participants had been interviewed that approximately one fourth of persons being seen at the wound care center had wound-related itch. Wound characteristics were assumed to have a disproportionate *n*. This disproportionate *n* reduced power relative to the same *n* divided equally. Power and sample size were computed for a two-sample *t*-test power analysis. A target sample size of 225 allowed for a power of .86 with a medium effect size and alpha set at .05. A refusal rate of approximately 5% was expected related to patient unwillingness to discuss negative sensations related to wounds, so a resulting sample size of 200 was sought. Children, persons aged less than 18 years as distinguished in

Michigan (S.241, 2004), were excluded as the interview questionnaires were designed for adults. Pregnant women were not likely to be followed at the wound care center, and pregnancy predisposes a woman to a multitude of pregnancy-related pruritic conditions (Shornick, 1994), so pregnancy was an exclusion criterion. Inclusion criteria allowed for patients: (a) with open wounds including vascular (arterial or venous), neuropathic, traumatic or pressure-related wounds (as determined by each patient's medical history and/or wound presentation), (b) age 18 years and older, and (c) able to understand and speak English. Exclusion criteria included: (a) pregnancy, (b) closed surgical wounds, (c) a rash in the area of the wound, or (d) a pruritic skin condition involving more than 20% of body surface area. The participant was not excluded if sensation in the area could not be confirmed, as itch could potentially be perceived without sensation in the area of the wound according to an understanding of a central, in addition to peripheral, origin of itch as previously described. Patients with surgical wounds and extensive burns are not typically followed at the wound care center.

Data Collection Procedures

All patients who met inclusion criteria and were followed at the wound care center were considered for inclusion in the study. Data were collected by the primary investigator who introduced the study to patients and determined eligibility. The primary investigator approached persons who were waiting in private rooms at the wound care center to introduce the study to each person. Persons willing to participate in the study were asked the screening questions (Appendix A) to determine eligibility. Once eligibility was determined the primary investigator reviewed the content of the information sheet (Appendix B) with the patient. Each person willing to participate was assessed and interviewed in a private room. All questionnaires were read to the participants for response. Each interview took 20 to 60 minutes to complete,

depending on number of symptoms and speed of response. The medical record was reviewed during the visit day for diagnoses, medical history, medications, and allergies.

One wound for each patient was assessed for wound characteristics and itch: either the largest wound with associated itch or the largest wound when itch was not described. Photographs of each assessed wound were taken as is routine at the wound care center. Photographs of each wound were obtained for purposes of the researcher's recollection, use for publication, and inclusion in presentations. A disposable Semmes-Weinstein 5.07 (10 gram) monofilament was used to evaluate sensation in the area of the wound. Wound assessments were conducted concurrently with the wound care center staff to avoid unnecessary discomfort associated with dressing changes and wound assessments. This protocol followed standard procedure, so the risk of injury was small. A log was kept at the wound care center, which included each participant's name and the date of the interview, so that interviews were not duplicated.

Participants were each given $10 at completion of the interview and wound assessment in appreciation of their time and cooperation. When payment was received the participant initialed a form (Appendix C) concerning receipt of the information sheet and receipt of the compensation money. The form included the participant's name, the amount of payment, the data researcher's signature, and the date. This form was added to each participant's chart. No monetary award was given to participants who did not complete the interview or assessment.

Data collection was reviewed after the first five participants had completed the pilot phase of the study. The data collection process was reviewed and evaluated. Feedback on the process was obtained from the wound care center, and the research process continued.

Instruments

Bates-Jensen Wound Assessment Tool (BWAT). The Bates-Jensen Wound Assessment Tool was developed cooperatively by Bates-Jensen with Bolton and colleagues (2004) for documentation of wound assessments. The instrument was formerly known as the Pressure Sore Status Tool (PSST) with a content validity index of .91 and a mean inter-rater reliability coefficient of .915 among enterostomal therapy nurses, and .78 among practitioners (Bates-Jensen, Vredevoe, & Brecht, 1992; Bates-Jensen & McNees, 1995). The PSST was subsequently modified to accommodate all types of wounds (Bolton et al., 2004). Cronbach's alpha (internal consistency reliability coefficient) for this instrument is .96 (Bolton et al., 2004). It was used to document wound characteristics (such as size, surrounding tissue, exudate, presence of necrotic or granulation tissue, and epithelialization) as obtained during clinical wound assessments. Sensation around the wound and current treatment regime were documented additionally. This BWAT empirically captured disruption of skin integrity as described in the Theory of Wound Itch. The instrument contains two items for documentation of wound location and shape, 13 numbered assessment items, and a "Wound Status Continuum." The descriptors for each assessment item are scored and ranked on a modified Likert scale (*1* being the healthiest attribute of the characteristic and *5* being the least healthy attribute of the assessment item). A higher score indicates a more severe wound status. The 13 assessment items scores are added to determine a numerical indicator of wound health or degeneration (Lyder & Ayello, 2010). Two items were added to the BWAT: an item for recording sensation in the area of the wound and an item for recording current dressing. Permission to use the instrument was obtained from Dr. Bates-Jensen and Dr. Bolton. See Appendix D for the BWAT.

Medical (10 gram) Monofilament. A disposable 10-gram monofilament (Medical Monofilament Manufacturing, Plymouth, MA) was used, following the procedure as described

by Driver, Landowski, and Madsen (2007), to determine sensation in the area of the wound. The American Diabetes Association recommends annual screening for diabetic neuropathy using the10-gram monofilament (Boulton et al., 2005) with intra-rater reliability established for assessment of cutaneous sensitivity in feet (Collins et al., 2010). The monofilament is a hand-held device with a short filament (fishing line) attached to a paper handle. The instrument has been standardized to deliver a 10-gram force to an area of the skin. Before assessment of sensation, the procedure was explained to the participant. According to the procedure, the participant was positioned for comfort and so that the area of the wound was accessible. The monofilament was first used on the participant's hand so that the participant knew what to expect. The participant was instructed to say "yes" when the monofilament was felt against the skin. The monofilament was applied perpendicular to the surface of the skin, within two centimeters of the wound margin, avoiding callus or open skin, and with enough force to cause the filament to bend. The monofilament was applied to a maximum of three areas, and only until sensation was confirmed, totaling approximately one to two seconds to approach, contact, and release each time. Sensation around the wound was recorded as a numbered response on the BWAT: 3 if sensation was felt in at all three areas, 2 if sensation was felt in two areas, 1 if sensation was felt in only one area, and 0 if sensation was not confirmed in any area.

Paul-Pieper Itching Questionnaire. The Paul-Pieper Itching Questionnaire (PPIQ), an instrument developed specifically for the evaluation of wound itch and persons' treatment of it, was developed by Dr. Barbara Pieper and the primary investigator of this study. The instrument was added to the data collection portion of Dr. Pieper's study, which was funded by the National Institute of Health, entitled "Effect of Drug Use on the Legs: Chronic Venous Insufficiency, Mobility and Pain." The larger study explored chronic venous disease, mobility and pain in

persons in methadone treatment. The Paul-Pieper Itching Questionnaire is a compilation of questions based on itch literature and clinical experience. It consists of 15 interview questions: three rating scales and 12 multiple response items concerning itching around the wound, itching on the wound, timing of wound itch, and treatments used for wound itch. This instrument empirically captures wound itch, regulation, and protection as described in the Theory of Wound Itch. Items are nominal so the responses were hand scored. Reliability of this instrument could not be calculated because it is a survey versus a summative rating scale. Based on use in the previous study (Paul et al., 2010), options were deleted related to no itch, and an early end-point was added for cases with no itch. Several options for treatment of itch were added as well as an item to determine what aggravates wound itch. See the Paul-Pieper Itch Questionnaire in Appendix E.

Characteristics of Itch Questionnaire. The Characteristics of Itch Questionnaire was developed by Dr. Gil Yosipovitch and colleagues, based on the Eppendorf Itch Questionnaire (Dawn et al., 2008). The Eppendorf Itch Questionnaire was developed based on the short form of the McGill Pain Questionnaire (Darsow et al., 2001). The Characteristics of Itch Questionnaire includes 10 demographic items, six items regarding itch history, 45 itch descriptors, an item regarding timing of itch, and an item about scratching. Wound-related itch is rated as 0 for *not at all,* 1 for *to a minimal extent* or *rarely*, 2 for *to a mild extent* or *maybe sometimes*, 3 for *to a moderate extent* or *occasionally*, and 4 for *to a great extent* or *very much*. Completion of the instrument took 15 to 20 minutes. This instrument empirically captured wound itch, regulation, and protection as described in the Theory of Wound Itch. The items are nominal and ordinal. Test-retest reliability is .8. Scoring was done by hand. See Appendix F for the Characteristics of Itch Questionnaire. As items are replicated between the Paul-Pieper

Itching Questionnaire and the Characteristics of Itch Questionnaire, the two instruments were divided and reorganized for a more logical sequence of questions for the interview. See Appendix I for the complete Wound Itch Interview Tool.

RAND-12 Health Status Inventory. The RAND-12 Health Status Inventory (RAND-12) is the short form of the RAND-36, which was developed to measure general health status (Hays et al., 1998). The RAND-12 consists of the same questions as the widely used Short Form 12 (SF-12), but with RAND scoring factor weights have been calculated with oblique rotation, so physical health and mental health components are allowed to correlate (Windsor, Rodgers, Butterworth, Anstey, & Jorm, 2006). The RAND-12 has demonstrated greater sensitivity than the SF-12 in persons with more moderate symptom severity (Lee, Browne, & Villanueva, 2008). Eight health constructs are covered: physical functioning (two items), role limitations caused by physical health problems (two items), pain (one item), general health perceptions (one item), emotional well-being (two items), role limitations caused by emotional problems (two items), social functioning (one item), and energy/fatigue (one item) (Hays et al., 1998). Two summary scores can be calculated (one for physical health and one for mental health) as well as a composite health score. Scores can be checked against established *t*-scores (Hays et al., 1998). Internal consistency reliability coefficients for the individual scales of the RAND-36 are reported with description of the RAND-12 as ranging from .71 to .90, with coefficients for the composite scales higher at .88 to .96 (Frederick, 2001). The instrument took only two to three minutes to complete. Continuity, as described in the Theory of Wound Itch, is empirically indicated by this instrument. This instrument is in the public domain and was used with permission granted by The Psychological Corporation. See Appendix G for the RAND-12.

Brief Pain Inventory. The Brief Pain Inventory (BPI) was originally developed for

cancer patients to measure intensity of pain and pain interference (Daut, Cleeland, & Flanery, 1983). Validity of the BPI for assessment of non-cancer pain has been established (Keller, Bann, Dodd, Schein, Mendoza, & Cleeland, 2004). The instrument has demonstrated a coefficient alpha above .7 and acceptable test-retest correlations (Statistics Solutions, 2010). The BPI consists of 15 items and addresses pain location, chronicity of pain, severity of pain, pain interference, and amount of relief. Scores for worst pain, least pain, average pain, and pain now are given along a 0-to-10 continuum, with high scores indicating more severe pain. A Pain Severity Score can be obtained from the mean of the scores for worst, least, and average pain (Keller et al., 2004). Scores for the amount of pain interference with general activity, mood, walking ability, normal work, relations with other people, sleep, and enjoyment of life over the past 24 hours are given along a 0-to-10 scale, with high scores indicating more interference. A Pain Interference Score can be obtained by averaging the scores for pain interference (Keller et al., 2004). The instrument took approximately five to ten minutes to complete. The BPI was included to allow participants to discuss their pain and to distinguish itch from pain. Descriptors of pain as included on some versions of the BPI overlapped with descriptors in the Characteristics of Itch Questionnaire. Participants rated descriptors for pain as included in the Characteristics of Itch Questionnaire and as taken from the McGill Pain Questionnaire to allow discussion of painful wound sensations and to allow further comparison of itch to pain. The Brief Pain Inventory is in the public domain. See Appendix H for the Brief Pain Inventory.

The instruments were included in entirety in the interview but were re-arranged for interview flow and clarity. The resulting Wound Itch Interview Tool is included in Appendix I.

Medical Record Data Collection Tool. Participants' medical records were accessed to obtain five categories of information including wound type/diagnosis, dermatologic diagnoses,

medical diagnoses, current medications, and allergies. The dermatologic diagnosis and current medications are items on the Characteristics of Itch Questionnaire. Wound type/diagnosis, medical diagnoses, and allergies were added as information that is likely pertinent to experiences of itch. The Medical Record Data Collection Tool is included in Appendix J.

Ethical Considerations

The primary investigator completed all Collaborative Institutional Training Initiative (CITI) modules for researchers prior to collecting data. Approval to conduct this study was obtained from Beaumont Hospital's Commission of Nursing Scholarship and Research (see Appendix K) and Beaumont's Human Investigation Committee (see Appendix L) and Wayne State University's HIC (see Appendix M). An amendment to the research protocol to include the office of a podiatrist was also approved by both institutions.

Data were collected only once each participant had agreed to participate in the study and had received the information sheet about the research study. Every effort was taken to maintain participant privacy and confidentiality of information. The interviews and wound assessments were conducted in private rooms of the wound care center. Participants' wounds were assessed, which may have caused discomfort. Wound assessments were done concurrently with the wound care physician or nurse practitioner to avoid unnecessary discomfort associated with dressing changes and wound assessments. Participants were asked to recall and discuss the personal and potentially distressing phenomena of wound itch and pain. Analgesics or anti-pruritics were offered as indicated. Participants may have felt obligated to participate in the study, as the wound care center staff encouraged participation. All participants were given the option of discontinuing participation in the study at any time during the interviews or wound assessments.

A paper list of participants and their coded identifiers were kept in a locked cabinet in the primary investigator's office, which is located in the hospital with which the wound care center is affiliated. Only the primary investigator had access to the list. A booklet of participants' names without coded identifiers was kept at the wound care center. Only the primary investigator and wound care center staff had access to the booklet, to keep track of study participants in order to prevent duplication of data. Photographs were taken in such a manner that participants cannot be identified in them. Completed data collection forms continue to be stored in a second locked cabinet in the primary investigator's office and have been coded so as not to contain identifying information.

Data Analysis

Data were analyzed using SPSS (Version19) software. As a doctoral student, the primary investigator received statistical assistance from the Center for Health Research, College of Nursing, Wayne State University. Descriptive statistics were used, including X^2, *t*-tests, and other exploratory procedures. The primary outcome measure, wound itch, was measured with five questions on the Paul-Pieper Itching Questionnaire (question numbers 9 – 13). Two questions measured severity of itch. Wound itch was measured dichotomously (yes/no) with one question. Two questions were used to determine if itch was sensed on the wound versus near the wound. Responses of those two questions were combined and recorded as wound-related itch. The distribution of itch was dichotomous as wound-related itch was either present or not present.

Descriptive statistics were used to answer the research question concerning the frequency, timing, duration and intensity of itch related to chronic wounds and the research question concerning treatments used by participants manage wound itch. Descriptive statistics, including frequencies, ranges, and means, were used to summarize wound itch frequency,

timing, duration, and intensity as well as information about therapeutic measures.

Characteristics of wounds were assessed with the Bates-Jensen Wound Assessment Tool, which assesses 13 wound characteristics with ordinal response scales coded one through five, with higher scores indicating more serious wound status. The association of each characteristic to wound itch was evaluated. Four types of analyses were performed: (a) Independent group *t*-tests were used to compare mean ratings across itch and non-itch groups. This analysis treats the ordinal categories numerically and is a sensitive test when the probability of itch is linearly related to wound characteristics. Student's *t*-tests column proportions were reviewed to further explore significant categories within wound characteristics, but did not provide meaningful results. The independent group *t*-test is comparable to the point-biserial correlation between itch and the wound characteristic score, the ordinary least squares regression of itch on the wound characteristic, and the linear by linear association in the chi-square results for the SPSS Crosstabs procedure. (b) X^2 tests of association were used to identify significant associations between itch and wound characteristics. The X^2 test can detect associations that are not linear. (c) Bar plots were examined to determine the possibility of nonlinear functional relationships that would not be identified with either *t*-test or X^2. (d) Logistic regression analysis was used to test nonlinear functional relationships when descriptive plots showed nonlinearity in column proportions (e.g., when the conditional probability of itch, given the level of wound characteristic, could be described as a trend that first increased, then decreased).

The logistic regression used four pre-defined contrasts. Each contrast compared the first wound characteristic category with one of the succeeding categories. Binary logistic regression was used to analyze wound itch associated each subsequent category against the lowest (best) category for each wound characteristic on the Bates-Jensen Wound Assessment Tool. Logistic

regression was also used to provide 95% confidence intervals for category proportions.

Spearman's rank order correlations and point-biserial correlations were calculated and compared to determine the magnitude of linearity of each Bates-Jensen wound characteristic. Spearman's rank order correlation is a non-parametric index in which all data are first ranked for each of the two variables, and the ranked data are subsequently correlated. The point-biserial correlation coefficient is appropriate when one measure is on an interval scale (Bates-Jensen wound characteristic) and the other measure is dichotomous (wound itch present or not present).

The research question concerning the effect of wound itch on quality of life was analyzed by using independent samples *t*-tests to compare responses of participants who reported wound-related itch with responses of participants who did not report itching. Independent samples *t*-tests of the Physical Component Scores as well as the Mental Component Scores for participants with and without wound-related itch were also performed.

Correlations between responses about wound itch and responses about pain were calculated to answer the research question concerning the relationship between wound itch and pain. Descriptors of wound itch were correlated with descriptors of wound pain.

CHAPTER V

Results

Sample Characteristics

Participants. Persons (N = 200) with wounds being followed at the wound care center were interviewed and their wounds assessed. Data from one participant were excluded from data analysis due to the extent of missing data: data from 199 participants were included in the analysis. Their ages ranged from 21 to 98 years with a mean age of 67 years. Participants included 112 males (56%), 170 white persons (84%), including 95 (48%) who were married. Wound-related itch, determined by combining positive responses about itch in or around the wound, was reported by 56 (28%) of the 199 participants. Participants with wound-related itch (n = 56, 28%) were compared to participants without wound-related itch (n = 143, 71.5%) throughout the analyses. Mean age of those with wound-related itch was 62.73 years (SD = 14.44 years), which was lower (but not significantly lower, p = .52) than the mean age of those without itch, 68.42 years (SD = 13.63 years). The itch and no itch groups were similar in terms of participant characteristics (see Table 3). The group with wound-related itch included 30 males (53%), 45 white persons (80%), including 32 (51%) who were married. Table 3 compares participant characteristics between those with wound-related itch and those without wound-related itch.

Not all patients seen at the wound care center participated in the study. A total of 18 persons refused to participate with three simply not wanting to participate, one not interested, one depressed about the wound, two suspicious, two citing lack of time, three with family members stating not enough time, two denying sensation and symptoms, and four stating the wound being followed had healed. Several were not included due to skin conditions and

extensive rashes. Ten patients were too confused to answer questions appropriately. One patient was deaf and had communication difficulties. Three patients did not speak English. One patient was agreeable to participate in the study but fell asleep as the study was introduced.

Table 3

Participant Characteristics

Participant Characteristic (X^2)	Wound-related Itch (n = 56)	No Itch (n = 143)	Total (n = 199)
Gender (X^2 = .23, p = .63)			
Male	30	82	112
Female	26	61	87
Race (X^2 = 3.51, p = .32)			
White	45	124	169
Black	9	18	27
Hispanic	1	0	1
Country (X^2 = 10.89, p = .37)			
USA	52	135	187
Canada	1	1	2
Marital Status (X^2 = 5.37, p = .25)			
Married	32	63	95
Widowed	10	33	43
Never married	10	22	32
Education (X^2 = 4.5, p = .72)			
Completed 2 to 4 years of college	19	41	60
Completed high school	14	44	58
Employment Status (X^2 = 13.15, p = .02)*			
Retired	20	76	96
Unemployed	19	24	43
Employed full-time	13	20	33
General Health (X^2 = 5.27, p = .15)			
Good	21	67	88
Fair	25	49	74
Poor	4	22	26

Note. * denotes significance: $p <$ or = .05.

Using chi-square (X^2) test of independence, a significant difference was found between

groups in terms of employment status (X^2 [2, N = 172] = 13.15, p = .02) with fewer participants with itch (n = 20, 35.7%) being retired compared to participants without itch (n = 76, 53.1%), and more participants with itch (n = 19, 33.9%) being unemployed compared to participants without itch (n = 24, 16.8%). No other significant differences were found between groups for other characteristics including gender, race, marital status, education, or general health status.

Participants presented with varying medical conditions. The most frequent co-morbidities as reported in the medical record are listed in Table 4. More than 62% were identified with a history of hypertension.

Table 4

Frequency of Most Commonly Occurring Co-morbidities

Co-morbidity	Wound-related Itch (n = 56)	No Itch (n = 143)	Total (%) (n = 199)
Hypertension	33	91	124 (62.3%)
Diabetes mellitus	19	60	79 (39.7%)
Arthritis	23	51	74 (37.2%)

Chi-square tests of association were used to compare participants with and without wound-related itch based on 26 medical diagnoses. Wound-related itch occurred significantly more in persons with deep vein thrombosis (DVT) (X^2 [1, N = 199] = 5.11, p = .02) and with intravenous drug abuse history (IVDA) (X^2 [1, N = 199] = 4.43, p = .04). Among those persons with a DVT history (n = 40, 20.1%), proportionally more (n = 17, 30.4%) reported wound-related itch than those persons without itch (n = 23, 16.1%). Although only a total of four

participants had a history of IVDA, proportionally more (n = 3, 5.4%) reported wound-related itch than those without itch (n = 1, 0.7%).

Wounds. Each participant's largest or most bothersome wound was assessed. Table 5 depicts wound parameters including wound type, wound location, and wound age.

Table 5

Wound Parameters

Wound Parameter (X^2)	Wound-related Itch	No Itch	Total
Wound Type (X^2 = 10.24, p = .12)			
Traumatic	10	27	37(18.9%)
Pressure	6	27	33 (16.8%)
Diabetic/neuropathic	5	26	31(15.8%)
Venous*	14	17	31(15.8%)
Arterial	7	16	23 (11.7%)
Mixed vascular	0	3	3 (1.5%)
Other	13	25	38 (19.4%)
Wound Location (X^2 = 4.14, p = .04)*			
Head/trunk/upper extremities	3	23	26 (13.1%)
Lower extremities	53	119	172 (86.9%)
Wound Age (X^2 = 4.88, p = .56)			
<1 week	2	7	9 (4.8%)
1 week to 1 month	6	19	25 (13.3%)
>1 to 6 months	19	60	79 (42.0%)

Wound Parameters (Continued)

Parameter (X^2)	Wound-related Itch	No Itch	Total
>6 months to 1 year	11	14	25 (13.3%)
>1 to 5 years	10	23	33 (17.6%)
5 to 10 years	3	4	7 (3.7%)
>10 years	3	7	10 (5.3%)
Sensation around Wound ($X^2 = 9.35$, $p = .03$)*			
3 areas sensed	25	50	75 (38.9%)
2 areas sensed	12	25	37(19.2%)
1 area sensed	12	22	34 (17.6%)
0 areas sensed	5	42	47 (24.4%)

Note. * denotes significance: $p <$ or = .05.

Wound Type. Wound type was determined by physician diagnosis as included in the patient record or by presentation if a diagnosis was not documented. Chi-square analysis did not show that type of wound was significantly associated with wound itch; however, there were proportionally more venous wounds with wound-related itch (n = 14, 55%) than wound-related itch in other types of wounds.

Wound Location. For wound location, head, trunk and upper extremity wounds were grouped together for comparison to lower extremity wounds, as there were comparatively so many lower extremity wounds. Chi-square analysis showed a greater likelihood for wounds in the lower extremities to be itchy versus wounds in other areas of the body (X^2 [1, N = 198] =

4.14, p = .04). Only three (11.5%) of upper body wounds itched compared to 53 (30.8%) of lower extremity wounds that itched.

Wound Shape. Most wounds (n = 94, 47.2%) were round, followed by those with an irregular shape (n = 72, 36.2%). No significance was found between wound shape and wound itch.

Wound Age. Wound age ranged from less than one week to greater than 10 years with the greatest number of wounds (n = 79, 42%) being present one to six months. No significance was found between wound age and wound itch.

Sensation in the Area of the Wound. Sensation in the area of the wound was significantly associated with wound-related itch: X^2 (3, N = 193) = 9.35, p = .03. Among persons with no sensation in the area of the wound, proportionally fewer experienced wound-related itch (n = 5, 10.6 %) than those who did not itch (n = 42, 89.4%).

Research question #1: What is the frequency, timing, duration, and intensity of itch related to chronic wounds?

Frequency. Wound-related itch was reported by 56 (28.1%) participants. Of the 56 participants who responded that they had wound-related itch in the interview, 44 had stated so in response to the screening question, and 12 had not. Nine participants who said they had wound-related itch at the time of the screening questions did not identify wound-related itch during the interview.

Timing. Timing of itch was difficult to capture. People often responded that the wound itched whenever the dressing was removed, but this response was not recorded. The most frequent response about timing of wound-related itch was *in the night* (n = 15), followed by *in the evening* (n = 14), *in the morning* (n = 6), and *during the day* **(**n = 1). No seasonal variation

was found.

Duration. Wound-related itch was described as *intermittent* by 51 participants (98.1%) versus one person who described it as *continuous*. The most frequent response given about duration of wound-related itch episodes was *minutes*. The longest episode of wound-related itch was described by one participant as lasting "hours and hours."

Intensity. Participants rated intensity of a typical episode of wound-related itch on a scale of one-to-ten, with 1 meaning none and 10 meaning *unbearable*. Mean response was 5.59 (*SD* = 2.88). Most participants (*n* = 22, 51.2%) rated the result of scratching as *highly pleasurable*, while one person (2.3%) rated the result of scratching as *highly unpleasurable*.

Research question #2: What is the relationship between wound characteristics and itch?

Characteristics of wounds were assessed with the Bates-Jensen Wound Assessment Tool (BWAT), which assesses 13 wound characteristics with ordinal response scales coded one through five. The scales are summated to arrive at a total BWAT score with higher scores indicating more serious wound degeneration and lower scores indicating tissue health and wound regeneration. Measurement of wound surface area (length x width) was also examined as an alternative to the Bates-Jensen ordinal measure. The association of each characteristic to wound itch was evaluated. When *t*-test results are reported, the values for equal variance not assumed were used if Levene's test for equality of means was significant; these values are used when *t*-test results are reported in the text.

Wound Measurement. Measurement of wound surface area ranged from 0.01 to 176 cm^2 (M = 9.05, SD = 21.9) for wounds without itch, compared to 0.16 to 567 cm^2 (M = 20.95, SD = 78.4) for wounds that itched. This difference was not significant, t (58.4) = -1.78, p = .08. The presence of one very large wound among the wounds that itched could have skewed this

comparison. With this outlying measurement replaced with the next smallest value in the distribution, 176cm^2, by the process of Winsorizing, a significant difference was found between wounds that itched and those that did not: t (72.71) = -2.38, p = .02, d = .50, 95% CI[-21.88, -1.92].

Size Category. Wound size (length x width) was categorized on a 1-to-5 scale from 1 for *l x w < 4 sq cm*^{2} to 5 for *l x w > 80 sq cm*^{2}. There was a significant linear association between wound size category and itch: point-biserial correlation = .260, p < .001. See Table 6. Treating the size categories as nominal, there was a significant association between itch and wound size category: X^2 (4, N = 199) = 13.54, p = .009. Itch was reported significantly more often in Categories 4 and 5 than in Category 1. These results are shown in Figure 3 and Table 6.

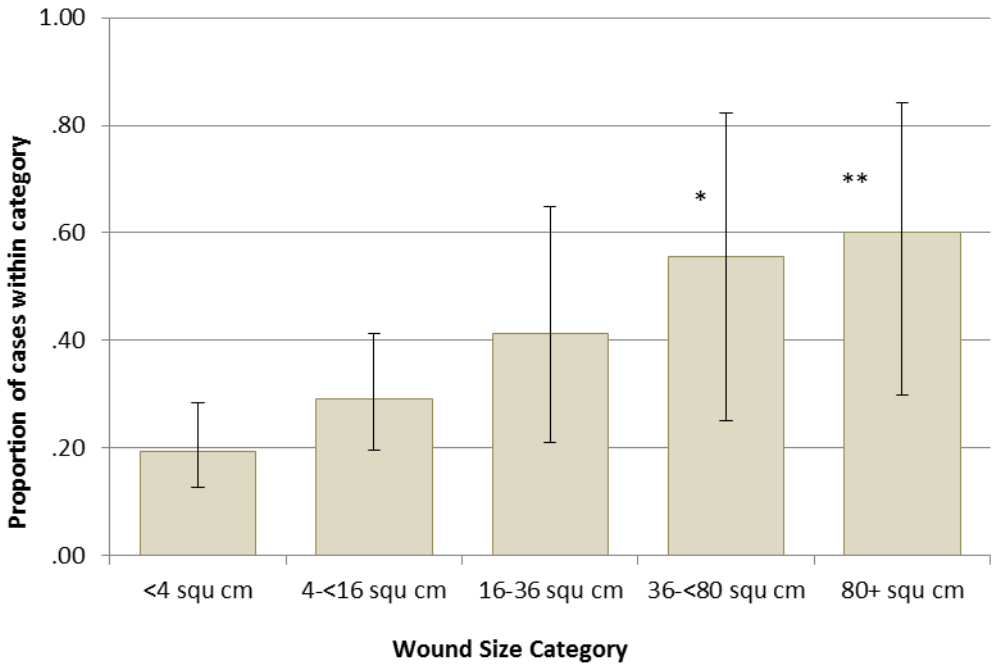


Figure 3. Proportion of cases with itch within each wound size category. The larger the wound the greater the itch. Compared to *< 4 squ cm* category a higher probability of itch was associated with *36 -<80 squ cm*, p = .022; and *80+ squ cm*, p = .008. Also shown are the 95% confidence intervals, N = 199. * p < .05, **p < .01.

Depth. Wound depth did not differ between wounds that itched and those that did not itch: t (114.16) = 0.18, p = .86, d = .03, 95% CI [-0.27, 0.03].

Edges. Wound edges did not differ between wounds that itched and those that did not itch: X^2 (4, N = 199) = 2.44, p = .79.

Undermining. Chi-square analysis of wound itch and undermining was not significant: X^2 (4, N = 198) = 8.79, p = .07. Too few wounds had undermining for analysis. However, the independent samples t-test showed that significantly more wounds with related itch had no undermining: t (195.05) = 2.38, p = .02, d = .29, CI[0.04, 0.42].

Necrotic Tissue Type. Necrotic tissue type did not differ between wounds that itched and those that did not itch: X^2 (4, N = 198) = 4.26, p = .33.

Necrotic Tissue Amount. The amount of necrotic tissue in the wound base did not differ between wounds which itched and those that did not itch: t (104.20) = -1.24, p = .22, d = .19, 95% CI[-0.83, 0.19]. However, greater itch was associated with Category 4 than with Category 1. See Figure 4 and Table 6.

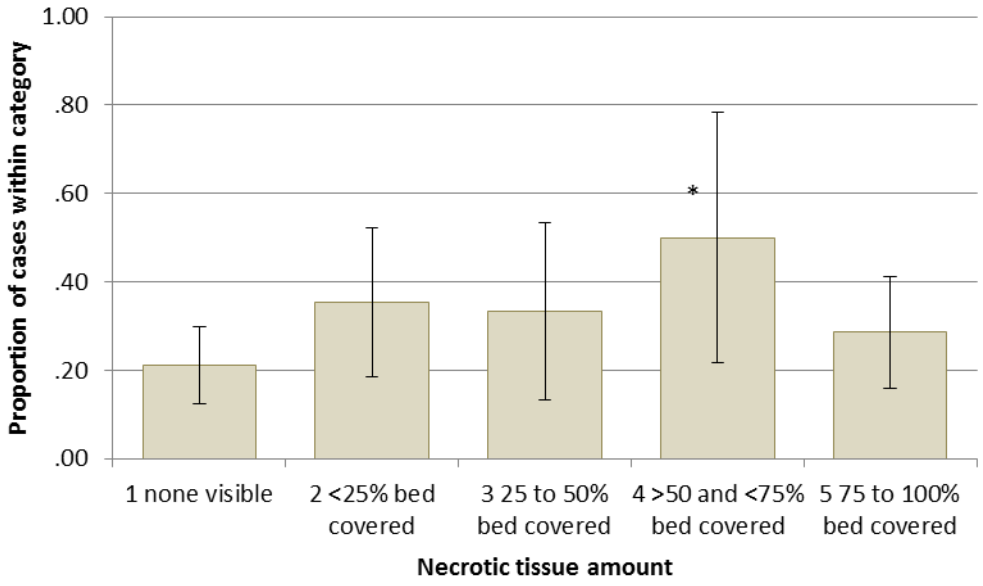


Figure 4. Proportion of cases reporting itch within each category of necrotic tissue amount. Compared to *none visible*, more itch was reported for Category 4 *>50 and <75%*, p = .039. Also shown are the 95% confidence intervals, N = 199. * $p \leq .05$.

Exudate Type. No significance was found between wounds which itched and those that did not itch related to exudate type: X^2 (4, N = 198) = 5.49, p = .24.

Exudate Amount. There was a significant association between exudate amount and itch (X^2[4, N = 198] = 11.68, p = .02). Greater itch was associated with Category 4, *moderate amount*, than with Category 1, *none*, p = .05. See Figure 5 and Table 6.

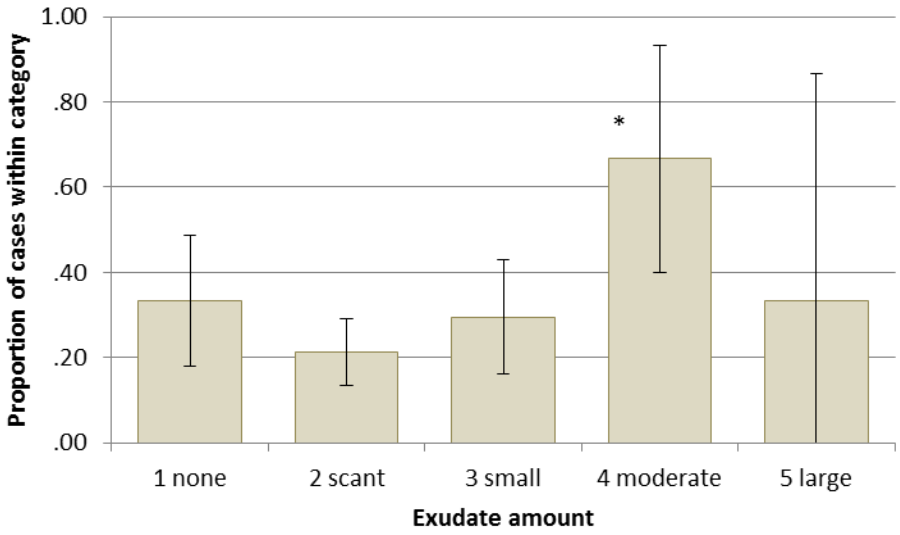


Figure 5. Proportion of cases reporting itch within each exudate amount category. Compared to the amount of itch reported for wounds with no exudate, more itch was reported for wounds with a moderate amount of exudate, $p = .050$. Also shown are the 95% confidence intervals, $N = 199$. * $p \leq .05$.

Skin Color Surrounding Wound: Skin color surrounding the wound did not differ between wounds that itched and those that did not itch: $X^2 (4, N = 198) = 3.20, p = .53$.

Peripheral Tissue Edema. Wounds with edema were more likely to itch: $t (88.38) = -2.20, p = .03, d = .37$, 95% CI[-0.93, -0.05]. A significant difference in column proportions was found between those in the category of *pitting edema < 4 cm around the wound* and those in the category of *no swelling or edema.* See Figure 6 and Table 6.

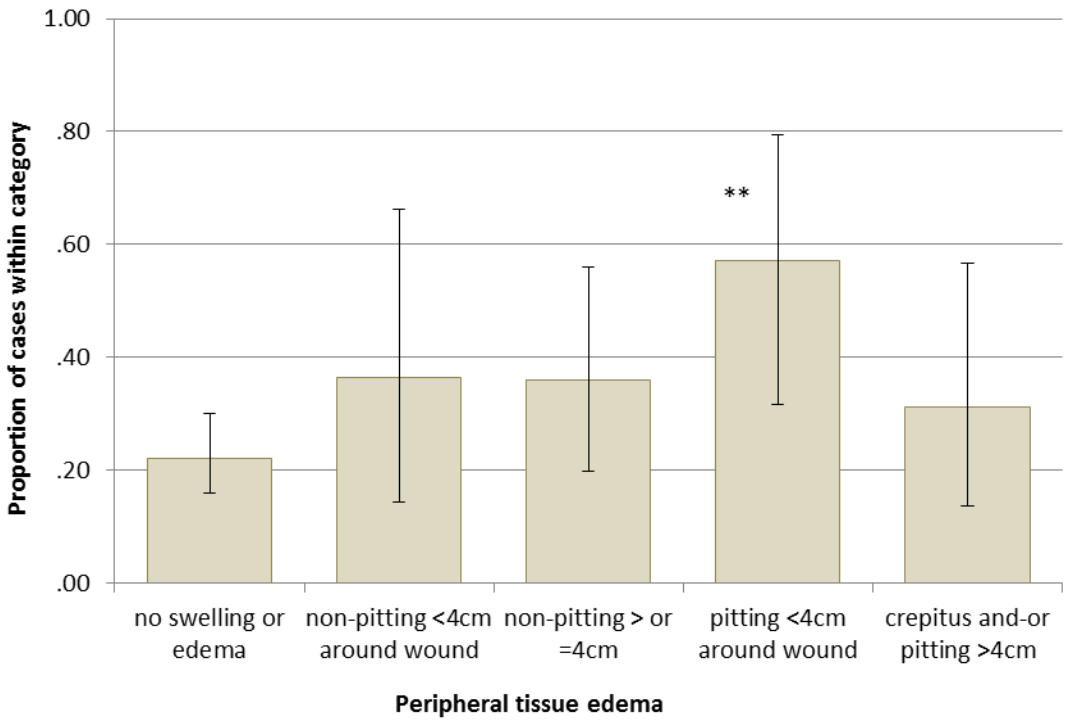


Figure 6. Proportion of cases with itch within each category of edema. Compared to *no swelling* a higher probability of itch was associated with *pitting < 4 cm*, $p = .008$. Also shown are the 95% confidence intervals, $N = 197$. ** $p < .01$.

Induration. Although the Student's *t*-test showed a linear relationship between wound itch and induration, only seven wounds demonstrated induration. X^2 analysis showed no significant difference between wounds that itched and those that did not itch related to induration: $X^2(3, N = 197) = 5.55, p = .14$.

Granulation Tissue. Wounds with granulation tissue present in the base were more likely to itch: $X^2(4, N = 198) = 8.06, p = .09$. Compared to those in the S*kin intact* category, a higher probability for itch was associated with the categories of *beefy or filled 75% to 100%* ($p = .035$), and *beefy or filled 25% to 75%* ($p = .044$). See Figure 7 and Table 6.

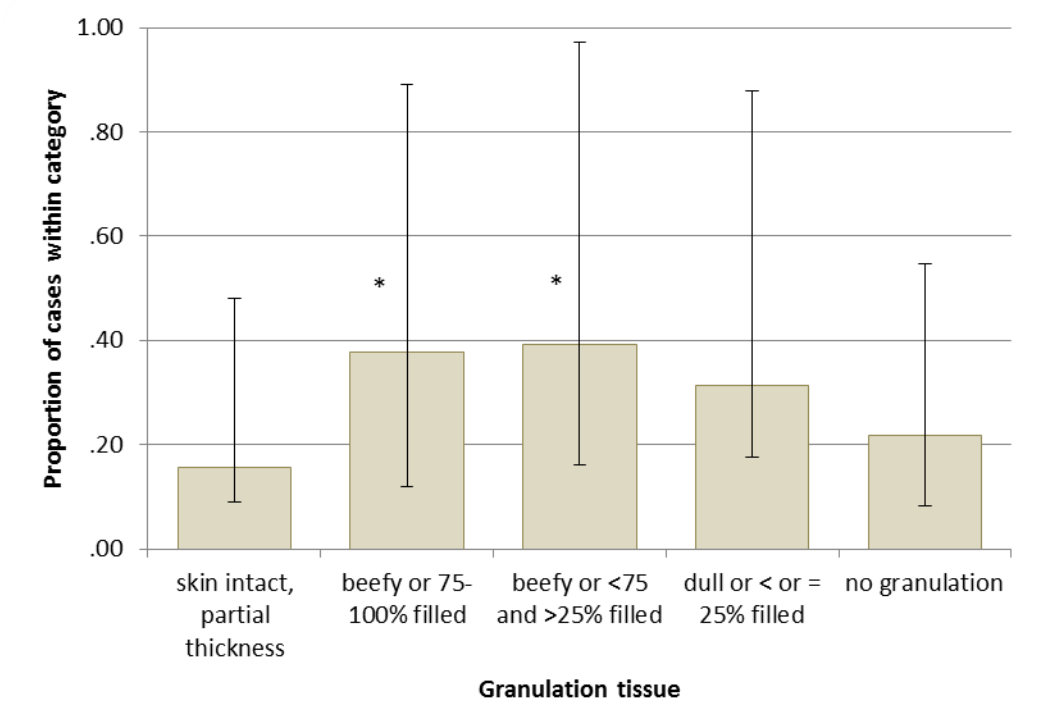


Figure 7. Proportion of cases with itch within each category of granulation tissue. Compared to *skin intact* a higher probability of itch was associated with *beefy or 75% to 100 % filled*, $p = .035$; and *beefy or <75% and > 25% filled*, $p = .044$. Also shown are the 95% confidence intervals. Note the asymmetry of the interval since proportions cannot be less than one, $N = 198$. * $p < .05$.

Epithelialization. No significance was found between wounds that itched and those that did not itch for wound epithelialization: $X^2(4, N = 198) = 1.47, p = .83$.

Table 6 summarizes and compares the results of five different tests of statistical association used in the analysis of the Bates-Jensen Wound Assessment Tool items: (a) the Spearman rank order correlation, (b) Student's *t*-test assuming equal within-group variance, (c) unequal variance *t*-test as used where Levene's test for unequal variance was significant, (d) Pearson chi-square, and (e) binary logistic regression. As a measure of the magnitude of linear association, the point-biserial correlation is also shown. The Student's *t*-test is a test of the significance of the point-biserial correlation. Wound size, peripheral edema, and tissue induration were linearly associated with itch ($p < .05$). Necrotic tissue amount, exudate amount, peripheral edema, and granulation tissue showed significantly elevated itch within categories.

Table 6.
Comparison of p Values for Different Statistical Tests of Association Between Bates-Jensen Wound Characteristics and Self-reported Wound Itch

Wound Characteristic	Point biserial correlation coefficient[a]	*p* Value								Comment
		Spearman's rank order correlation[b]	Student's t-test	Unequal variance t-test[c]	Pearson Chi-square	Binary Logistic Regression				
						Category				
						2	3	4	5	
1. Wound size category	.260	**.001**	**.0002**	**.002**	**.009**	. 148	.054	**.022**	**.008**	**See Figure 3.**
2. Wound depth	-.012	.852	.8667		.690	.54	.25	.35	1.0	Category 5 was reference.
3. Wound edges	-.055	.511	.4390		.781	.647	.513	.274	.625	
4. Wound undermining	-.123	**.041**	.0837	**.018**	.067					Too few to estimate.
5. Necrotic tissue type	.135	.077	.0583		.329	.427	.155	.584	.081	
6. Necrotic tissue amt.	.087	.148	.2244		.202	.119	.244	**.039**	.335	**See Figure 4.**
7. Exudate type	.053	.469	.4582		.833	.999	.579	.366	1.00	ML estimate does not exist. .
8. Exudate amount	.110	.233	.1244	.175	**.021**	.153	.716	**.050**	1.00	**See Figure 5.**
9. Skin color	.080	.110	.2602		.533	.999	.579	.366	1.00	ML estimate does not exist.
10. Peripheral edema	.164	**.012**	**.0211**	**.031**	.052	.291	.144	**.008**	.418	**See Figure 6.**
11 Tissue induration	.144	**.020**	**.0438**	.118	.135	.162		.467	.120	Only 7 with induration.
12 Granulation tissue	-.040	.675	.5763	.552	.089	**.035**	**.044**	.217	.475	**See Figure 7.**
13. Epitheliali-zation	.045	.747	.5272		.823	.563	.522	.271	.424	

Notes. The statistics used were Spearman's rho, Student's *t*, Unequal variance *t*-test, Pearson chi-square, and binary logistic regression.

[a]The point-biserial correlation is a measure of magnitude of linear association and the corresponding test of significance is Student's *t*-test.

[b]Spearman's rank order correlation is nonparametric measure of monotonic association and captured two effects not found using binary logistic regression.

[c]This result is shown only when the Levene test of equal variance is rejected.

Inspection of the condition probabilities in the Crosstabs tables showed a general tendency for itch to be more highly associated with the middle rather than the end categories.

This was apparent in significant logistic regression findings for necrotic tissue amount, exudate amount, peripheral edema, and granulation tissue. See Figures 3 through 7.

Total scores of the Bates-Jensen Wound Assessment Tool ranged from 15 to 46 along the Wound Status Continuum with no significant difference found between wound itch and total score: X^2 (7, N = 197) = 10.85, p = .15. Total scores fell between wound regeneration and wound degeneration.

Research question #3: What treatments do participants use to manage wound itch?

Wound itch treatment options were selected by 59 participants. See Table 7.

Table 7

Treatments Used for Wound-related Itch

Treatment	Number of Responses	Percent of Responses
Rubbing the area	29	14.5
Scratching the area	24	12.0
Lotion	20	10.0
Vaseline or petrolatum	9	4.5
Hot or warm water	8	4.0
Antihistamine pill	7	3.5
Steroid cream	6	3.0
Watching TV	6	3.0
Cold pack	5	2.5
Steroid ointment	4	2.0
Cool shower or bath	3	1.5

Treatments Used for Wound-related Itch (Continued)

Treatment	Number of Responses	Percent of Responses
Listening to music	3	1.5
Antibiotic ointment	2	1.0
Epsom salt	2	1.0
Heating pad	1	0.5
Air blowing on	1	0.5
Menthol ointment	1	0.5
Menthol lotion	0	0
Antihistamine cream	0	0
Local anesthetic	0	0

Additionally, participants mentioned treatment measures that they had used were not included on the interview list: patting the area of the wound, crying, praying, yelling at the saints, stomping a foot, vinegar, reading, walking, getting off of it (i.e., sitting), taking off the dressing, baking soda, bearing it, massaging the area, egg crate, and skin prep. Although no one admitted to using it, several participants mentioned that they would like to try pouring alcohol on the wound to relieve the itch.

Research question #4: How does wound itch affect quality of life for these participants?

Independent samples *t*-tests were done on responses to the RAND-12 questions to determine if there was a significant difference between responses about health from the

participants with wound-related itch and participants without wound-related itch. No difference was noted on the quality of life measures between participants with or without wound-related itch. Independent samples *t*-tests of the Physical Component Scores as well as the Mental Component Scores for participants with and without wound-related itch were also done with no significant differences found between participants with and without wound-related itch.

Research question #5: What is the relationship between wound itch and pain?

Ratings of generalized pain and wound-related itch. Generalized pain was assessed using the items on the Brief Pain Inventory (i.e., pain location, pain interference, ratings of worst, least, and average pain over the previous 24 hours, and a rating of present pain). Participants were instructed to consider all pain, wound-related or any other bodily pain, while responding to the Brief Pain Inventory. Seventy-two participants (36%) reported no pain. Pain was rated on a 0-to-10 scale**.** The mean response for *worst pain* was 4.25 (*SD* = 3.62). *Least pain* was rated with a mean of 1.26 (*SD* = 2.02). *Average pain* was rated with a mean of 3.21 (*SD* = 6.69). This compares to the mean score of 2.17 (*SD* = 2.89) for *pain now*. An overall intensity rating for pain was not obtained, but a Pain Severity Score was calculated as a mean of the responses for *worst pain*, *least pain* and *average pain,* at 2.91.

Average pain was defined as the average level of all pain in the last 24 hours prior to the interview. Because wound itch intensity was described as the rating for itch intensity over 24 to 48 hours prior to the interviews, *average pain* (*M* = 3.21, *SD* = 6.69) was correlated with wound itch *intensity* (*M* = 5.59, *SD* = 2.88) for a significant positive correlation (*r* = .42, *p* = .002).

Wound-related pain compared to wound-related itch. Interview questions about wound-related pain (in or around the wound) were also asked. Participants (*N* = 199) responded regarding wound-related pain: 98 (49%) responded positively to confirm the presence of wound-

related pain; 101 (51%) responded negatively. This pattern contrasts with wound-related itch, about which 56 (28%) of participants responded positively to confirm the presence of wound-related itch, and 143 (71.5%) responded negatively. Wound-related pain correlated with wound-related itch for a significant positive correlation ($r = .17$, $p = .02$).

Pain in and around the wound compared to itch in and around the wound. Pain around the wound was described by 39.2% of participants compared to 26.6% who described itch around the wound. Pain in the wound was described by 44.2% of participants compared to only 9.5% who described itch in the wound. Participants were asked to further rate the amount of pain and itch in and around the wound on a zero-to-ten scale. Mean rating for pain on the wound was 2.59 ($SD = 3.43$). This correlated positively ($r = .24$, $p = .001$) with the mean rating for the amount of itch on the wound, which was only 0.49 ($SD = 1.79$). Mean rating for amount of pain around the wound was 2.35 ($SD = 3.29$), which correlated positively ($r = .34$, $p < .001$) with the mean rating for the amount of itch around the wound, which was 1.43 ($SD = 2.80$).

Descriptors of pain compared to descriptors of itch. Table 8 depicts the mean scores each descriptor received related to itch and related to pain, arranged by itch score. Descriptors receiving the highest ratings for itch were *itching*, *annoying*, and *bothersome*. Descriptors receiving the highest ratings for pain were *annoying*, *bothersome,* and *bothering*. Paired sample *t*-test analysis was done to compare ratings of the descriptors for itch to ratings for pain. Bonferoni analysis against an alpha of .000125 (alpha of .05 divided by the number of comparisons, which is 40) eliminated all significant findings between pain and itch descriptors.

Table 8

Comparison of Scores for Wound Pain and Itch Descriptors (organized by itch score)

Descriptor	Itch Score	Pain Score	*t*	Sig. (2-tailed)	95% CI
Itching	3.48	0.60	4.49	<.01	1.04, 2.80
Annoying	2.87	3.37	-1.14	---	-0.77, 0.22
Bothersome	2.63	3.19	-0.86	---	-0.97, 0.40
Bothering	2.30	3.15	-1.98	---	-1.16, 0.02
Only desire no itch	2.23	0.41	5.91	<.01	1.21, 2.53
Unpleasant	2.17	3.01	-1.75	---	-1.21, 0.10
Stubborn	1.83	2.26	-1.52	---	-1.03, 0.16
Insistent	1.67	2.17	-1.29	---	-1.09, 0.25
Disturbing my sleep	1.63	2.10	-0.98	---	-0.87, 0.31
Disgusting	1.58	2.07	-1.41	---	-1.42, 0.26
Severe	1.54	2.10	0.10	---	-0.82, 0.90
Awful	1.52	1.93	-1.29	---	-1.06, 0.24
Tiresome	1.49	2.26	-1.05	---	-1.37, 0.44
Tickling	1.49	0.29	2.26	.03	0.08, 1.63
Prickling	1.45	0.87	0.92	---	-0.50, 1.30
Inflaming	1.44	1.56	-0.46	---	-0.63, 0.40
Tiring	1.44	1.88	-1.33	---	-1.42, 0.30
Tingling	1.42	1.15	.00	1.0	-0.67, 0.67
Unbearable	1.36	1.45	0.44	---	-0.54, 0.84

Comparison of Scores for Wound Pain and Wound Itch Descriptors (Continued)

Descriptor	Itch Score	Pain Score	*t*	Sig. (2-tailed)	95% CI
Comes in waves	1.35	2.09	-1.82	---	-1.56, 0.10
Dreadful	1.34	1.32	0.20	---	-0.74, 0.90
Burning	1.32	1.72	-1.98	---	-1.36, 0.03
Unmanageable	1.31	1.12	1.56	---	-0.18, 1.29
Terrible	1.30	1.67	0.22	---	-0.71, 0.88
Stinging	1.28	1.68	-2.79	.01	-1.67, -0.25
Uncontrollable	1.27	1.11	0.69	---	-0.48, 0.96
Hurting	1.20	3.07	-3.37	.002	-2.15, -0.52
Mosquito-bite like	1.20	0.23	3.89	.001	0.54, 1.75
Oppressive	1.15	1.73	-2.29	.03	-1.59, -0.08
Torturing	1.13	1.40	0.11	---	-0.73, 0.81
Restricting my life	1.10	2.29	-3.26	.003	-2.38, -0.54
Acute	1.05	1.63	-1.52	---	-0.97, 0.15
Pinprick-like	1.00	0.87	0.85	---	-0.46, 1.10
Painful	0.96	3.10	-3.49	.002	-2.53, -0.65
Sharp	0.96	2.26	-4.21	<.01	-2.15, -0.74
More when warm	0.96	0.67	-0.79	---	-1.05, 0.47
Pricking	0.91	0.87	-0.13	---	-0.67, 0.59
Warm	0.90	0.94	-1.38	---	-1.29, 0.25
Ant-like	0.87	0.16	2.67	.01	-0.03, 1.16

Comparison of Scores for Wound Pain and Wound Itch Descriptors (Continued)

Descriptor	Itch Score	Pain Score	*t*	Sig. (2-tailed)	95% CI
Penetrating	0.86	1.91	-0.99	---	-1.03, 0.36
Throbbing	0.75	2.01	-4.25	---	-2.47, -0.86
Pulsating	0.69	1.59	-2.74	.01	-2.01, -0.29
Hot	0.63	0.74	-0.97	---	-0.96, 0.35
Like sunburn	0.61	0.35	1.97	---	-0.03, 1.16
More when cold	0.31	1.11	-1.77	---	-1.60, 0.13

Note. Descriptors with negative *t*-tests are more associated with pain; descriptors with positive *t*-tests are more associated with itch.

Additional Analysis

Paired samples *t*-tests were done between treatments used for wound-related itch and treatments used for bodily itch. Antibiotic ointment, menthol ointment, menthol lotion, antihistamine cream, capsaicin, and local anesthetic were selected for both types of itch equally. Paired sample correlations for *antihistamine pills* ($r = .45$, $p = .01$) and *watching TV* ($r = .47$, $p = .007$) showed the association of those methods of treatment for bodily and wound-related itch. *Rubbing the area* was the only treatment with significant paired *t*-test results: $t\ (30) = -3.50$, $p = .001$, 95% CI [-0.61, -0.16], so that rubbing the area was used significantly more for wound-related itch than bodily itch.

CHAPTER VI

Discussion

This study quantified and described wound-related itch. Greater than one fourth of patients being seen at the wound care center reported wound-related itch. Each wound characteristic was explored to determine its association with wound itch. Some association was found between wound itch and seven of the 13 Bates-Jensen wound characteristics. Greater wound size, more peripheral edema and more tissue induration were found to be significantly associated to wound itch ($p < .05$). Pain and itch were positively correlated. The effect of wound itch on quality of life was not discerned.

Frequency of Wound Itch

Wound-related itch was described by approximately one fourth ($n = 56$, 28%) of 199 persons being followed for their wounds and is perhaps the most important finding of this study. This finding both confirms and quantifies the existence of the wound itch phenomenon which, until now, has been recognized clinically but not described in the literature. No previous studies were found which quantified wound itch .

Participants were asked if they had itch related to their wound and, if so, were asked if the itch was around the wound, in the wound, or both in and around the wound. Then participants with wound-related itch were asked to rate the amount of itch in the wound and/ or around the wound. Because of the inconsistencies given between the questions, itch related to the wound (in or around) was tallied. There was also inconsistency in some instances between the screening question regarding wound-related itch and the responses given about wound-related itch in the interview. The inconsistency of responses between the screening questions

and the interview questions about wound-related itch may be attributed to misunderstanding or minimizing the wound itch phenomenon, as more people reported wound- related itch in the interview than in the screening questions.

That the participants with wound-related itch were elderly (M = 67.78, SD = 14.44) requires that the phenomenon be further explored in varying age groups. It is well known that aging skin tends to be prone to xerosis and pruritus (Baronoski, Ayello, Tomic-Canic, & Levine, 2012). Age-associated skin changes result in itchy skin as discussed by Norman (2003), Reddy (2008), and Yosipovitch (2004a). Transepidermal water loss is increased in the very young and the very old (Yosipovitch, 2004a). Xerosis is age-associated dry skin which is estimated to be in 30 to 60% of the adult population (Yosipovitch, 2004b).

Wound itch was found with and without sensation in the area of the wound. No persons with spinal cord injury described wound-related itch. Five of 34 persons with diagnosed neuropathy described wound-related itch. Itch with limited sensation in the area of the wound may be explained by a larger innervation area of itch-sensitive C-fibers (Schmelz et al., 1997) or a central rather than peripheral neurological process.

Significantly more itchy wounds were found in the lower extremities (p = .04), in persons with DVT (p = .02), and in persons with an injection drug use history (p = .04). Compared to other wound types, a greater proportion of persons with venous wounds reported wound-related itch. These findings are consistent with the findings of Duque, Yosipovitch, Chan, Smith, & Levy (2005) who found that 66% of persons with chronic venous insufficiency describe wound-related itch. These findings are also consistent with previous findings of Paul, Pieper, & Templin (2011) where 45.9% of persons with a history of injection drug use reported itch in the legs and/or feet, and where itchiness correlated with degree of venous disease (r =.26,

p = .025). Dermatitis with itchiness is characteristic of venous disease (Sieggreen & Kline, 2012). Persons with venous ulcers should therefore be assessed for itch and its deleterious effects. It must be noted that other wound types including arterial, neuropathic, pressure and traumatic wounds were also represented in the wound itch group. All wound types must therefore be considered as potential sources of wound itch.

Timing and Duration of Wound Itch

Timing and duration of wound-related itch were difficult to capture with patient recall and as questioned. In trying to describe time-of-day of wound-related itch, participants frequently commented that wound-related itch occurred at the time of dressing change, regardless of time-of-day. This outcome might occur due to exposure of the wound bed to air or relief of pressure from the dressing. That most participants were bothered most by wound-related itch in the night is similar to previous findings of Duque and colleagues (2005). Greaves (2005) suggests that increased itch in the night may be related to skin temperature or circadian rhythms of itch mediators.

Intensity of Wound Itch

Mean intensity of wound-related itch was 5.59 (*SD* 2.88) on a 1-to-10 scale. This can be compared to the mean score for *worst bodily pain* of 4.25 (*SD* 3.62) on a 1-to-10 scale, so that wound itch intensity was rated as worse than bodily pain.

Quality of Wound Itch

While participants had difficulty distinguishing and rating itch in and around their wounds, they were able to distinguish wound-related itch from wound-related pain and choose descriptors for each phenomenon. Descriptors receiving the highest ratings for wound-related itch were *itching*, *annoying*, and *bothersome*. *Worrisome* and *aggravating* were additional

descriptors volunteered by participants for wound-related itch: these descriptors exemplify the anxiety wound-related itch causes because of the unknown implications of the sensation. Qualities of wound-related itch could be distinguished from other wound sensations and confirmed wound-related itch as a negative sensation.

Wound Characteristics and Itch

The relationship of each wound characteristic to wound-related itch is discussed below. Characteristics of wounds and their relationship to itch have not been previously described. No association between wound itch and wound depth, wound edges, necrotic tissue type, exudate type, skin color, or epithelialization was found. Linear relationships between wound size, tissue edema, and tissue induration are discussed. Significantly elevated itch categories as found with necrotic tissue amount, exudate amount, peripheral tissue edema, and granulation tissue are also discussed.

Wound Size. Wounds that itched were larger than those which did not itch. The linear association of wound size with wound itch supports the Theory of Wound Itch, which predicts that the wound (the interrupted skin integrity) is what triggers itch. This notion contrasts with the understanding that itch is specific to the skin (Yosipovitch & Papoiu, 2008), as skin is damaged or missing in open wounds. Metze (2004) reported that itch could not be induced where epidermis had been removed. Additionally, itch is not transmitted by nerves in the deeper layers of the dermis and subcutaneous fat (Yosipovitch, Carstens, & McGlone, 2007), so the tissues in the base of the wound are likely not the source of the itch sensation. The larger wound border may produce more pruritogens such as histamine and growth factors which may explain the greater itchiness of larger wounds.

Undermining. Wounds with undermining were less likely to itch. Generalizations

about undermining and itch should not be made as so few wounds were found with undermining.

Necrotic tissue amount. Necrotic tissue is dead tissue, which is typically brown or black (Baranoski et al., 2012). It forms a blockage for wound healing, so removal of necrotic tissue promotes wound healing. While itch and necrotic tissue amount were not significantly associated, greater itch was found associated with the category of *>50% and <75% of wound covered*. Itch leads to scratch, which is an attack and remove response (Yosipovitch, Carstens, & McGlone, 2007). Although potentially damaging, scratching may serve a physiologic purpose of removing necrotic tissue by functionally debriding the wound to enable wound healing.

Exudate amount. More itch was noted at the fourth level, *moderate*, compared to other categories of wound exudate, very possibly implicating maceration. Maceration is softening of skin surrounding a wound due to excess drainage or moisture (Baranoski et al., 2012). Moderate wound drainage can moisten and macerate the peri-wound area which may trigger itch.

Peripheral Tissue Edema. Edema mechanically stretches cells and tissues, which may exacerbate itchiness. While histamine-sensitive C-nerve fibers are mechanically insensitive, edematous changes of nerve fiber bundles that occurs with mast cell invasion may provoke or aggravate itchiness (Sugimoto, Umakoshi, Nojiri, & Kamei, 1998). Additionally, other C-nerve fibers exist, which are mechanically sensitive and are able to transmit itch (Yosipovitch, Carstens, & McGlone, 2007). Histaminergic as well as non-histaminergic mechanisms for itch have been found (Patel & Dong, 2010). Protease-induced itch is transmitted via mechanically sensitive C-nerve fibers (Tey & Yosipovitch, 2011). A high probability of itch was associated with *pitting edema < 4 cm around wound* compared to other categories of edema. The differences between response categories for edema on the Bates-Jensen Wound Assessment Tool range from *non-pitting edema* at one end to *extensive pitting and/or crepitus* on the other; this

finding may explain the category-associated increase in itch probability. Itch might be minimized by controlling edema.

Induration. Induration is firmness of the tissue indicative of further tissue damage in the peri-wound area (Baranoski, Ayello, & Langemo, 2012). Induration was significantly associated with wound itch; however, analysis is limited as only seven wounds demonstrated induration. Induration is most likely related to inflammatory processes initiated by tissue damage and pruritogens as released with mast cell degradation (Baranoski et al., 2012). The inflammatory phase of wound healing is prolonged in chronic wounds (Doughty & Sparks-Defriese, 2007), so itchiness with induration follows.

Granulation tissue. Granulation tissue is the beefy, red, velvety tissue found in actively healing wounds. It is the hallmark of the proliferative phase of wound healing (Doughty & Sparks-Defriese, 2009). Granulation tissue is composed of capillary loops and connective tissue proteins with fibroblasts and inflammatory cells within. Granulation tissue in the base of the itching wound fits the physiological understanding of itch in that granulation tissue indicates active wound healing. Wound healing brings histamine, nerve growth factor, and other pruritogens into the wound (Tey & Yosipovitch, 2011). Friable granulation tissue that bleeds easily can be produced excessively in cases of wound infection (Gardner & Franz, 2012), so itching with excessive, friable granulation tissue and tissue induration (previously described) could indicate an infectious process which may impair wound healing.

"It's itching; it must be healing," is a phrase heard frequently from health care providers as well as patients with wounds. The accuracy of this saying remains unknown. Greater itch found in upper categories of wound characteristics meant greater wound itch in more severe wounds. Total scores of itching wounds fell along the Bates-Jensen Wound Status Continuum in

the areas of regeneration and degeneration.

Treatments Used for Wound Itch

Wound-related itch motivated participants to actively seek treatment of the sensation. Rubbing (n = 29, 14.5%) and scratching (n = 24, 12.0%) were found to be most frequently used responses to wound-related itch followed by lotion (n = 20, 10.0%) and petrolatum (n = 9, 4.5%). Scratching may be under-reported, as patients would often respond, "I know better than that," when the option of scratching was listed and would volunteer that they patted the area of the wound in response to itching. These findings can be compared to those of Paul, Pieper, and Templin (2011) in which most participants with venous disease used antibiotic ointment, followed by petrolatum, scratching, and lotion. It is well known that pruritus induces scratching (Weisshaar, et al., 2003). Conventional therapy for pruritus includes antihistamines (Pogatzki-Zahn et al., 2008). Emollients and anti-inflammatory agents are used to manage itch during scar formation (Weisshaar et al., 2003).

Relationship of Wound Itch to Pain

Average generalized bodily pain, which included wound-related pain as well as any bodily pain, was compared to wound-related itch intensity to determine the relationship of the sensations. While a Pain Severity Score could be calculated based on other responses about pain, a general pain intensity score was not obtained. Average pain was rated on a 0-to-10 scale, while itch intensity was rated on a 1-to-10 scale. Average pain (M = 3.21, SD = 6.69) was correlated positively (r = .42, p = .002) with itch intensity (M = 5.59, SD = 2.88). These findings are similar to those of Verhoeven and colleagues (2007) who found a moderate correlation (r = .38-.49) among symptoms of itch, pain, and fatigue in patients with skin diseases found in general practice. Intensity of wound-related itch correlated positively with intensity of

wound-related pain ($r = .17$, $p = .02$). Painful wounds should also be assessed for itchiness.

Pain and itch are both subjective phenomena, dependent on self-report. Inconsistencies in responses were noted between the yes/no answers about pain and itch in and around the wound and ratings of amounts of pain and itch in and around the wound. Responses for wound-related pain and wound-related itch were tallied to accommodate for the inconsistency. While the amount of pain on the wound ($M = 2.59$, $SD = 3.43$) and around the wound ($M = 2.35$, $SD = 3.29$) was greater than the amount of itch on the wound ($M = 0.49$, $SD = 1.79$) and around the wound ($M = 1.43$, $SD = 2.80$), the ratings were significantly positively correlated ($r = .24$**,** $p = .001$ on the wound; $r = .34$, $p < .001$ around the wound). It is interesting to note that pain on the wound was rated higher than pain around the wound, while itch around the wound was rated higher than itch on the wound.

These findings demonstrate the close interaction between itch and pain. Itch sensitization in the periphery and in the central nervous system has many similarities to pain sensitization (Schmelz, 2010). Pain inhibits itch, while itch can be induced by exogenous opiates. Current understanding of itch promotes the sensitivity and selectivity theories of itch (Patel & Yosipovitch, 2010). The specificity theory suggests sensory neurons that are specific to itch stimuli. The selectivity theory suggests that itch neurons can also be excited by painful stimuli. Both theories have been supported by physiological findings (Patel & Yosipovitch, 2010). The fact that pain and itch activate the same areas of the brain implies a different pattern of activation for the two stimuli (Patel & Yosipovitch, 2010).

Nerve growth factor is a neuropeptide which regulates growth and function of nerve cells and is likely found in wounds, as its main sources are keratinocytes and mast cells (Tey & Yosipovitch, 2011). The amount of nerve growth factor is correlated with the severity of itching

and eruptions in atopic dermatitis, but pain results when nerve growth factor is injected into normal skin (Stander & Schmelz, 2006; Tey & Yosipovitch, 2011). Depletion of neuropeptides is a process that has been used to treat both itch and pain (Tey & Yosipovitch, 2011). As more is learned about nerve growth factor and other physiological phenomena related to itch and pain, a better understanding of the two sensations related to wounds should be gained.

Participants in the study were able to distinguish between the two sensations, both in terms of sensation location and ratings as well as descriptors of the wound-related sensations. Both sensations were described negatively: *annoying* and *bothersome* received high ratings for both itch and pain.

Quality of Life

No differences were found between persons with and without wound-related itch in terms of quality of life. Persons with chronic wounds have reported a negative impact on quality of life (Essex, Clark, Warriner, & Cullum, 2009). Persons suffering from itch have reported poor general health (Dalgaard, Svensson, Holm, & Sundby, 2004). In our previous study, persons with itch in the legs or feet had poorer physical quality of life (Paul et al., 2010). As in the study by Spilsbury and colleagues (2007), it was difficult to distinguish the effects of the wound from the effects of other conditions. The RAND-12 was chosen because of its usefulness in determining participants' overall mental and physical health quotients. Perhaps dermatological quality of life instruments would have better captured quality of life as it was affected by wounds and by itch.

Fit of Results with the Theory of Wound Itch

The Theory of Wound Itch as derived from Levine's Conservation Model supposes that a wound is the trigger for a physiological response, which can result in the itch sensation. Itch

then triggers the desire to scratch and other measures to manage the itch with the goal of healing and continuity of the individual. The assumptions of the Theory of Wound Itch were sustained.

Results of this study showed the frequency of wound-related itch in the participants with chronic wounds, the characteristics of the wounds that itched versus those which did not, the relationship of pain to wound itch, and measures used by participants to manage wound itch. That wound itch was reported and quantified fits the Theory of Wound Itch. Characteristics of wounds associated with wound itch were described. A wound does not always trigger itch. Both the selectivity theory and the specificity theory address the neurophysiology of itch and can explain how itch and pain can be triggered. Regulation and protection are empirically represented by scratching as well as other measures taken in response to wound itch. Nursing intervention for management of wound-related itch was not explored in this study but would be represented by protection. The effect of wound itch on quality of life was not detected in this study, but further research may determine the effect of wound itch on continuity using other measures evaluating different aspects of quality of life.

Limitations

Research subjects were patients who were followed at a suburban wound care center. The sample may be representative of a more educated population with a higher socioeconomic status than other populations. Participants were approached consecutively, not with any randomization, so that generalizability of the findings is limited.

Atopy involves a personal or family history of asthma, allergic rhinitis and atopic dermatitis (Hanifin & Rajka, 1980) and may have been a confounding factor in the study as it predisposes the person to pruritus. While rashes are visible and were examined for determination of inclusion in the study, approximately 17% of the general population has atopic

dermatitis or eczema (Yosipovitch, 2004b), likely not diagnosed.

The in-depth process of rating pain and itch descriptors was difficult for persons with impaired or low-level cognitive functioning. The very elderly participants demonstrated difficulty with numeric scales.

While the data were collected completely by the primary investigator, providing consistency throughout this study, another wound care specialist may have rated the same wound characteristics quite differently. Drainage amount and color were especially difficult to categorize with one-time wound assessments. Wound odor is not part of the Bates-Jensen Wound Assessment Tool but may be a wound characteristic with significance to itch. No option is given for adherent brown eschar, which was a frequent finding.

A particular timeframe was not specified for the Paul-Pieper Itching Questionnaire. Timing was clarified as one or two days prior to the interview. A 24-hour timeframe was too restrictive. Additionally, many of the treatment options for itch listed in the questionnaire were never selected. Alcohol might be a treatment option to add, as several participants reported that they wished to apply alcohol topically to the itchy area. Participants volunteered *aggravating* and *worrisome* as appropriate descriptors for wound-related itch. *Duration* of itch and *length of time without itch* required prompts. Seasonal variation could usually not be recalled or described.

Patients were settled into an examination room with dressings removed and topical 2% Lidocaine jelly (Akorn, Inc.) applied over the wound before they were approached for inclusion in the study. Additionally, 4% Lidocaine topical solution (Qualitest ®) was sometimes added during the visit if requested by the patient. Use of the monofilament to assess sensation in the area of the wound was done outside of the area of topical Lidocaine application; however,

sensation in the area of the wound was likely affected by the Lidocaine. Timing of most recent procedure was not collected, as most wounds were debrided at each visit.

Conclusion

This study was innovative in that it explored wound itch, which is documented clinically, but is not well described in the literature. Linear associations of wound itch with wound size and tissue edema were found. Greater itch was described with more severe wounds as evidenced by greater wound size, more necrotic tissue, and moderate wound exudate. Greater itch associated with more granulation tissue may reflect the associated pruritogens in the base of granulating wounds. Qualities of wound itch were examined and compared to wound pain, further defining the similarities and differences between the sensations of pain and itch. So many variables may play into the subjective experience of itch as it occurs related to chronic wounds. Findings of this study increase general knowledge and awareness of wound itch and its impact on the individual. Successful management of wound itch can improve healing and quality of life for persons with wounds and positively impact society as a whole.

APPENDIX A

PARTICIPANT SCREENING TOOL

Date (mo/day/year) _____ Collection time _____ Code _____
Data Collector Initials (first and last initial, printed) ___ ___

Wound Care Center location _____
1. You are being asked to participate in a research study about wound itch. Are you willing to answer a few questions to determine if you are eligible to participate?
___Yes ___No
*(If the answer is "**no**," respond, "Okay, thank you. We will not be asking more of you," and do not proceed.*
*If the answer is "**yes**," continue.)*

2. Do you have a wound that is being seen here at the wound care center?
___Yes ___No
*(If the answer is "**no**," respond, "Okay, thank you. We will not be asking more of you," and do not proceed.*
*If the answer is "**yes**," continue.)*

3. Are you 18 years old or older?
___Yes ___No
*(If the answer is "**no**," respond, "Okay, thank you," and do not proceed.*
*If the answer is "**yes**," continue.)*

4. (*If the respondent is female*) Is there any possibility that you are pregnant?
___Yes ___No
*(If the answer is "**yes**," respond, "Okay, thank you. We will not be asking more of you," and do not proceed.*
*If the answer is "**no**," continue.)*

5. Do you have a rash in any area of your body?
___Yes ___No
*(If the answer is "**yes**," estimate if the area of the rash is greater than 20% of body surface area. If the rash area is greater than 20% of body surface, respond, "Okay, thank you. We will not be asking more of you" and do not proceed.*
*If the answer is "**no**" or if the area of rash is 20% of body surface area or less, continue.)*

6. Do you have a rash in the area of the wound?
___Yes ___No
*(If the answer is "**yes**," respond, "Okay, thank you. We will not be asking more of you" and do not proceed.*
*If the answer is "**no**," continue.)*

7. Does your wound itch?

___Yes ___No

(Proceed with, "Okay; we will continue once you are in a private room.")

APPENDIX B
INFORMATION SHEET

Project: Itch Occurring with Chronic Wounds
Principle Investigator: Julia Paul, RN, MSN
Location: Beaumont Hospital Wound Care Center – Royal Oak; private office of Dr. Tad Sprunger - Troy

Purpose:
You are being asked to be in a research study to obtain information about your wound and related symptoms, including itch and pain. This study will be conducted at William Beaumont Hospital in Royal Oak and at the private office of Dr. Tad Sprunger in Troy.

Study Procedures:
If you take part in the study, you will be asked to have your wound assessed and photographed, have sensation assessed in the area of the wound using a hand-held instrument with a fishing-line-like tip, and answer questions in a one-time interview during your visit. The wound assessment will be done with your usual wound assessment. The interview portion of the study will take approximately 45 minutes. Your medical record will be accessed to obtain information including diagnoses, medical history, medications and allergies. This information will be used to gain a better understanding of itch related to wounds.

Benefits:
There will be no direct benefits for you.
Risks:
The only risk of this study is the potential risk of loss of confidentiality. We are very concerned about your privacy and will make every effort to maintain the security of your records.
Costs/Compensation:
There will be no costs to you for participation in this research study. For taking part in this study, you will receive $10 (U.S. dollars) for your time and inconvenience. Payment will be given to you when the wound assessment and interview have been completed.

Confidentiality:
All information collected from you will be kept confidential, without any identifiers. You will be identified in the research records by a code name/number. Photographs will be edited if necessary to de-identify you as much as possible.

Voluntary Participation/Withdrawal:
Taking part in this study is voluntary. You may choose not to take part in this study, or if you decide to take part, you can change your mind later and withdraw from the study. You are free to not answer any questions or withdraw at any time. Your decision will not change any present or future relationships with William Beaumont Hospital or its affiliates.

Questions:
If you have any questions about this study now or in the future, you may contact Julia Paul at 248-898-0401. If you have questions or concerns about your rights as a research participant, please contact the Beaumont Hospital Human Investigation Committee at (248)551-0662 or the Wayne State University Human Investigation Committee at (313)577-1628.

Participation:
By proceeding with the wound assessment and interview, you are agreeing to participate in this study.

APPENDIX C

RECEIPT OF PATIENT INFORMATION SHEET AND RECEIPT OF COMPENSATION

HIC # 2010-230

Itch Occurring with Chronic Wounds

The participant, _____, received the Itch Occurring with Chronic Wounds Information Sheet and has agreed to participate in the study.

Researcher signature:_____

Date:_____

The participant, _____, received ten dollars ($10) for participation in the study entitled "Itch Occurring with Chronic Wounds."

Researcher signature:_____

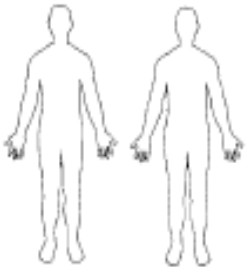
Date:_____

APPENDIX D

BATES-JENSEN WOUND ASSESSMENT TOOL

Location: Anatomic site. Identify right (R) or left (L) and use an "X" to mark site on body diagram.

__Sacrum/ coccyx
__Trochanter
__Ischial tuberosity
__Other site
__Lateral ankle
__Medial ankle
__Heel



Shape: Overall wound pattern; assess by observing perimeter and depth. Circle the appropriate descriptor.

__Irregular
__Round/ oval
__Square/ rectangular
__Linear or elongated
__Bowl/ boat
__Butterfly
__Other shape

Item	Assessment	Score
1. Size	1 = length x width < 4sq cm 2 = l x w 4-<16sq cm 3 = l x w 16.1-<36sq cm 4 = l x w 36.1-< 80sq cm 5 = l x w > 80sq cm	
2. Depth	1 = Non-blanchable erythema on intact skin 2 = Partial thickness skin loss involving damage or necrosis 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	
3. Edges	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	

4. Undermining	1 = Not present 2 = Undermining < 2 cm in 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	
5. Necrotic tissue type	1 = None visible 2 = White/grey non-viable tissue and/or non-adherent yellow slough 3 = Loosely adherent yellow slough 4 = Adherent, soft, black, eschar 5 = Adherent, hard, black, eschar	
6. Necrotic tissue amount	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	
7. Exudate type	1 = None 2 = Bloody 3 = Serosanguinous: thin, watery, pale 4 = Serous: thin, watery, clear 5 = Purulent: thin or thick, opaque, tan/yellow, with or without odor	
8. Exudate amount	1 = None: dry wound 2 = Scant: wound moist but no observable exudate 3 = Small 4 = Moderate 5 = Large	
9. Skin color surrounding wound	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 7/or non-blanchable 5 = Black or hyperpigmented	
10. Peripheral tissue edema	1 = No swelling or edema 2 = Non-pitting edema extends <4 cm around wound 3 = Non-pitting edema extends > or = 4 cm around wound 4 = Pitting edema extends < 4 cm around wound 5 = Crepitus &/or pitting edema extends > or = 4 cm around wound	
11. Peripheral tissue induration	1 = None present 2 = Induration, < 2 cm around wound 3 = Induration 2-4 cm extending < 50% around wound 4 = Induration 2-4 cm extending > or = 50% around wound 5 = Induration > 4 cm in any area around wound	
12. Granulation tissue	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% and > 25 % of wound filled 4 = Pink, &/or dull, dusky red &/or fills < or = 25% of wound 5 = No granulation tissue present	
13. Epithelialization	1 = 100% wound covered, surface intact 2 = 75% to < 100% wound covered&/or epithelial tissue extends > 0.5 cm into wound bed 3 = 50% to < 75% wound covered &/or epithelial tissue extends < 0.5 cm into wound bed 4 = 25% to < 50% wound covered 5 = < 25% wound covered	
Total score		

14. Sensation of monofilament in the area of the wound:

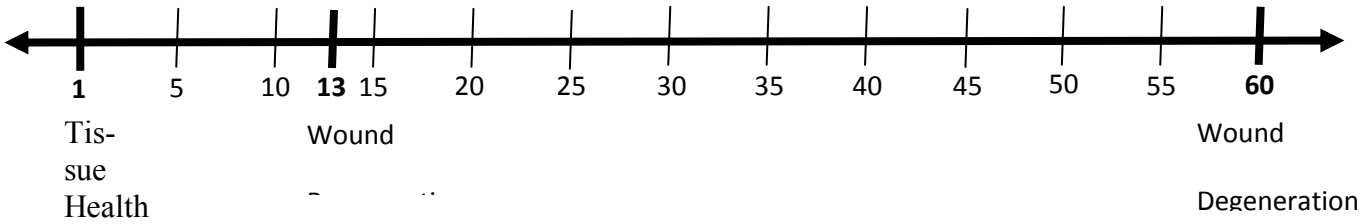
(3)__3 areas sensitive
(2)__2 areas sensitive
(1)__1 area sensitive
(0)__No areas sensitive

15. Current dressings:

Medication:_____
Gauze:_____
Adhesive:_____

Wound Status Continuum

Plot the total score on the Wound Status Continuum by putting an "X" on the line and the date beneath the line.



APPENDIX E

PAUL-PIEPER ITCHING QUESTIONNAIRE

Code Number _____

1. Rate the amount of itching you have on your body

0 1 2 3 4 5 6 7 8 9 10

None Unbearable itching

**** If no itching reported, do not proceed.****

2. If you have itching, where on your body does it bother you (check all that apply)?

a. Head ____
b. Arms ____
c. Hands ____
d. Chest ____
e. Back ____
f. Legs ____
g. Feet ____
h. Other (Please specify where) _____

3. What relieves or decreases your body itching? Check all that apply

i. Cold pack/ice ____
j. Heating pad_____
k. Taking a cool shower or tub bath _____
l. Hot/warm water _____
m. Epsom's salt ____
n. Air blowing on the area ____
o. Vasoline or petrolatum ____
p. Lotion (Calamine) _____
q. Steroid ointment (Cortaid)____
r. Steroid cream (Synalar)_____
s. Antibiotic ointment ____
t. Menthol ointment (Vicks) _____
u. Menthol lotion (Sarna) _____
v. Antihistamine pill (Benadryl or Atarax) ____
w. Antihistamine cream (Benadryl)____
x. Capsaicin (Zostrix) _____
y. Local anesthetic (Lidoderm)_____
z. Watching TV _____
aa. Listening to music _____
bb. Rubbing the area _____
cc. Scratching the area _____
dd. Other (please specify) _____

4. What makes your itching worse?

ee. Heat _____
ff. Cold _____
gg. Eating certain foods _____
hh. Worry _____
ii. Other _____

5. Do you have a wound?

a.___ Yes b. ___ No

If yes, "Please answer questions about itching and wounds."

6. Where on your body is the wound?

jj. Head ____
kk. Arms ____
ll. Hands ____
mm. Chest ____
nn. Back ____
oo. Legs ____
pp. Feet ____
qq. Other (Please specify where) _____

7. How long have you had the wound?

___days ___weeks ___months ___years

8. Have procedures been done to your wound?

a.__yes b.__no

If "yes," please list date and type of last procedure:

Date of last procedure:_____
Type of last procedure:_____

9. Does your wound itch?

a.___yes b.___no

If "no," do not proceed. The questioning is complete.

10. Rate the amount of itching you have <u>on your wound</u>

0 1 2 3 4 5 6 7 8 9 10
None Unbearable itching

11. Rate the amount of itching you have on your skin <u>around the wound</u>

0 1 2 3 4 5 6 7 8 9 10
None Unbearable itching

12. How long has your wound been bothered with itching?

a. 1 week or less _____
b. 1-6 months _____
c. 7 -11 months _____
d. 1-5 years _____
e. Greater than 5 years _____

13. When does your wound itch the most (select one)?

a. Morning _____
b. Afternoon _____
c. Evening _____
d. During sleep _____

14. What treatment(s) do you use for wound itching (check all that apply)?

a. Cold pack/ice ____
b. Heating pad_____
c. Taking a cool shower or tub bath _____
d. Hot/warm water _____
e. Epsom's salt ____
f. Air blowing on the area ____
g. Vaseline or petrolatum ____
h. Lotion (Calamine) _____
rr. Steroid ointment (Cortaid)____
ss. Steroid cream (Synalar)_____
tt. Antibiotic ointment ____
uu. Menthol ointment (Vicks) _____
vv. Menthol lotion (Sarna) _____
ww. Antihistamine pill (Benadryl or Atarax) ____
xx. Antihistamine cream (Benedryl)____
yy. Capsaicin (Zostrix) _____
zz. Local anesthetic (Lidoderm)_____
aaa. Watching TV _____
bbb. Listening to music _____
ccc. Rubbing the area _____
ddd. Scratching the area _____
eee. Other (please specify) _____

15. What makes your wound itch worse?

a. Heat _____
b. Cold _____
c. Eating certain foods _____
d. Worry _____
e. Other _____

APPENDIX F

CHARACTERISTICS OF ITCH QUESTIONNAIRE

Section 1: Personal Information

Sex: Male Female **Date of Birth/ (Age)**:_____

Country:_____

Family Status: Never married Married Divorced Separated Widowed

Which of the following best describes your primary racial or ethnic identification? (Check all that apply)

__ Black (African, African American)
__Hispanic (Mexican, Puerto Rican, Cuban, Latin American)
__Native American (American Indian, Alaska Native)
__White (Caucasian)
__Asian, Oriental
__Native Hawaiian + Other Pacific Islander
__Other (Specify) _____

Which is the highest level of education that you have completed? (Check the appropriate box)

__No formal education
__Some grade school
__Completed grade school
__Some high school
__Completed high school
__Some college
__Completed 2- or 4-year college degree
__Some graduate education
__A graduate professional degree

Are you presently: (Check the appropriate box)

__Employed, full time
__Employed, part time
__Unemployed
__Retired
__Student
__Full-time homemaker

How would you classify your overall health status?

__Poor
__Fair
__Good
__Excellent

Medical history:

Dermatologic diagnosis(es):_____

Medical diagnosis(es):_____

_____

_____

Current Medication(s):_____

_____

Section 2: Itch History

Q1. Do you currently suffer from itch? __Yes __No

Q2. Have you suffered from itch within the past year? __Yes __No

Q3. How many months and/or years have you suffered from itch?_____

Q4. How often does itch occur?

__Greater than 10 episodes per day
__5 to 10 episodes per day
__2 to 4 episodes per day
__1 episode per day
__2 to 6 episodes per week
__1 episode per week
__1 episode per month

Q5. What symptoms occur along with itch? (Check all that apply)

__Pain within area of itch
__Sweating
__Heat sensation
__Cold sensation
Other(s)_____

Q6. Location of itch:

		Anterior	**Posterior**
__Face	Hand	_____	_____
__Scalp	Forearm	_____	_____
__Neck	Arm	_____	_____
__Shoulder	Thigh	_____	_____
__Armpit	Shin	_____	_____
__Chest	Foot	_____	_____
__Abdomen	Other	_____	_____
__Back			
__Buttocks			
__Groin			

Section 3: Characteristics of Itch

To what extent do the descriptions below match your itch?

0 = Not at all
1 = To a minimal extent
2 = To a mild extent
3 = To a moderate extent
4 = To a great extent

	0	1	2	3	4		0	1	2	3	4
Pulsating						**Sharp**					
Throbbing						**Tingling**					
Prickling						**comes in waves**					
Hurting						**Hot**					
Tickling						**Unbearable**					
Painful						**Annoying**					
Stinging						**bothersome**					
Warm						**mosquito-bite like**					
Burning						**Unpleasant**					
Penetrating						**Awful**					
Inflaming						**Bothering**					
Disgusting						**unmanageable**					
Tiresome						**my only desire: no itch**					
Tiring						**Stubborn**					
	0	**1**	**2**	**3**	**4**		**0**	**1**	**2**	**3**	**4**
restricting my life						**Severe**					
disturbing my sleep						**Pricking**					
more when cold						**Dreadful**					
Acute						**Oppressive**					
more when warm						**Insistent**					
pinprick-like						**uncontrollable**					
Itching						**Terrible**					
feels ant-like						**Torturing**					
like sunburn											

When do you feel the itch?

	0	1	2	3	4		*If applicable, fill in*	Y	N
In the morning							**Constantly (all day and night)**		
During the day							**Constantly during the day**		
In the evening							**Constantly during the night**		
At night							**Intermittently**		
During the Spring							**Frequency of attacks per day**		
During the Summer							**Duration of attacks**		
During the Autumn							**Duration of interval without itch**		
During the Winter							**Association with rash**		

Please identify the intensity of a typical episode of itch that has occurred within the last two weeks.

10 9 8 7 6 5 4 3 2 1

Unbearable None

Please identify the result that scratching has on a typical episode of itch within the last two weeks.

5 4 3 2 1 0 -1 -2 -3 -4 -5

Highly pleasurable (5) Neutral (0) Highly unpleasurable (-5)

APPENDIX G

RAND-12

1. In general, would you say your health is:

__1 = Excellent
__2 =Very good
__3 = Good
__4 = Fair
__5 =Poor

The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

2. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf

__1 = Yes, limited a lot
__2 =Yes, limited a little
__3 = No, not limited at all

3. Climbing several flights of stairs

__1 = Yes, limited a lot
__2 =Yes, limited a little
__3 = No, not limited at all

During the past four weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

4. Accomplished less than you would like

__1 =Yes
__2 = No

5. Were limited in the kind of work or other activities

__1 = Yes
__2 = No

During the past four weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

6. Accomplished less than you would like

__1 = Yes
__2 = No

7. Didn't do work or other activities as carefully as usual

__1 = Yes
__2 = No

8. During the past four weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

__1 = Not at all
__2 = A little bit
__3 = Moderately
__4 = Quite a bit
__5 = Extremely

The following questions are about how you feel and how things have been with you during the past four weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past four weeks:

9. Have you felt calm and peaceful?

__1 = All of the time
__2 = Most of the time
__3 = A good bit of the time
__4 = Some of the time
__5 = A little of the time
__6 = None of the time

10. Did you have a lot of energy?

__1 = All of the time
__2 = Most of the time
__3 = A good bit of the time
__4 = Some of the time
__5 = A little of the time
__6 = None of the time

11. Have you felt downhearted and blue?

__1 = All of the time
__2 = Most of the time
__3 = A good bit of the time
__4 = Some of the time
__5 = A little of the time
__6 =None of the time

12. During the past four weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

__1 = All of the time
__2 = Most of the time
__3 = Some of the time
__4 = A little of the time
__5 = None of the time

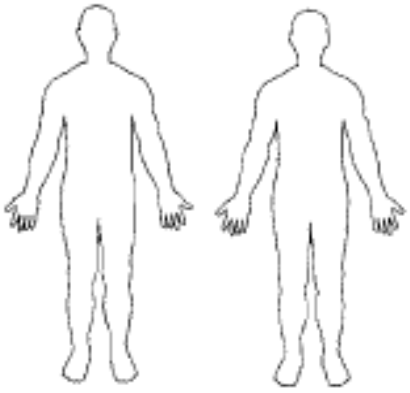
APPENDIX H

BRIEF PAIN INVENTORY (SHORT FORM)

1. Throughout our lives, most of us have had pain from time to time (such as minor headaches, sprains, and toothaches). Have you had pain other than these everyday kinds of pain today?

__Yes __No

2. On the diagram, shade the areas where you feel pain. Put an "X" on the area that hurts the most.



3. Please rate your pain by choosing the one number that best describes your pain at its **worst** in the last 24 hours.

0 1 2 3 4 5 6 7 8 9 10

No pain Pain as bad as you can imagine

4. Please rate your pain by choosing the one number that best describes your pain at its **least** in the last 24 hours.

0 1 2 3 4 5 6 7 8 9 10

No pain Pain as bad as you can imagine

5. Please rate your pain by choosing the one number that best describes your pain on the **average**.

0 1 2 3 4 5 6 7 8 9 10

No pain Pain as bad as you can imagine

6. Please rate your pain by choosing the one number that tells how much pain you have **right now.**

0 1 2 3 4 5 6 7 8 9 10

No pain Pain as bad as you can imagine

7. What treatments or medications are you receiving for your pain?

8. In the last 24 hours, how much relief have pain treatments or medications provided? Please circle the one percentage that most shows how much **relief** you have received.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

No relief Complete relief

9. Circle the one number that describes how, during the past 24 hours, pain has interfered With your:

A. General activity

0	1	2	3	4	5	6	7	8	9	10
Does not interfere										Completely interferes

B. Mood

0	1	2	3	4	5	6	7	8	9	10
Does not interfere										Completely interferes

C. Walking ability

0	1	2	3	4	5	6	7	8	9	10
Does not interfere										Completely interferes

D. Normal work (includes both work outside the home and housework)

0	1	2	3	4	5	6	7	8	9	10
Does not interfere										Completely interferes

E. Relations with other people

0	1	2	3	4	5	6	7	8	9	10
Does not interfere										Completely interferes

F. Sleep

0	1	2	3	4	5	6	7	8	9	10
Does not interfere										Completely interferes

G. Enjoyment of life

0	1	2	3	4	5	6	7	8	9	10
Does not interfere										Completely interferes

APPENDIX I

WOUND ITCH INTERVIEW TOOL

1. Sex:
a.___Male b.___Female
2. **Date of Birth/ (Age)**:_____
3. Country:_____
4. Family Status:
a.___Never married
b.___Married
c.___Divorced
d.___Separated
e.___Widowed
5. Which of the following best describes your primary racial or ethnic identification? (Check all that apply)
a.___ Black (African, African American)
b,___ Hispanic (Mexican, Puerto Rican, Cuban, Latin American)
c.___Native American (American Indian, Alaska Native)
d.___White (Caucasian)
e.___Asian, Oriental
f.___Native Hawaiian + Other Pacific Islander
g.___Other (Specify) _____
6. Which is the highest level of education that you have completed? (Check the appropriate box)
a.___No formal education
b.___Some grade school
c.___**C**ompleted grade school
d.___Some high school
e.___Completed high school
f.___ Some college
g.___Completed 2- or 4-year college degree
h.___Some graduate education
i.____A graduate professional degree
7. Are you presently: (Check the appropriate box)
a.___Employed, full time
b.___Employed, part time
c.___Unemployed
d.___Retired
e.___Student
f.___Full-time homemaker
8. How would you classify your overall health status?
a.___Poor
b.___Fair
c.___Good
d.___Excellent

RAND-12

9. In general, would you say your **health** is:

___1 = Excellent
___2 =Very good
___3 = Good
___4 = Fair
___5 =Poor

The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

10. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf

__1 = Yes, limited a lot
__2 =Yes, limited a little
__3 = No, not limited at all

11. Climbing several flights of stairs

__1 = Yes, limited a lot
__2 =Yes, limited a little
__3 = No, not limited at all

During the past four weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

12. Accomplished less than you would like

__1 =Yes
__2 = No

13. Were limited in the kind of work or other activities

__1 = Yes
__2 = No

During the past four weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

14. Accomplished less than you would like

__1 = Yes
__2 = No

15. Didn't do work or other activities as carefully as usual

__1 = Yes
__2 = No

16. During the past four weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

__1 = Not at all
__2 = A little bit
__3 = Moderately
__4 = Quite a bit
__5 = Extremely

The following questions are about how you feel and how things have been with you during the past four weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past four weeks:

17. Have you felt calm and peaceful?

__1 = All of the time
__2 = Most of the time
__3 = A good bit of the time
__4 = Some of the time
__5 = A little of the time
__6 = None of the time

18. Did you have a lot of energy?

__1 = All of the time
__2 = Most of the time
__3 = A good bit of the time
__4 = Some of the time
__5 = A little of the time
__6 = None of the time

19. Have you felt downhearted and blue?

__1 = All of the time
__2 = Most of the time
__3 = A good bit of the time
__4 = Some of the time
__5 = A little of the time
__6 =None of the time

20. During the <u>past four weeks</u>, how much of the time has your <u>physical health or emotional problems</u> interfered with your social activities (like visiting with friends, relatives, etc.)?

__1 = All of the time
__2 = Most of the time
__3 = Some of the time
__4 = A little of the time
__5 = None of the time

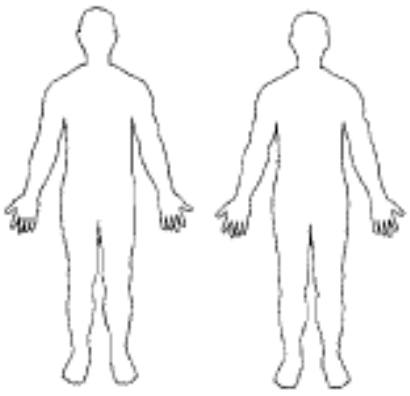
<u>Pain History</u>

Brief Pain Inventory (Short Form)

21. Most of us have had pain from time to time (such as minor headaches, sprains, and toothaches). Have you had pain other than these everyday kinds of pain today?

__Yes __No

22. On the diagram, shade the areas where you feel pain. Put an "X" on the area that hurts the most.



23. Please rate your pain by choosing the one number that best describes your pain at its **worst** in the last 24 hours.

0	1	2	3	4	5	6	7	8	9	10
No pain										Pain as bad as you can imagine

24. Please rate your pain by choosing the one number that best describes your pain at its **least** in the last 24 hours.

0	1	2	3	4	5	6	7	8	9	10
No pain										Pain as bad as you can imagine

25. Please rate your pain by choosing the one number that best describes your pain on the **average**.

0	1	2	3	4	5	6	7	8	9	10
No pain										Pain as bad as you can imagine

26. Please rate your pain by choosing the one number that tells how much pain you have **right now.**

0	1	2	3	4	5	6	7	8	9	10
No pain										Pain as bad as you can imagine

27. What treatments or medications are you receiving for your pain?

28. In the last 24 hours, how much relief have pain treatments or medications provided? Please circle the one percentage that most shows how much **relief** you have received.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
No relief										Complete relief

29. Circle the one number that describes how, during the past 24 hours, pain has interfered: With your:

A. General activity

0	1	2	3	4	5	6	7	8	9	10
Does not interfere										Completely interferes

B. Mood

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely interferes

C. Walking ability

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely interferes

D. Normal work (includes both work outside the home and housework)

0	1	2	3	4	5	6	7	8	9	10
Does not										Completely

Interfere										interferes
E. Relations with other people										
0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely interferes
F. Sleep										
0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely interferes
G. Enjoyment of life										
0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely interferes

30. Do you have pain related to your wound?
a.____Yes, around the wound
b.____Yes, in the wound
c.____No
***If "no*," proceed to # 35 (questions about itch).**

31. Rate the amount of pain you have <u>on your wound</u>

0 1 2 3 4 5 6 7 8 9 10
None Unbearable pain

32. Rate the amount of pain you have on the skin <u>around the wound</u>

0 1 2 3 4 5 6 7 8 9 10
None Unbearable pain

<u>Characteristics of *Wound* Pain</u>
33. To what extent do the descriptions below match your pain?
0 = Not at all
1 = To a minimal extent
2 = To a mild extent
3 = To a moderate extent
4 = To a great extent

	0	1	2	3	4		0	1	2	3	4
Pulsating						**Sharp**					
Throbbing						**Tingling**					
Prickling						**comes in waves**					
Hurting						**Hot**					
Tickling						**unbearable**					
Painful						**Annoying**					
Stinging						**bothersome**					
Warm						**mosquito-bite like**					
Burning						**unpleasant**					
Penetrating						**Awful**					
Inflaming						**Bothering**					
Disgusting						**unmanageable**					
Tiresome						**my only desire: no itch**					
Tiring						**Stubborn**					
	0	**1**	**2**	**3**	**4**		**0**	**1**	**2**	**3**	**4**
restricting my life						**Severe**					
disturbing my sleep						**Pricking**					
more when cold						**Dreadful**					
Acute						**Oppressive**					
more when warm						**Insistent**					
pinprick-like						**uncontrollable**					
Itching						**Terrible**					
feels ant-like						**Torturing**					
like sunburn											

34. When do you feel the pain?

	0	**1**	**2**	**3**	**4**		***If applicable, fill in***	**Y**	**N**
In the morning							**Constantly (all day and night)**		
During the day							**Constantly during the day**		
In the evening							**Constantly during the night**		
At night							**Intermittently**		
During the Spring							**Frequency of attacks per day**		
During the Summer							**Duration of attacks**		
During the Autumn							**Duration of interval without itch**		
During the Winter							**Association with rash**		

35. Do you have a wound?
a.___Yes b.___ No

If yes, please answer questions about itching and wounds.

36. Location of wound:

a.__Face
b.__Scalp
c.__Neck
d.__Shoulder
e.__Armpit
f.__Chest
g.__Abdomen
h.__Back
i.__Buttocks
j.__Groin

	Anterior	**Posterior**
Hand	k._____	l. _____
Forearm	m._____	n. _____
Arm	o._____	p. _____
Thigh	q._____	r. _____
Shin	s._____	t._____
Foot	u._____	v._____
Other	_____	

37. Is the **itch** in the area of a **wound**?

a.__Yes, around the wound b.__Yes, in the wound c.__No

38. Rate the amount of **itching** you have **on your wound**

0 1 2 3 4 5 6 7 8 9 10
None Unbearable itching

39. Rate the amount of **itching** you have on your skin **around the wound**

0 1 2 3 4 5 6 7 8 9 10
None Unbearable itching

40. How long has your wound been bothered with itching?
a. 1 week or less _____
b. 1-6 months _____
c. 7 -11 months _____
d. 1-5 years _____
e. Greater than 5 years _____

41. When does your wound itch the most (select one)?
a. Morning _____
b. Afternoon _____
c. Evening _____
d. During sleep _____

42. What **treatment(s)** do you use for **wound itching** (check all that apply)?
a. Cold pack/ice ____
b. Heating pad_____
c. Taking a cool shower or tub bath _____
d. Hot/warm water _____
e. Epsom's salt ____
f. Air blowing on the area ____
g. Vaseline or petrolatum ____
h. Lotion (Calamine) _____
i. Steroid ointment (Cortaid)____
j. Steroid cream (Synalar)_____
k. Antibiotic ointment ____
l. Menthol ointment (Vicks) _____
m. Menthol lotion (Sarna) _____
n. Antihistamine pill (Benadryl or Atarax) ____
o. Antihistamine cream (Benedryl)____
p. Capsaicin (Zostrix) _____
q. Local anesthetic (Lidoderm)_____
r. Watching TV _____
s. Listening to music _____
t. Rubbing the area _____
u. Scratching the area _____
v. Other (please specify) _____

43. What makes your **wound itch worse**?
a. Heat _____
b. Cold _____
c. Eating certain foods _____
d. Worry _____
e. Other _____

Characteristics of *Wound* Itch

44. To what extent do the descriptions below match your wound itch? (*These descriptors are the same as previously used to describe pain.*)

0 = Not at all
1 = To a minimal extent
2 = To a mild extent
3 = To a moderate extent
4 = To a great extent

	0	1	2	3	4		0	1	2	3	4
Pulsating						**Sharp**					
Throbbing						**Tingling**					
Prickling						**comes in waves**					
Hurting						**Hot**					
Tickling						**unbearable**					
Painful						**Annoying**					
Stinging						**bothersome**					
Warm						**mosquito-bite like**					
Burning						**unpleasant**					
Penetrating						**Awful**					
Inflaming						**Bothering**					
Disgusting						**unmanageable**					
Tiresome						**my only desire: no itch**					
Tiring						**Stubborn**					

	0	1	2	3	4		0	1	2	3	4
restricting my life						**Severe**					
disturbing my sleep						**Pricking**					
more when cold						**Dreadful**					
Acute						**Oppressive**					
more when warm						**Insistent**					
pinprick-like						**uncontrollable**					
Itching						**Terrible**					
feels ant-like						**Torturing**					
like sunburn											

45. When do you feel the itch?

	0	1	2	3	4		*If applicable, fill in*	Y	N
In the morning							**Constantly (all day and night)**		
During the day							**Constantly during the day**		
In the evening							**Constantly during the night**		
At night							**Intermittently**		
During the Spring							**Frequency of attacks per day**		
During the Summer							**Duration of attacks**		
During the Autumn							**Duration of interval without itch**		
During the Winter							**Association with rash**		

46. Please identify the **intensity of a typical episode of itch** that has occurred within the last two weeks.

10 9 8 7 6 5 4 3 2 1
Unbearable None

47. Please identify the **result that scratching has** on a typical episode of itch within the last two weeks.

5 4 3 2 1 0 -1 -2 -3 -4 -5
Highly pleasurable (5) Neutral (0) Highly unpleasurable (-5)

Itch History

You have been asked about itch related to your wound. Please answer the following questions about any other itch you experience.

48. Do you currently suffer from itch?

a.__Yes **b.**__No

49. Have you suffered from itch within the past year?

a.__Yes **b**.__No

50. How many months and/or years have you suffered from itch?_____

51. How often does itch occur?

a.___Greater than 10 episodes per day
b.___5 to 10 episodes per day
c.___2 to 4 episodes per day
d.___1 episode per day
e.___2 to 6 episodes per week
f.___1 episode per week
g.___1 episode per month

52. What symptoms occur along with itch? (Check all that apply)

a.___Pain within area of itch
b.___Sweating
c.___Heat sensation
d.___Cold sensation
Other(s)_____

53. Location of itch:

		Anterior	**Posterior**
a.__Face	Hand	k._____	l. _____
b.__Scalp	Forearm	m._____	n. _____
c.__Neck	Arm	o._____	p. _____
d.__Shoulder	Thigh	q._____	r. _____
e.__Armpit	Shin	s._____	t._____
f.__Chest	Foot	u._____	v._____
g.__Abdomen	Other	_____	
h.__Back			
i.__Buttocks			
j.__Groin			

54. Rate the amount of **itching** you have **on your body**

0 1 2 3 4 5 6 7 8 9 10

None Unbearable itching

55. What relieves or decreases your **body itching**? Check all that apply
a. Cold pack/ice ____
b. Heating pad_____
c. Taking a cool shower or tub bath _____
d. Hot/warm water _____
e. Epsom's salt ____
f. Air blowing on the area ____
g. Vaseline or petrolatum ____
h. Lotion (Calamine) _____
i. Steroid ointment (Cortaid)____
j. Steroid cream (Synalar)_____
k. Antibiotic ointment ____
l. Menthol ointment (Vicks) _____
m. Menthol lotion (Sarna) _____
n. Antihistamine pill (Benadryl or Atarax) ____
o. Antihistamine cream (Benedryl)____
p. Capsaicin (Zostrix) _____
q. Local anesthetic (Lidoderm)_____
r. Watching TV _____
s. Listening to music _____
t. Rubbing the area _____
u. Scratching the area _____
v. Other (please specify) _____

56. What makes your itching worse?
a. Heat _____
b. Cold _____
c. Eating certain foods _____
d. Worry _____
e. Other _____

APPENDIX J

MEDICAL RECORD DATA COLLECTION TOOL

[*This information obtained from medical record*]

Wound diagnosis/ type:_____

Dermatologic diagnosis(es):_____

Medical diagnosis(es):_____
_____
_____

Current Medication(s):_____
_____
_____

Allergies:_____
_____

APPENDIX K

APPROVAL FROM BEAUMONT COMMISSION OF NURSING SCHOLARSHIP AND RESEARCH

Beaumont® Hospital
Royal Oak

November 9, 2010

Ms. Julia Paul
3601 W. 13 Mile
Royal Oak, MI 48073

Re: Itch Occurring with Chronic Wounds

Dear Julia:

The above mentioned project was reviewed by the Commission of Nursing Scholarship and Research and is approved to be conducted as specified in the application at Beaumont Hospital-Royal Oak.

Sincerely,

Cathy Campbell, MSN, APRN, BC
Director Nursing Scholarship, Quality & Research

APPENDIX L – BEAUMONT HIC APPROVAL

Beaumont Hospitals®

Research Institute
Human Investigation Committee

John M. Koerber, Pharm.D.
Chairperson

November 8, 2010
Julia Paul, RN, MSN, NP
Department of Physician Extenders
Beaumont Hospitals - Wound Care Center

RE: HIC #: 2010-230
Protocol Title: ITCH OCCURRING WITH CHRONIC WOUNDS

Sponsor: Investigator-Initiated

Dear Ms. Paul,

It has been determined that the above referenced project with waiver of consent documentation and the following submitted documents (if applicable); involve no more than minimal risk to human subjects per the code of federal regulations.

- Patient Information Sheet version date – Nov. 5, 2010
- Study Protocol/Dissertation including questionnaires and data collection tools

This project has been granted **FULL APPROVAL** under the Expedited Review of Research Policy # 213 of the Human Investigation Committee, Category [(7)]. A Progress Report must be reviewed by the HIC prior to the expiration date of **November 7, 2011**, or HIC approval will expire.

Please refer to the HIC policy #200, *Unanticipated Problems and Adverse Events Reporting* for guidelines and timeframes for reporting Unanticipated Problems.

Any amendment to the protocol, except one necessary to eliminate apparent immediate hazard to a human subject, must be reviewed and approved by the HIC prior to initiation.

Any deviation from the protocol that affects the health or safety of a study subject must be reported to the HIC within 7 days of site's knowledge of the event.

HIPAA Restriction: Please check the Research Institute (RI) website for a list of patients who have Opted Out of Research participation at Beaumont, at
http://employee.beaumonthospitals.com/portal/pls/portal/docs/1036147.PDF
Per RI Policy #108 *Communicating a Patients Request to Opt Out of Research,* the use of any protected health information of these patients for research is not allowed.

Sincerely,

John M. Koerber, Pharm.D.
Human Investigation Committee
Chairperson
/ck
NOTE: The HIC number 2010-230 MUST be used on all correspondence with reference to this project.

3811 West Thirteen Mile Road Royal Oak, Michigan 48073-6769
248-551-0662

APPENDIX M - WAYNE STATE UNIVERSITY HIC APPROVAL

WAYNE STATE UNIVERSITY

HUMAN INVESTIGATION COMMITTEE
87 East Canfield, Second Floor
Detroit, Michigan 48201
Phone: (313) 577-1628
FAX: (313) 993-7122
http://hic.wayne.edu

NOTICE OF EXPEDITED APPROVAL

To: Julia Paul
College of Nursing

From: Dr. James Puklin or designee
Chairman, Human Investigation Committee

Date: December 03, 2010

RE: HIC #: 072710MP4E
Protocol Title: Itch Occurring with Chronic Wounds
Funding Source:
Protocol #: 1007008542

Expiration Date: December 02, 2011

Risk Level / Category: Research not involving greater than minimal risk

The above-referenced protocol and items listed below (if applicable) were **APPROVED** following *Expedited Review* (Category (7)*) by the Chairperson/designee *for* the Wayne State University Institutional Review Board (MP4) for the period of 12/03/2010 through 12/02/2011. This approval does not replace any departmental or other approvals that may be required.

- This protocol has met all criteria at 45 CFR 46.110 and 111 for expedited review approvals.
- Receipt of IRB Approvals from William Beaumont Hospital along with IRB Approved Information Sheet
- Receipt of Dissertation Doctoral Proposal - 2010

- Federal regulations require that all research be reviewed at least annually. You *may* receive a *"Continuation Renewal Reminder"* approximately two months prior to the expiration date; however, it is the Principal Investigator's responsibility to obtain review and continued approval ***before*** the expiration date. Data collected during a period of lapsed approval is unapproved research and can ***never*** be reported or published as research data.
- All changes or amendments to the above-referenced protocol require review and approval by the HIC **BEFORE** implementation.
- Adverse Reactions/Unexpected Events (AR/UE) must be submitted on the appropriate form within the timeframe specified in the HIC Policy (http://www.hic.wayne.edu/hicpol.html).

NOTE:

1. Upon notification of an impending regulatory site visit, hold notification, and/or external audit the HIC office must be contacted immediately.
2. Forms should be downloaded from the HIC website at ***each*** use.

*Based on the Expedited Review List, revised November 1998

REFERENCES

Andrew, D., & Craig, A. D. (2001). Spinothalamic lamina I neurons selectively sensitive to histamine: A central neural pathway for itch. *Nature Neuroscience*, *4*(1), 72-77.

Armstrong, D. G., Lavery, L. A., Wrobel, J. S., & Vileikyte, L. (2008). Quality of life in healing diabetic wounds: Does the end justify the means? *The Journal of Foot and Ankle Surgery*, *47*(4), 278-282. doi: 10.1053/j.jfas.2008.02.015

Baharestani, M. M. (2008). Quality of life and ethical issues. In S. Baranoski & E. A. Ayello (Eds.), *Wound care essentials: Practice principles (2nd ed.)* (pp. 2-17). Philadelphia: Lippincott Williams & Wilkins.

Baker, R. A., Zeller, R. A., Klein, R. L., Thornton, R. J., Shuber, J. H., Marshall, R. E., . . . Liebfarth, A. G. (2001). Burn wound itch control using H_1 and H_2 antagonists. *Journal of Burn Care and Rehabilitation*, *22*(4), 263-268.

Baranoski, S., & Ayello, E. A. (2008). *Wound care essentials: Practice principles (2nd ed.)*. Philadelphia: Lippincott Williams & Wilkins.

Baranoski, S., Ayello, E. A., & Langemo, D. K. (2012). Wound assessment. In S. Baranoski & E. A. Ayello (Eds.), *Wound care essentials: Practice principles (3rd ed.)* (pp. 101-125). Philadelphia: Lippincott Williams & Wilkins.

Bates-Jensen, B., &McNees, P. (1995). Toward an intelligent wound assessment system. *Ostomy/ Wound Management*, *41*(7A Suppl), 80S-86S.

Bates-Jensen, B., Vredevoe, D. L., & Brecht, M. L. (1992). Validity and reliability of the Pressure Sore Status Tool. *Decubitus*, *5*(6), 20-28.

Bell, L, McAdams, T., Morgan, R., Parshley, P., Pike, R., Riggs, P., & Carpenter, J. (1988). Pruritus in burns: A descriptive study. *Journal of Burn Care and Rehabilitation*, *9*(3), 305-309.

Bernhard, J. D. (1992). Phantom itch, pseudophantom itch, and senile pruritus. *International Journal of Dermatology*, *31*(12), 856-857.

Bernhard, J. D. (Ed.). (1994). *Itch: Mechanisms and Management of Pruritus*. New York: McGraw-Hill, Inc.

Bolton, L., McNees, P., van Rijswijk, L., de Leon, J., Lyder, C., Kobza, L., . . . Wound Outcomes Study Group. (2004). Wound-healing outcomes using standardized assessment and care in clinical practice. *Journal of Wound, Ostomy and Continence Nursing*, *31*(2), 65-71.

Boulton, A. J. M., Vinik, A. I., Arezzo, J. C., Bril, V., Feldman, E. L., Freeman, R., . . .Ziegler, D. (2005). Diabetic neuropathies: A statement by the American Diabetes Association. *Diabetes Care*, *28*(4), 956-962.

Bromm, B. (2005). Viewpoint 3. In R. Paus (Ed.) How to fight that nasty itch – from new insights into the neuroimmunological, neuroendocrine, and neurophysiological bases of pruritus to novel therapeutic approaches. *Experimental Dermatology*, *14*, 225-140.

Carlson, N.R. (2010). *Physiology of behavior* (10th ed.). Boston: Allyn & Bacon.

Collins, S., Visscher, P., De Vet, H. C., Zuurmond, W. W. A., & Perez, R. S. G. M. (2010). Reliability of the Semmes Weinstein monofilament to measure coetaneous sensibility in the feet of healthy subjects. *Disability and Rehabilitation*, *32*(24), 2019-2027.

Dalgaard, F., Svensson, A., Holm, J. O., & Sundby, J. (2004). Self-reported skin morbidity among adults: Associations with quality of life and general health in a Norwegian survey. *Journal of Investigative Dermatology and Symptom Processing*, *9*, 120-5.

Darsow, U., Drzezga, A., & Ring, J. (2004). Central nervous system imaging of itch with PET. In G. Yosipovitch, M. W. Greaves, A. B. Fleischer, Jr., & F. McGlone (Eds.), *Itch: Basic mechanisms and therapy* (pp. 63-70), New York: Marcel Dekker, Inc.

Darsow, U., Scharein, E., Simon, E., Walter, G., Bromm, B., & Ring, J. (2001). New aspects of itch pathophysiology: Component analysis of atopic itch using the "Eppendorf Itch Questionnaire." *International Archives of Allergy and Immunology*, *124*, 326-331.

Daut, R. L., Cleeland, C. S., & Flanery, R. C. (1983). Development of the Wisconsin Brief Pain Questionnaire to assess pain in cancer and other diseases. *Pain*, *17*, 197-210.

Davidson, S., Zhang, X., Khasabov, S. G., Simone, D. A., & Giesler, Jr., G. J. (2009). Relief of scratching: State-dependent inhibition of primate spinothalamic tract neurons. *Nature Neuroscience*, *12*(5), 544-546. doi: 10.1038/nn.2292

Dawn, A., Papoiu, A. D. P., Chan, Y. H., Rapp, S. R., Rassette, N., & Yosipovitch, G. (2008). Itch characteristics in atopic dermatitis: results of a web-based Questionnaire. *British Journal of Dermatology*, *160*, 642-644. doi: 10.1111/j.1365-2133.2008.08941.x

Demling, R.H., & DeSanti, L. (2001). Topical doxepin is effective in relieving severe pruritus caused by burn injury: a preliminary study. *Wounds*, *13*(6), 210-215.

Doughty, D. B., & Holbrook, R. (2007). Lower-extremity ulcers of vascular etiology. In R. A. Bryant & D. P. Nix (Eds.), *Acute and Chronic Wounds: Current Management Concepts* (3rd ed.) (pp. 258-306). St. Louis, MO: Mosby/Elsevier.

Doughty, D. B., & Sparks-Defriese, B. (2007). Wound-healing physiology. In R. A. Bryant & D. P. Nix (Eds.), *Acute and Chronic Wounds: Current Management Concepts* (pp. 307-336). St. Louis, MO: Mosby/Elsevier.

Driver, V. R., Landowski, M. A., & Madsen, J. L. (2007). Neuropathic wounds: The diabetic wound. In R. A. Bryant & D. P. Nix (Eds.), *Acute and Chronic Wounds: Current Management Concepts* (3rd ed.) (pp. 307-336). St. Louis, MO: Mosby/Elsevier.

Drzezga, A., Darsow, U., Treede, R., Siebner, H., Frisch, M., Munz, F., . . . Bartenstein, P. (2001). Central activation by histamine-induced itch: Analogies to pain processing: A correlational analysis of O-15 H_2O positron emission tomography studies, *Pain*, *92*, 295-305.

Duque, M. I., Yosipovitch, G., & Pegram, P. S. (2004). Itch in HIV-infected patients. In G. Yosipovitch, M. W. Greaves, A. B. Fleischer, Jr., & F. McGlone (Eds.), *Itch: Basic mechanisms and therapy* (pp. 219-229), New York: Marcel Dekker, Inc.

Duque, M. I., Yosipovitch, G., Chan, Y. H., Smith, R., & Levy, P. (2005). Itch, pain, and burning sensation are common symptoms in mild to moderate chronic venous insufficiency with an impact on quality of life. *Journal of the American Academy of Dermatology*, *53*(3), 504-508. doi: 10.1016/j.jaad.2005.04.079

Essex, H. N., Clark, M., Sims, J., Warriner, A., & Cullum, N. (2009). Health-related quality of life in hospital in-patients with pressure ulceration: assessment using generic health-related quality of life measures. *Wound Repair and Regeneration*, *17*, 797-805.

Fawcett, J. (2005). *Contemporary nursing knowledge: Analysis and evaluation of nursing models and theories* (2nd ed.). Philadelphia, PA: F. A. Davis Company.

Field, T., Peck, M., Hernandez-Reif, M., Krugman, S., Burman, I., & Ozment-Schenck, L. (2000). Post burn itching, pain, and psychological symptoms are reduced with massage therapy. *Journal of Burn Care and Rehabilitation*, *21*(3), 189-193. doi: 10.1067/mbc.2000.105087

Finlay, A. Y., & Khan, G. K. (1994). Dermatology Life Quality Index (DLQI) – a simple practical measure for routine clinical use. *Clinical and Experimental Dermatology*, *19*, 210-216.

Frederick, R. I. (2001). Review of the RAND-36 Health Status Inventory. In *The Fourteenth Mental Measurements Yearbook* (pp.983-984). Lincoln, Nebraska: University of Nebraska Press.

Gardner, S. E., & Frantz, R. A. (2012). Wound bioburden and infection. In S. Baranoski & E. A. Ayello (Eds.), *Wound care essentials: Practice principles (3rd ed.)* (pp. 126-156). Philadelphia: Lippincott Williams & Wilkins.

Gieler, U., Niemeier, V., Brosig, B., &Kupfer, J. (2002). Psychosomatic aspects of pruritus. *Psychosomatic Dermatology*, *3*,6-13.

Gottrup, F., Nix, D. P., & Bryant, R. A. (2007). The multidisciplinary team approach. In R. A. Bryant & D. P. Nix (Eds.), *Acute and Chronic Wounds: Current Management Concepts* (pp. 23-38). St. Louis, MO: Mosby/Elsevier.

Greaves, M. W. (2005). Itch in systemic disease: Therapeutic options. *Dermatologic Therapy*, *18*, 323-327.

Greaves, M. W., & Khalifa, N. (2004). Itch: More than skin deep. *International Archives of Allergy and Immunology*, *135*(2), 166-172.

Guarneri, C., Terranova, M., Terranova, G., & Guarneri, F. (2005). The future: Critical knowledge about anti-itch therapy. *Dermatologic Therapy*, *18*, 363-365.

Hanafin, J. M., & Rajka, G. (1980). Diagnostic features of atopic dermatitis. *Acta Dermato-Venereologica*, *92*, 44-47.

Hareendran, A., Bradbury, A., Budd, J., Geroulakos, G., Hobbs, R., Kenkre, J., & Symonds, T. (2005). Measuring the impact of venous leg ulcers on quality of life. *Journal of Wound Care*, *14*(2), 53, 54, 56, 57.

Hareendran, A., Doll, H., Wild, D.J., Moffat, C. J., Musgrove, E., Wheatley, C., & Franks, P. J. (2007). The venous leg ulcer quality of life (VLU-Qol) questionnaire: Development and psychometric validation. *Wound Repair and Regeneration*, *15*, 465-473. doi: 10.1111/j.1524-475X.2007.00253x

Hartoch, R. S., McManus, J. G., Knapp, S., & Buettner, M. F. (2007). Emergency management of chronic wounds. *Emergency Medicine Clinics of North America*, *25*, 203-221. doi: 10.1016/j.emc.2007.01.010

Hawkins, J. M., & Allen, R. (Eds.). (1991). *The Oxford encyclopedic English dictionary*. Oxford: Clarindon Press.

Hays, R. D., Prince-Embury, S., & Chen, H. (1998). Rand-36 Health Status Inventory. San Antonio, TX: The Psychological Corporation.

Herde, L., Forster, C., Strupf, M., & Handwerker, H. O. (2007). Itch induced by a novel method leads to limbic deactivation – A functional MRI study. *Journal of Neurophysiology*, *98*, 2347-2356. doi: 10.1152/jn.00475.2007

Hettrick, H., O'Brien, K., Laznick, H., Sanchez, J., Gorga, D., Nagler, W., & Yurt, R. (2004). Effect of transcutaneous electrical nerve stimulation for the management of burn pruritus: A pilot study. *Journal of Burn Care and Rehabilitation*, *25*(3), 236-240.

Heymann, W. R. (2006). Itch. *Journal of the American academy of Dermatology*, *54*(4), 705-706. doi: 10.1016/j.jaad.2005.12.001

Ikoma, A., Steinhoff, M., Stander, S., Yosipovitch, G., & Schmelz, M. (2006). The neurobiology of itch. *Neuroscience*, *7*, 535-547. doi: 10.1038/nrn1950

Ischia, J., Patel, O., Shulkes, A., & Baldwin, G. S. (2009). Gastrin-releasing peptide: Different forms, different functions. *Biofactors*, *35*(1), 69-75. doi: 10.1002/biof.10

Jacome, D. (1978). Phantom itching relieved by phantom feet. *Journal of the American Medical Association*, *240*(22), 2432.

Jacox , A., Suppe, F., Campbell, J., & Stashimko, E. (1999). Diversity in philosophical approaches. In A. S. Hinshaw, E. L. Futham, & J. L. F. Shaver (Eds.) *Handbook of clinical nursing research*. Thousand Oaks, CA: Sage.

Johanek, L. M., Meyer, R. A., Hartke, T., Hobelmann, J. G., Maine, D. N., LaMotte, R. H., & Ringkamp, M. (2007). Psychophysical and physiological evidence for parallel afferent pathways mediating the sensation of itch. *The Journal of Neuroscience*, *27*(28), 4790-4797. doi: 10.1523/JNEUROSCI.1249-07.200

Kamei, C., & Hossen, M. A. (2005). Commentary 1. In R. Paus (Ed.) How to fight that nasty itch – from new insights into the neuroimmunological, neuroendocrine, and neurophysiological bases of pruritus to novel therapeutic approaches. *Experimental Dermatology*, *14*, 225-140.

Keller, S., Bann, C. M., Dodd, S. L., Schein, J., Mendoza, T. R., & Cleeland, C. S. (2004). Validity of the Brief Pain Inventory for use in documenting the outcomes of patients with noncancer pain. *Clinical Journal of Pain*, *20*(5), 309-318.

Kopecky, E. A., Jacobson, S., Hubley, P., Palozzi, L., Clarke, H., & Koren, G. (2001). Safety and pharmacokinetics of EMLA in the treatment of post burn pruritus in pediatric patients: A pilot study. *Journal of Burn Care and Rehabilitation*, *22*(3), 235-242.

Lazarus, G. S., Cooper, D. M., Knighton, D. R., Margolis, D. J., Pecoraro, R. E., Rodeheaver, G., & Robson, M. C. (1994). Definitions and guidelines for Assessment of Wounds and Evaluation of Healing. *Archives of Dermatology*, *130*, 489-493.

Lee, A., Browne, M. O., & Villanueva, E. (2008). Consequences of using SF-12 and RAND-12 when examining levels of well-being and psychological distress. *Australian and New Zealand Journal of Psychiatry*, *42*, 315-323.

Leknes, S. G., Bantick, S., Willis, C. M., Wilkinson, J. P., Wise, R. G., & Tracey, I. (2007). Itch and motivation to scratch: An investigation of the central and peripheral correlates of allergen- and histamine-induced itch in humans. *Journal of Neurophysiology*, *97*, 415-422. doi: 10.1152/jn.00070.2006

Levine, M. E. (1967). The four conservation principles of nursing. *Nursing Forum*, *6*(1), 45-59.

Levine, M. E. (1969a). *Introduction to clinical nursing*. Philadelphia, PA: F. A. Davis Company.

Levine, M. E. (1969b). The pursuit of wholeness. *American Journal of Nursing*, *69*(1), 93-98.

Levine, M. E. (1971). Holistic nursing. *Nursing Clinics of North America*, *6*(2), 253-264.

Levine, M. E. (1973). *Introduction to clinical nursing* (2nd ed.). Philadelphia: F. A. Davis Company.

Levine, M. E. (1989a). Beyond dilemma. *Seminars in Oncology Nursing*, *5*(2), 124-128.

Levine, M. E. (1989b). The conservation principles of nursing: Twenty years later. In J. P. Riehl (Ed.), *Conceptual models for nursing practice* (3rd ed., pp. 325-327). Norwalk, CT: Appleton & Lange.

Levine, M. E. (1990). Conservation and integrity. In M. E. Parker (Ed.), *Nursing theories in practice* (pp. 189-201). New York: National League for Nursing.

Levine, M. E. (1991). The conservation principles: a model for health. In K. M. Schaefer and J. B. Pond (Eds.) *Levine's conservation model: A framework for nursing practice* (pp.1-11). Philadelphia, PA: F. A. Davis Company.

Levine, M. E. (1995). The rhetoric of nursing theory. *Image: Journal of Nursing Scholarship*, *27*(1), 11-14.

Levine, M. E. (1996). The conservation principles: A retrospective. *Nursing Science Quarterly*, *9*, 38-41.

Lierman, L. M. (1988). Phantom breast experiences after mastectomy. *Oncology Nursing Forum*, *15*(1), 41-44.

Lyder, C. H., & Ayello, E. A. Chapter 12. Pressure ulcers: A patient safety issue. In R. Hughes (Ed.), *Patient safety and quality: An evidence-based handbook for nurses* (p.16), http://www.nea.cms.hhs.gov/manuals/download.

Maida, V., Ennis, M., Kuzienisky, C., & Trozzolo, L. (2009). Symptoms associated with malignant wounds: A prospective case study. *Journal of Pain and Symptom Management*, *37*(2), 206-211. doi:10.1016/j.painsymman.2008.01.009

Matheson, J., Clayton, J., & Muller, M. (2001). The reduction of itch during burn wound healing. *Journal of Burn Care and Rehabilitation*, *22*(1), 76-81.

McMahon, S. B., & Koltzenburg, M. (1992). Itching for an explanation. *Trends in Neuroscience*, *15*(12), 497-501.

Melzack, R. (1992). Phantom limbs. *Scientific American*, *266*, 120-126.

Mendham, J. (2004). Gabapentin for the treatment of itching produced by burns and wound healing in children: a pilot study. *Burns*, *30*(8), 851-853. doi: 10.1016/j.burns.2004.05.009

Metze, D. (2004). Skin nerve anatomy: Neuropeptide distribution and its relationship to itch. In G. Yosipovitch, M. W. Greaves, A. B. Fleischer, Jr., & F. McGlone (Eds.), *Itch: Basic mechanisms and therapy* (pp. 71-86), New York: Marcel Dekker, Inc.

Michigan Children's Protection Registry Act of 2004, S. 241, 92nd Legislature (2004).

Miller, M. J. S., Rueter, B. K., Wallace, J. L., Sharkey, K. A., & Bobrowski, P. (2004). Mechanistic and clinical assessment of Zangrado, an extract of the Amazonian ethnomedicine sangre de grado, for the treatment of itch. In G. Yosipovitch, M. W. Greaves, A. B. Fleischer, Jr., & F. McGlone (Eds.), *Itch: Basic mechanisms and therapy* (pp. 305-314), New York: Marcel Dekker, Inc.

National Pressure Ulcer Advisory Panel (NPUAP). (2007). NPUAP staging report. Retrieved from http://www.npuap.org/positn6.html.

Neswick, R. S. (1997). Myra E. Levine: A theoretical basis for ET nursing. *Journal of Wound Ostomy and Continence Nursing*, *24*(1), 6-9.

Norman, R. (2003). Xerosis and pruritus in the elderly: Recognition and management. *Dermatologic Therapy*, *16*(3), 254-259.

Oxford English Dictionary Online. (2009). Retrieved from http://www.oed.com.

Pacifico, A., de Angelis, L., Fargnoli, M., De Felice, C., Chimenti, S., & Peris, K. (2005). Clinical trial on Aveeno Skin Relief Moisturizing Lotion in patients with itching accompanied by skin lesions and xerosis. *The Journal of Applied Research*, *5*(2), 325-330.

Patel, K. N., & Dong, X. (2010). An itch to be scratched. *Neuron*, *68*(4), 334-339. doi: 10.1016/j.neuron.2010.10.018

Patel, T. S., & Yosipovitch, G. (2010). Central transmission: From skin to brain. In L. Misery & S. Stander (Eds.), *Pruritus* (pp. 23-26). London: Springer-Verlag.

Paul, J., Pieper, B., & Templin, T. (2011). Itch: Association with chronic venous disease, pain and quality of life. *Journal of Wound Ostomy and Continence Nursing*, *38*(1), 46-54.

Paus, R., Schmelz, M., Biro, T., & Steinhoff, M. (2006). Frontiers in pruritus research: Scratching the brain for more effective itch therapy. *The Journal of Clinical Investigation*, *16*(5), 1174-1185. doi: 10.1172/JCI28553

Persoon, A., Heinen, M. M., van der Vleuten, C. J. M., de Rooij, M.J., van de Kerkof, P. C. M., & van Achterberg, T. (2004). Leg ulcers: a review of their impact on daily life. *Journal of Clinical Nursing*, *13,* 341-354.

Pieper, B. (2007). Mechanical forces: pressure, sheer, and friction. In R. A. Bryant & D. P. Nix (Eds.), *Acute and chronic Wounds: Current management concepts* (pp. 205-234). St. Louis, MO: Mosby/Elsevier.

Pieper, B., Szczepaniak, K., & Templin, T. (2000). Psychosocial adjustment, coping, and quality of life in persons with venous ulcers and a history of intravenous drug use. *Journal of Wound, Ostomy and Continence Nursing*, *27*(4), 227-237. doi: 10.1067/mjw.2000.107877

Pogatzki-Zahn, E., Marziniak, M., Schneider, G., Luger, T. A., & Stander, S. (2008). Chronic pruritus: Targets, mechanisms and future therapies. *Drug News Perspectives*, *21*(10), 541-551. doi:10.1358/dnp.2008.21.10.1314057

Ratcliff, S., Brown, A., Rosenberg, L., Rosenberg, M., Robert, R., Cuervo, L., . . Villarreal, C. (2006). The effectiveness of a pain and anxiety protocol to treat the pediatric burn patient. *Burns*, *32*(5), 554-562. doi:10.1016/j.burns.2005.12.006

Reddy, M. (2008). Skin and wound care: Important considerations in the older adult. *Advances in Skin and Wound Care*, *21*(9), 424-436.

Roebuck, H. (2006). For pruritus combination therapy works best. *The Nurse Practitioner*, *31*(3), 12-13.

Sarvis, C. (2005). Providing relief to patients with malignant wounds. *Nursing Spectrum*, *14*(23), 19-21.

Schmelz, M. (2005). Viewpoint 4. In R. Paus (Ed.) How best to fight that nasty itch-from new insights into the neuroimmunological, neuroendocrine, and neurophysiological bases of pruritus to novel therapeutic approaches. *Experimental Dermatology*, *14*, 225-240. doi: 10.1016/j.pain.2006.05.022

Schmelz, M. (2010). Modulators of pruritus: Peripheral and central sensitization. In L. Misery & S. Stander (Eds.), *Pruritus* (pp. 22-29). London: Springer-Verlag.

Schmelz, M., & Handwerker, H. O. (2004). Neurophysiologic basis of itch. In G. Yosipovitch, M. W. Greaves, A. B. Fleischer, Jr., & F. McGlone (Eds.), *Itch: Basic mechanisms and therapy* (pp. 5-12), New York: Marcel Dekker, Inc.

Schmelz, M., Schmidt, R., Bickel, A., Handwerker, H. O., & Torebjork, H. E. (1997). Specific C-receptors for itch in human skin. *The Journal of Neuroscience*, *17*(20), 8003-8008.

Shai, A., & Halevy, S. (2005). Direct ulceration in patients with venous insufficiency. *International Journal of Dermatology*, *44*, 1006-1009.

Shornick, J.K. (1994). Pruritus in pregnancy. In J. D. Bernhard (Ed.), *Itch: Mechanisms and management of pruritus* (pp. 261-279). New York, NY: McGraw-Hill, Inc.

Sieggreen, M. Y., & Kline, R. A. (2012). Venous disease and lymphedema management. In S. Baranoski & E. A. Ayello (Eds.), *Wound care essentials: Practice principles (3rd ed.)* (pp. 360-397). Philadelphia: Lippincott Williams & Wilkins.

Spilsbury, K., Nelson, E. A., & Cullum, C. (2007). Inpatients felt that pressure ulcers had an emotional, mental, physical, and social effects on quality of life because nurses did not adequately treat or manage their pain or discomfort. *Evidence-based Nursing*, *10*, 128. doi:10.1111/j.1365-2648.2006.04140.x

Stander, S., & Schmelz, M. (2006). Chronic itch and pain – similarities and differences. *European Journal of Pain*, *10*(5), 473-478. doi: 10.106/j.ejpain.2006.03.005

Stander, S., Steinhoff, M., Schmelz, M., Weisshaar, E., Metze, D., & Luger, T. (2003). Neurophysiology of pruritus: Cutaneous elicitation of itch. *Archives of Dermatology*, *139*, 1463-1470.

Stander, S., Weisshaar, E., Mettang, T., Szepietowski, J., Carstens, E., Ikoma, A., . . . Bernard, J. D. (2007). Clinical classification of itch: A position paper of the International Forum for the Study of Itch, Acta Dermato-Venereologica, 87, 291-294. Doi: 10.2340/00015555-0305

Statistics Solutions. (2010). Retrieved from http://www.statisticssolutions.com/methods-chapter/directory-of-service-instruments/brief-pain-inventory.

Stedman's Medical Dictionary (28th ed.). (2006). Philadelphia: Lippincott, Williams & Wilkins.

Sugimoto, Y., Umakoshi, K., Nojiri, N., & Kamei, C. (1998). Effects of histamine H_1 receptor antagonist compound 48/80-induced scratching behavior in mice. *European Journal of Pharmacology*, 351, 1-5.

Sun, Y., & Chen, Z. (2007). A gastrin-releasing peptide receptor mediates the itch sensation in the spinal cord. *Nature*, *448*(7154), 700-703. doi: 10.1038/nature06029

Swain, M. G. (2008). Gastrin-releasing peptide and pruritus: More than just scratching the surface. *Journal of Hepatology*, *48*, 681-683. doi: 10.1016/j.hep.2008.01.007

Tey, H. L., & Yosipovitch, G. (2011). Targeted treatment of pruritus: A look into the future. *British Journal of Dermatology*, *165*, 5-17.

Twycross, R., Greaves, M. W., Handwerker, H., Jones, E. A., Libretto, S. E., Szepietowski, J. C., & Zylicz, Z. (2003). Itch: Scratching more than the surface. *Quarterly Journal of Medicine*, *96*(1), 7-26.

Van Os-medendorp, H., Eland-de Kok, P. C. M., Ros, W. J. G., Bruijnzeel-Koomen, C, A. F. M., & Grypdonck, M. (2007). The nursing programme 'Coping with itch': A promising intervention for patients with chronic pruritic skin diseases. *Journal of Clinical Nursing*, *16*, 1238-1246.

Verhoeven, E. W. M., Kraaimaat, F. W., van der Kerkhof, P. C. M., van Weel, C., Duller, P., van der Valk, P. G. M., . . . Evers, A. W. M. (2007). Prevalence of physical symptoms of itch, pain, and fatigue in patients with skin diseases in general practice. *British Journal of Dermatology*, *156*, 1346-1349.

Wallengren, J. (2004). Cutaneous nerve stimulation in the treatment of localized itch. In G. Yosipovitch, M. W. Greaves, A. B. Fleischer, Jr., & F. McGlone (Eds.), *Itch: Basic mechanisms and therapy* (pp. 335-341), New York: Marcel Dekker, Inc.

Walshe, C. (1995). Living with a venous leg ulcer: A descriptive study of patients' experiences. *Journal of Advanced Nursing*, *22*, 1092-1100.

Waxler, B., Dadabhoy, Z. P., Stojiljkovic, L., & Rabito, S. F. (2005). Primer of postoperative pruritus for anesthesiologists. *Anesthesiology*, *103*, 168-178.

Weisshaar, E., Kucenic, M. J., & Fleischer, A. B. (2003). Pruritus: A review. *Acta Dermato-Verereologica*, *Suppl. 213*, 5-32.

Weldon, D. R. (2006). Quality of life in patients with urticaria. *Allergy and Asthma Proceedings*, *27*(2), 96-99.

Windsor, T. D., Rodgers, B., Butterworth, P., Anstey, K. J., & Jorm, A. F. (2006). Measuring physical and mental health using the SF-12: Implications for community surveys of mental health. *Australian and New Zealand Journal of Psychiatry*, *40*, 797-803.

Yelverton, C. B., & Yosipovitch, G. (2007). Exogenous factors in the itch response. *Current Problems in Dermatology*, *35*, 146-153.

Yosipovitch, G. (2004a). Dry skin and impairment of barrier function associated with itch –new insights. *International Journal of Cosmetic Science*, 26, 1-7.

Yosipovitch, G. (2004b). Epidemiology of itching in skin and systemic diseases. In G. Yosipovitch, M. W. Greaves, A. B. Fleischer, Jr., & F. McGlone (Eds.), *Itch: Basic mechanisms and therapy*. New York: Marcel Dekker, Inc.

Yosipovitch , G., & Greaves, M. W. (2004). Definitions of itch. In G. Yosipovitch, M. W. Greaves, A. B. Fleischer, Jr., & F. McGlone (Eds.), *Itch: Basic mechanisms and therapy* (pp. 1-4), New York: Marcel Dekker, Inc.

Yosipovitch, G., & Hundley, J. L. (2004). Practical guidelines for relief of itch. *Dermatology Nursing*, *16*(4), 325-238.

Yosipovitch, G., & Papoiu, A. D. P. (2008). What causes itch in atopic dermatitis? *Current Allergy and Asthma Reports*, *8*, 306-311.

Yosipovitch, G., Carstens, E., & McGlone, F. (2007). Chronic itch and chronic pain: Analogous mechanisms. *Pain*, 131, 4-7. Doi: 10.1016/j.pain.2007.04.017

Yosipovitch, G., Duque, M. I., Fast, K., Dawn, A. G., & Coghill, R. C. (2007). Scratching and noxious heat stimuli inhibit itch in humans: A psychophysical approach. *British Journal of Dermatology*, *156*, 629-634. doi: 10.1111/j.1365-2133.2006.07711.x

Yosipovitch, G., Goodkin, R., Wingard, E. M., & Bernhard, J. D. (2004). Neuropathic pruritus. In G. Yosipovitch, M. W. Greaves, A. B. Fleischer, Jr., & F. McGlone (Eds.),*Itch: Basic mechanisms and therapy* (pp. 1-4), New York: Marcel Dekker, Inc.

Yosipovitch, G., Greaves, M., & Schmelz, M. (2003). Itch. *Lancet*, *362*, 690-694.

Yosipovitch, G., Ishiuji, Y., Patel, T.S., Hicks, M. I., Oshiro, Y., Kraft, R. A., . . . Coghill, R. C. (2008). The brain processing of scratching. *Journal of Investigative Dermatology*, *128*, 1806-1811.

Yosipovitch, G., Zucker, I., Boner, G., Gafter, U., Shapira, Y, & David, M. (2001). A questionnaire for the assessment of pruritus: Validation in uremic patients. *Acta Dermato-Venereologica*, *81*, 108-111.

ABSTRACT

ITCH OCCURRING WITH CHRONIC WOUNDS

by

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May, 2012

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Major: Nursing

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Background: Itch is an irritation of the skin which can be as disturbing as pain. It is a familiar phenomenon yet remains poorly understood. Itch associated with wounds is recognized clinically, but is not well described in the literature related to chronic wounds commonly encountered in wound care practice. Chronic wounds include vascular, neuropathic, traumatic, and pressure-related wounds as well as wounds of mixed etiology. Chronic wounds mostly affect those persons over sixty years of age, so the percentage of persons with chronic wounds is likely to increase with the aging of society. Because of the itch-scratch cycle, wounds can be perpetuated by scratching in response to itch. Frequency of wound itch, characteristics of wounds that itch, measures used by persons with chronic wounds to manage wound itch, and impact that itch has on quality of life for persons with chronic wounds is not known. Nurses are in a unique position for assessment and management of wound itch. The Theory of Wound Itch derived from Levine's Principles of Conservation provided a theoretical framework for this nursing study.

Purpose: To examine the phenomenon of itch associated with chronic wounds as found in wound care practice. Research questions were: (a) What is the frequency, timing, duration and intensity of itch related to chronic wounds? (b) What are the characteristics of wounds that itch? (c) What treatments do participants use to manage wound itch? (d) How does wound itch affect quality of life for these participants? (e) What is the relationship between wound itch and pain? **Methods**: The study design was observational, descriptive. 200 participants will be recruited from hospital-affiliated wound care centers.

Participants were interviewed with structured interview tools, and wounds were assessed according components of the Bates-Jensen Wound Assessment Tool. Data were analyzed to answer the research questions using descriptive and parametric statistics. **Results**: Participants were 21 to 98 years (M = 66.82; SD = 14.02); men (56%) and women; primarily white (85%). One fourth of participants (56 of 199) reported wound-related itch. Compared to wounds without itch, wounds that itched were generally larger, $t(72.71) = -2.38$, $p = .02$, $d = .50$, 95% CI[-21.88, -1.92], had more tissue edema, $t(88.38) = -2.20$, $p = .03$, $d = .37$, 95% CI[-0.93, -0.05], and more granulation tissue in the wound base, $X^2(4, N = 198) = 8.06$, $p = .09$. Rubbing (14.5%) and scratching (12.0%) were described as well as lotion to the area of wound itch (10%). No effect on quality of life was found. Wound-related pain and wound-related itch were positively correlated ($r = .17$, $p = .02$). **Conclusion**: Wound itch was described by one fourth of persons with chronic wounds. Wound itch was present with larger wounds, with more tissue edema, and with more granulation tissue in the wound base. While no effect on quality of life was found, participants were able to distinguish wound itch from pain and described it as annoying and bothersome. Pain and wound itch were positively correlated. **Implications**: This study advanced nursing science by providing an understanding of itch with chronic wounds, so that itch might be assessed and treated to promote healing and improve quality of life for persons with chronic wounds.

AUTOBIOGRAPHICAL STATEMENT

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EDUCATION

Present- Doctor of Philosophy in Nursing, Wayne State University, Detroit, Michigan.
1991- Master of Science in Nursing, Wayne State University, Detroit, Michigan.
1983- Bachelor of Science in Nursing, Valparaiso University, Valparaiso, Indiana.

PROFESSIONAL APPOINTMENTS

1996 to present- Nurse Practitioner, Plastic Surgery, William Beaumont Hospital, Royal Oak, Michigan.
1995 to 1996- Clinical Nurse, Outpatient Surgery, William Beaumont Hospital, Royal Oak, Michigan.
1992 to 1995- Physician Extender, Cardiovascular Surgery, William Beaumont Hospital, Royal Oak, Michigan.
1990 to 1992- Clinical Nurse Specialist, Cardiovascular Surgery, William Beaumont Hospital, Royal Oak, Michigan.
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1985 to 1987- H.D.S. Instructor, Corporate H.D.S. Department, William Beaumont Hospital, Royal Oak, Michigan.
1983 to 1985- Clinical Nurse, Oncology Unit, William Beaumont Hospital, Royal Oak, Michigan.

PROFESSIONAL ASSOCIATIONS

Present American Board of Wound Management
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AWARDS & COMMITTEE APPOINTMENTS

2011 University Dissertation Fellowship, Graduate School, Wayne State University
2008 Alumni Nursing Scholarship, College of Nursing, Wayne State University
2005 Third Place Writing Award from the American Society of Plastic Surgical Nursing
2003 Star Employee of the Month, William Beaumont Hospital

PUBLICATIONS & PRESENTATIONS

Paul, J., Pieper, B., & Templin, T. (2011). Itch: Association with Chronic Venous Disease, Pain, and Quality of Life. Journal of Wound, Ostomy and Continence Nursing, *38*(4), 46-54.

Paul, J., & Pieper, B. (2008). Topical Metronidazole for the treatment of wound odor: A review of the literature. *Ostomy Wound Management, 54* (3), 18-28.

Paul, J. (2005). Vacuum-assisted closure therapy: A must in plastic surgery. *Plastic Surgical Nursing*, *25* (2), 61-65.

A poster entitled, "Itch Occurring with Chronic Wounds" was presented at the 6th World Congress on Itch which took place September, 2011, in Brest, France.

A presentation was given in 2009, at the Midwest Nursing Research Society Conference with posters there, at Wayne State University College of Nursing's Annual Research Day in 2009 and 2010, and at Wayne State University's Graduate Exhibition in 2010 and 2011.