

CHRONIC WOUNDS PAIN MANAGEMENT IN ELDERLY PEOPLE

A literature review

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TIIVISTELMÄ

Krooniset haavat ovat yksi yleisimmistä terveysongelmista vanhuksilla ja niihin liittyvä kipu aiheuttaa valtavan taakan potilaille, terveydenhuollon tarjoajille ja koko terveydenhuoltojärjestelmälle. Sopimattomat kivunlievitysmenetelmät voivat saada potilaat kärsimään enemmän tai johtaa tarpeettomaan lääketieteellisten resurssien tuhlaamiseen. Siksi tarvitaan menetelmiä kroonisten haavakivun tehokkaiden hoitoa.

Tämän opinnäytetyö avoitteena on selvittää mitkä riskitekijät lisäävät kroonisen haavan kipua ja selvittää minkälaisia hoitotyön interventioita voidaan käyttää vähentämään kroonisen haavan kipua. Opinnäytetyön tarkoituksena on lisätä sairaanhoitajien kroonisen haavan kivunhoitotaitoja.

Suoritettu menetelmä ei kuvaileva kirjallisuuskatsaus. Opinnäytetyössä on analysoitu 21 tutkittua artikkelia, analyysissä käytettiin laadullinen analyysimenetelmä.

Tutkimustulokset osoittivat, että kroonista haavan kipua lisääviä **pääasiallisia** riskitekijöitä oli neljä: sidosten vaihtaminen infektiot, haavan puhdistaminen ja psykologiset tekijät. Tulosten mukaan kipulääkkeen tieteellinen soveltaminen, sidosten vaihdossa taitojen parantaminen ja psykologiset toimenpiteet, kuten ihon läpi tapahtuva sähköinen hermostimulaatio osoittivat positiivisia tuloksia kivun lievittämisessä.

Asiasanat: krooniset haavat, vanhukset, krooninen haavakipu, kivun hallinta.

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ABSTRACT

Chronic wound is one of the most common health issues in elderly people and the pain related chronic wounds results in a huge burden to patients, healthcare givers and health care system. Inappropriate pain reduction methods could either make the patients suffering more or lead to needless medical resource waste. Hence, a set of effective chronic wound pain interventions is needed.

In this thesis, the aim is to find out what risk factors contribute to increase chronic wounds pain and to figure out what kinds of methods can be used by nurses. The purpose of the thesis is to improve the nursing skills of chronic wound pain management for elderly people.

The conducted method was a literature review. 21 researched articles were analyzed in this thesis. A qualitative analyzing method was undertaken in the analysis.

The findings revealed that there are four main risky factors increasing chronic wound pain: dressing change, infection, debridement and psychological factors. The interventions about chronic wound pain management appear in this thesis including scientific application of analgesic, improvement of dressing change skills and psychological interventions electrical nerve stimulation had shown positive outcomes in pain reduction.

Key words: chronic wounds, elderly, chronic wound pain, pain management.

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LIST OF ABBREVIATIONS

CWP	Chronic wound pain
CVU	Chronic venous ulcer
DFU	Diabetic foot ulcer
MPQ	The McGill Pain Questionnaire
NSAIDs	Non-steroidal anti-inflammatory drugs
PU	Pressure ulcers
VAS	The visual analogue scale
VRS	The verbal rating scale
WHS	Wound Healing Society

1 INTRODUCTION

Nowadays, there are many statistics showing that chronic wounds become increasingly heavy healthcare burden on individuals, families and social healthcare expenditure. For instance, only in the United States, in 2009, there were 6.5 million people suffering from chronic wounds and this number is still rising. World-wide, patients with chronic wounds consumed \$15.3 billion on the wound care products market by 2010. 31.5 million of outpatient surgeries related to chronic wound were performed in USA in 2000. (Sen et al 2009.) But this reality is only a tip of the iceberg of chronic wounds.

The biggest concern cared by healthcare givers and patients is the severest complication of chronic wound -- pain. Chronic wound pain does not only affect patient's physical health but also impacts on patient's psychological wellbeing (Soon & Acton 2006). In 2008, Price and his team conducted an experiment for assessing how patients feel the pain related chronic wounds globally: they selected 2008 elderly people over 65 years from 15 various countries, the results showed that only 32.3% of them feel pain "rarely" or "never", the rest of the patient described pain as "quite often" or "mostly". In addition to this, pain was ranked to be the first one factor that affects their life the most. (Price et al 2008.). As we can see from those statistics, chronic wounds pain has become a severe health issue among elderly people worldwide and it is becoming a huge financial burden for many countries.

Therefore, the aim of this thesis was to find out what are the risk factors that contribute to increase chronic wounds pain and to figure out what kinds of methods can be used by nurses. The purpose of the thesis was to improve the nursing skills of chronic wound pain management for elderly people. The methodology was a literature review conducted in the thesis.

2 THEORETICAL BACKGROUND

2.1 The most common types of chronic wounds in elderly people

There are two major parts included in theoretical background: chronic wounds and chronic wounds pain. In the subsection of chronic wounds, there are four types of the most common chronic wounds presented: pressure ulcer, diabetic foot ulcer, venous ulcer and arterial insufficiency ulcer (Chronic wound care guidelines 2006). In the subsection of chronic wounds pain, there are two different types of chronic wound pain - nociceptive pain and neuropathic pain presented.

Chronic wounds are defined as the wounds which are not able to follow the normal wound healing stages sequentially within 3 months or even longer (Frykberg & Bank 2015). Generally, chronic wounds are usually categorized as pressure ulcer, diabetic ulcers venous ulcer and arterial insufficient ulcer. Five phases are involved in chronic wounds healing--“inflammatory phase, proliferative phase, remodeling phase, epithelialization and wound contraction”. (Mustoe 2005.) In the majority of cases, chronic wounds mostly maintain in the inflammation phase and the pain caused by chronic wound is often complained. (Frykberg & Bank 2015).

2.1.1 Pressure ulcer

Pressure ulcer, is also well known as bed sore or decubitus ulcer. As the name implies, the International National Pressure Ulcer Advisory Panel (NPUAP) defines pressure ulcer as “A pressure ulcer is a localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure or pressure in combination with shear”. The pathology of pressure ulcer is complicated and so far there is no specific main cause that has been confirmed. In the most cases, the contributing factors are combined. (NPUAP 2009.) The most likely to be wounded sites are sacrum, ischium, heel and trochanter. A number of external confounding factors, such as friction, shear, moisture or a number of internal confounding factors that cause skin damage, immobility, edema, venous blockage or dehydration contribute much to development of pressure ulcers. (Jaul 2010.)

According to the International NPUAP-EPUAP Pressure Ulcer Classification System (2009) (Figure 1), the degree of pressure ulcer can be divided into four levels: Nonblanchable Erythema, partial Thickness Skin Loss, Full Thickness Skin Loss and Full Thickness Tissue Loss, the wounded tissue goes deeper and deeper as the pressure ulcer developing. The typify symptoms of pressure ulcer may be various: at the beginning, may only redness appear on the pressurized skin, as the pressure consisting to work on the skin, “a red pink wound bed or open/ruptured serum-filled blister” may present. These are called pressure ulcer stage 1 and stage 2. From stage 3 to stage 4, the wounded tissue is going deeper, the symptoms are also from the exposed taneous fat turns to the visible bone, tendon or muscle, in some cases, slough or eschar may appear. (NPUAP-EPUAP Pressure Ulcer Classification System 2009.)

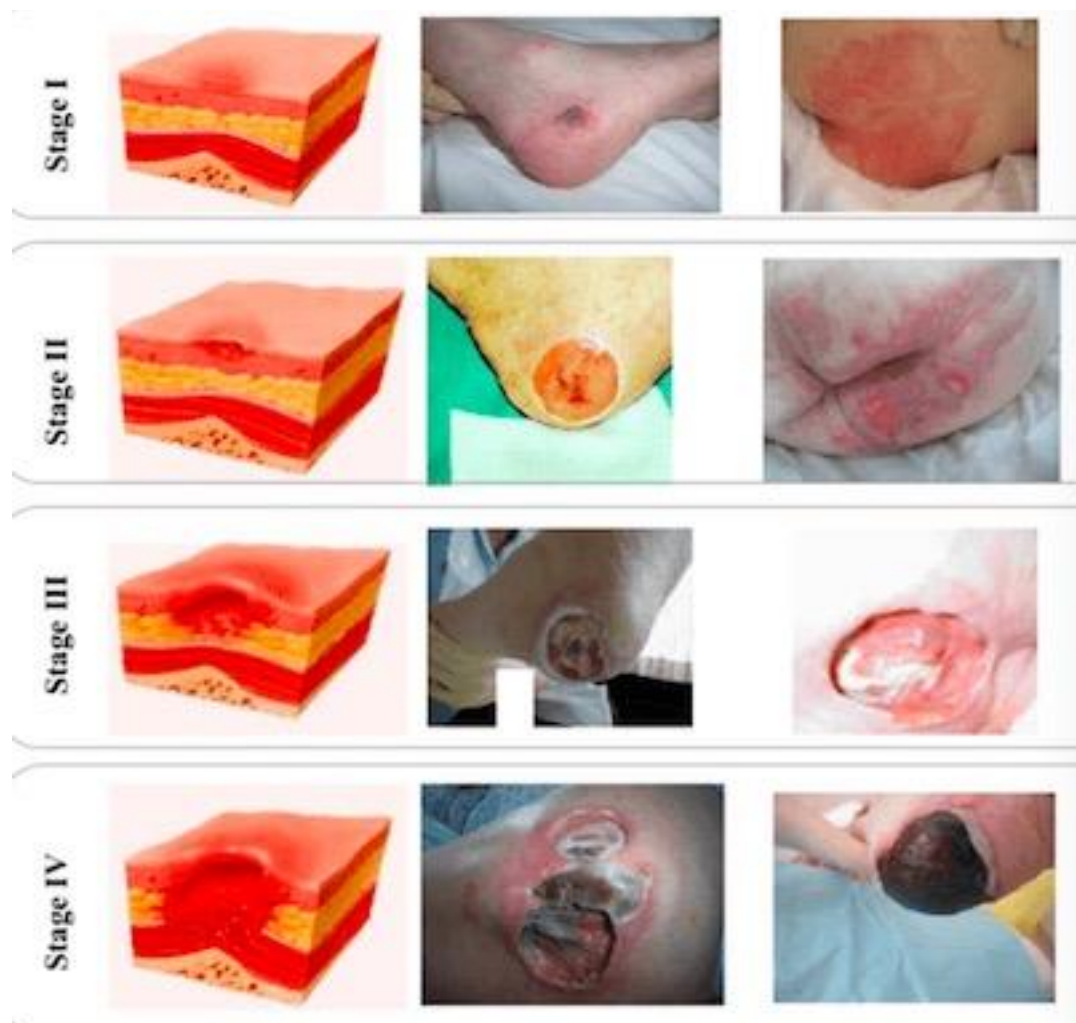


Figure 1 International NPUAP-EPUAP Pressure Ulcer Classification System 2009.

The pressure ulcer should be treated holistically, from dealing with the risk causes that may accelerate the development of pressure ulcer to manage the wound itself, both of them should be addressed seriously. The contraindications of application of coexisting medicine should be taken into account, particularly those medications that have harmful impacts on skin status and blood circulation. (Jaul 2010.)

The rooted cause of pressure ulcer is vulnerable site under external pressure for long time, so that the immobile people is the most vulnerable group who can be easily attacked by pressure ulcer. Thus, changing position timely is a key method for addressing this problem. Additionally, there are also many other techniques can be applied for preventing pressure ulcer, for example using functional mattress or cushions to ease pressure or applying some devices that can protect the vulnerable parts of body that with less subcutaneous fat such as ankle and heel. Repositioning the bedridden patients at least every two hours and keeping the head of bed less than 30°. (Jaul 2010.)

Also, intake of sufficient nutrition, either in oral or via nasogastric feeding tube, carries the benefit of prevention or alleviating pressure ulcer. But for dementia patients, tube feeding may not succeed to achieve this goal because the side effects of tube feeding and patients' uncooperative behavior would low the curative effects. Local pressure offloading or debridement for necrotic wound is also recommended as pressure ulcers treatments. But for elderly with chronic pressure ulcer, procedures like surgery, skin-grafting, hyperbaric oxygen, water immersion, should not be utilized cautiously until the causes of pressure ulcer are ascertained. (Jaul 2010.)

2.1.2 Diabetic foot ulcers

Diabetic ulcer most likely attacks the people who are living with diabetics. The most representative underlying causes of diabetic ulcer are uncontrolled hyperglycemia, neuropathy and arterial impairment (Braadvedt 2010). Apart from these, joint immobility, history of ulceration, amputation and foot malformations also are identified as risk factors. Generally, the consequence of diabetic foot ulcer is amputation, which can be seen as patient's physical and psychological trauma. In this section, two causes of diabetic foot ulcer--diabetic neuropathy and peripheral

arterial disease are demonstrated specifically because they are mostly considered as the initial risk factor of diabetic foot ulcer. (Amin & Doupis 2016.)

The diabetic neuropathy is one of the most common complications of diabetes. It is caused by dysfunctional peripheral nerve. The symptoms of neuropathy are various depending on which type of nerves are damaged. For instance, sensory neuropathy can decrease the pain sensation, patients may hurt themselves and get ulcers without any consciousness. (Casey 2011.) Diabetic neuropathy is divided into two types, motor neuropathy and autonomic neuropathy. Each of them can ultimately cause ulcer formation by unbalance distribution of pressure and edema respectively. (Amin & Doupis 2016.)

For diagnosing diabetic neuropathy, there are many kinds of measurement methods can be conducted. Firstly, patient's medical history and complains should be taken for assessing the patient's overall health situation. Secondly, there are some evaluation scales can be applied for measuring diabetic neuropathy, for example the Neuropathy Symptom Score which is the one that widely used. The other options such as the Neuropathy Symptom Profile, the Michigan Neuropathy Screening Instrument and Diabetic Neuropathy Symptom Profile are valuable as well. (Amin & Doupis 2016.) In addition to that, the vibration perception examination is also generally used for diagnosing neuropathy (Braadvedt 2010).

Diabetic disease attacks patients' peripheral arteries mostly, which may lead to peripheral arterial disease (PAD) (Amin & Doupis 2016). PAD generally results in insufficient blood circulation, this symptom may lead to form ulceration easily, because the oxygen and nutrients carried by blood cells cannot meet the broken tissue healing demand, consequently, prolongs wound healing (Braadvedt 2010). The most characterized symptom of PAD is intermittent claudication, it is deteriorated when patient is walking or exercising, and turn to be better when they are at rest (Amin & Doupis 2016).

The most common assessment tool for PAD is the ankle brachial index (ABPI). It is administered firstly by taking brachial blood pressure and ankle pressure with Doppler machine respectively, secondly, by dividing systolic ankle pressure by systolic brachial pressure, the figure result is the ankle brachial index. The range between 0.9 – 1.2 means the foot is at the low risk of ulceration, the range from

0.6 to 0.9 means the risk of ulcerating foot is increasing, similarly, less than 0.6 always indicate the foot is at high risk of ulceration. Exceptionally, the ankle brachial index is not applicable for calcified arteries. (Braadvedt 2010.) The other measurement tools can be considered including segmental limb pressure assessment and pulse volume recording, ultrasound velocity spectroscopy and imaging and computed tomographic angiography (Amin & Doupis 2016).

The priority of treating DFU is debridement. The healthy tissue could not grow without erasing the necrosis. Three debridement methods can be opted. For large area of necrosis and devitalized tissues, the surgical debridement is preferred. Enzymatic debridement is effective on those ulcers that show a positive reaction to the biochemical agents, such as trypsin, streptokinases, collagenase, ect. But the drawback of this method is the agents cost much, for this reason, the scalpel blade as auxiliary is used to improve its efficacy. Although mechanical debridement is easy and cheap, it does not only get rid of devitalized tissues but also healthy tissues and may cause severe pain. Biological debridement, also called Maggot therapy specifically, is getting more and more attention because its efficacy and anti-infection. (Amin & Doupis 2016.) Overall, choosing a appropriate debridement method for DFU patient depends on the patient's own situation is essential for treating DFU. (A. Barbul et al 2006).

Another key treatment of DFU is pressure off-loading and therapeutic footwear is recommended. But these treatments require longstanding insistence, for those patients who cannot stick to this rule, a total contact cast may meet their needs. (Amin & Doupis 2016.) Additionally, dressings also play essential role on the treatments and the application of dressing should be tailored individually. (Braadvedt 2010). For instance, hydrogel dressings are ideal for dry wounds but may lead to maceration around the wound surrounding, thus, the merits and the drawbacks of different kinds of dressings should be both considered while practitioners are making decision (Amin & Doupis 2016). For the infectious DFU, antibiotics is applicable. For the purpose of administering accurate antibiotic to the targeted bacteria, bacterial culture should be performed beforehand. (Amin & Doupis 2016.)

2.1.3 Venous leg ulcer

Venous leg ulcer is more likely caused by venous diseases (Casey 2011). The most vulnerable group is the elderly people who are over 70 years old since they are more likely attacked by venous illness (Flanagan 2006). Venous hypertension caused by chronic venous insufficiency is the essential risk factor to ulcerate elderly people's lower limbs. Venous hypertension may obstruct the functions of capillaries which lead to the symptoms including edema, inflammatory, deposition of haemoglobin. Because of those results mentioned above, the legs present the consequences as lipodermatosclerosis, hyperpigmentation, sclerosis, ischemia, eventually ulceration formats. (Casey 2011.) The rest of risk factors, such as family history of venous illness, DVT, varicose veins, lower leg's fractures or trauma, obesity and sedentary occupation are determined as well (Regmi 2012.)

Assessment plays a crucial role in formulating effective strategies for managing venous leg ulcer. The ankle-brachial pressure index (ABPI) is very meaningful for assessing venous leg ulcer. The other measuring methods, such as Duplex scanning, venography and plethysomgraphy are also can be applied for determining the risk factors of insufficient venous blood volume. In addition to that, the complications of venous ulcer, for example, exudation, odor, the location and size of lension and the surrounding of wound bed and itself need to be taken into account while set up treatment strategies. (Regmi 2012.)

Generally, oedema, exudation and venous eczema are the most common complications of venous ulcer (Casey 2011). Hence, the treatments of venous ulcer always company with compression, the application of high compression therapy is preferred (Chronic wound care guidelines 2007). The principles of compression therapy application are strict, constant and graduation. Stick to these principles can prevent venous ulcer recurrence at large extent. (Casey 2011.)

Medication also plays an important role in treatment of venous leg ulcer. Pentoxigylline and Aspirin can change blood hemodynamics, such as blood viscosity reduction, microcirculation improvement and platelet aggregation inhibition, etc. The function of Mocronized purified flavonoid fraction (Daflon 500mg) inhibit endothelium activation and prevent patients from edema. (Casey 2011.)

2.1.4 Arterial insufficient ulcer

Adequate blood volume flowing through the arterial is the most important promise to make the cells more active because blood cells carries the most nutrients that skin needs. On the opposite, without these essential elements, such as oxygen, nutrients, skin may become more vulnerable to be ulcerated when damage occurs. Atherosclerosis is commonly regarded as the main reason of causing arterial insufficient ulcer. (Casey 2011.)

The symptoms may rarely appear until 70% of the cavity of artery is blocked by fat embolus. The risk factors of atherosclerosis, such as hypertension, diabetes, smoking and hypercholesterolemia have been identified as the causes of arterial ulcer (Chronic wound care guidelines 2007). Either the acute or chronic occlusion may lead to the consequence of ulceration. Intermittent claudication may appear when patient is on physical movement. (Casey 2011).

The ideal treatment of Arterial insufficient ulcer is surgical revascularization. The aims of these treatments are to alleviate symptoms and focus on managing wound itself. Infection control is prior consideration while treating Arterial insufficient ulcer. In addition, debridement is not recommended for dry scab of an arterial ulcer, because it will worsen the ulcer. (Casey 2011.) For long-term goals, the principles of treating arterial insufficiency ulcer is to control the risk factors, for instance, giving up unhealth lifestyle like smoking and drinking, doing more exercise, managing lipemia, high blood pressure actively. (A. Barbul et al 2006.)

2.2 Aging as a developmental risk factor of chronic wound

From physical perspective, as age is increasing, the functions of skin are declining, such as the decline in the elasticity of skin. The dermo-epidermal is flattening, the subcutaneous tissue is becoming thinner and thinner as well. The muscle mass is losing, the skin cells hardly repair, the capacity of perfusion and oxygenation of intradermal vascular is diminishing. (Jaul 2010.)

Aging is also a synonym of vulnerability. A study showed that 70% of elderly people who are over 70 years old were affected by pressure ulcer. The main reason is the older the more easily getting illness as the systemic functions are weakening in both physical and psychological aspects. The risk factors are variable, such as

immobility, poor blood circulation, side-effects of psychological drugs and unbalanced moist skin status, all of them contribute to chronic wounds. (Jaul 2010.)

Furthermore, as people is continuing to age, their metabolic capacity and absorption capacity is decreasing, meanwhile, their social and mental conditions are changing progressively once they are regarded as elderly people. In the meantime, malnutrition plays a significant role on processing chronic wounds as well, especially on pressure ulcer. This could be a reminder for the caregivers to aware that elderly people are at a high risk at this point. There is a strong relationship between pressure ulcer and protein consumption. Lack of protein is regarded as the resource of any kind of ulcers. There are many factors contributing to protein shortage, for instance, diseases that result in insufficient protein intake or digestive problems caused by some specific medicine which leads to the fact that the body cannot absorb enough protein. Thus, the comprehensive nutritional assessment is extremely needed at this point. The Subjective Global Assessment and the Mini Nutritional Assessment Short Form are widely used in this case. Anthropometric index is the crucial evaluation criteria of nutrition. (Jaul 2010.)

2.3 Chronic wounds pain

Pain, as the fifth most important vital sign has been paid more attention than breathing, pulse, temperature and blood pressure (Bowers & Barrett 2009). The International Association for the Study of Pain (IASP) 1994 defines pain as an unpleasant feeling and emotional experience characterized by actual or potential tissue damage or injury (IASP 1994). It is a complex physiological and psychological phenomenon, that is often accompanied by autonomic nervous activity, motor reflex and emotional response, which is a complicated feeling peculiar to human beings. Pain is a personalized feeling, different races, families and cultural backgrounds lead to different experiences and expressions of pain. (Mudge & Orsted 2010.)

Pain includes two aspects: pain sense and pain response. Pain sense is a consciousness phenomenon, which belongs to individual subjective perceptual experience. It is influenced by people's psychology, personality, experience, mood and cultural background. Patients often have strong emotional reactions, manifested as anxiety, terror, aversion and suffering. Pain can be used as a

warning of injury, causing a series of defensive protective reactions. Pain response refers to changes in visceral activity, mood and behavior during pain, which can be divided into somat-motility reflex such as fist clenching, struggle, muscle reflex spasm; autonomous-visceral reflexes such as shortness of breath, elevated blood pressure, dilated pupils or sweating; Neuro-psychological reflexes such as anxiety and discomposure. (Flanagan 2006.)

2.3.1 The mechanism and classification of pain

At present, there is no theory that can explain the mechanism of pain comprehensively and reliably. Gate Control Theory of Pain Mechanism points out that psychological and behavioral factors play an important role in pain perception (Mudge & Orsted 2010.) It claims that there is a gate-like nerve mechanism in the dorsal horn of the spinal cord, which can weaken and enhance the impulse from the peripheral to the central nervous system. The degree of weakening and enhancement is determined by the relative activities of coarse fibers and O-fibers and the downward effects of the brain. The generation of pain depends on the types of afferent fibers excited by stimulation and the characteristics of function and structure of the central nervous system. It is believed that pain is a complex multi-dimensional experience generated by the integration of cognitive, emotional and other information in the brain. (Flanagan 2006.)

There are many kinds of pain classification so far, according to its pathogenesis and duration, it can be divided into acute pain and chronic pain. Acute pain is a kind of immediate pain caused by various noxious substances acting on the organism, it is mainly manifested in acute symptoms as a result of diseases or tissue damage. It usually lasts for 4 to 6 weeks, and the pain usually disappears after the wound is repaired. Acute pain can be regarded as a signal of tissue damage, a warning of pathological state, an important function to protect individuals from further injury, so it is also called physiological pain. Because of its short duration and clear focus, acute pain is easily recognized by medical staff, so it is more likely to receive active treatment. (Bowers & Barrett 2009.)

Chronic pain refers to the persistent pain that lasts for more than a month or exceeds the normal course of the disease, or the normal healing period of tissue damage and affecting normal life, it not only fails to play a protective role, but also

endangers health. It usually persists after tissue repair, so it cannot be explained clearly just from pathological point of view. (White 2008.)

Chronic wound pain mainly affects elderly, and more than 2/3 of patients are over 70 years old (Flanagan 2006). It is defined as a harmful symptom or unpleasant experience directly related to open skin injury. At the level of pathophysiology, wound pain can be caused by tissue damage (nociceptive pain) and neuropathic dysfunction (neuropathic pain). Chronic wound pain may have both nociceptive pain and neuropathic pain. (Mudge & Orsted 2010.)

Nociceptive pain is caused by tissue damage, sensory receptors which in nerve endings of tissues receive damage signals and transmit them to brain to produce pain. For example, mechanical trauma and inflammation caused by tissue damage. "sharp" or "stinging" belongs to nociceptive pain, it is the functional response of the body to the stimulation of injury and a protective signal for potential tissue damage. The perception of nociceptive pain often enhanced with the increase of stimulation intensity. (Mudge & Orsted 2010.)

Neuropathic pain is caused by peripheral or central nervous system injury, lesion or dysfunction, and it is the main reason of chronic pain. Its characteristics may be different from nociceptive pain, neuropathic pain sometimes produces spontaneous pain without noxious stimulation, and the intensity of stimulation is not proportional to the pain feeling. Therefore, it is no benefit to the body and seriously affects the quality of people's life. (White 2008.)

In addition, wound pain can be divided into background pain and breakthrough pain. Background pain refers to the pain that occurs without any treatment for the wound, it is related to the potential pathological process of the wound, such as ischemia, inflammation, infection, impregnation, etc. Breakthrough pain is temporary exacerbated pain that occurs suddenly in patients whose basic pain has been adequately controlled or in a relatively stable state, it can also be divided into spontaneous pain and pain related to specific predictable or unpredictable triggers. (Bowers & Barrett 2009.)

Pain is the most common occurrence for patients living with chronic wounds and it is the main cause of suffering for those patients. The pain caused by chronic

wounds can be very severe, it is often described as feeling with “red and swollen” or “splashing sulphuric acid on the skin” (Flanagan 2006). Many studies have shown that pain is not only contributes to significant levels of suffering and distress, but also has adverse effects on wound healing, as well as affects the quality of life of patients, and lead to some patients to fear treatment. Physiologically, chronic wound pain may lead to sleep disorders, loss of appetite and digestive disturbances. Besides, patients would be afraid to turn over and get out of bed because of pain, which is prone to lower extremity venous thrombosis. It can also lead to psychosocial effects such as social isolation, depression and loss of identity. In addition, the pain caused by repeated treatment for wound can also make patients become more sensitive, so that even gentle dressing changes may cause strong pain feeling. (Mudge & Orsted 2010.)

2.3.2 Factors that contribute to chronic wound pain

The pain experienced by patients with chronic wounds is multicausal in general. First, pain from chronic wound itself such as injury, inflammatory reaction or infection, wound infection is a complex process caused by the interaction of harmful substances between patients and pathogens, this interaction can delay wound healing and cause or aggravate wound pain. (Mudge & Orsted 2010.)

Secondly, pain can also come from some treatment of wound. Pain caused by various interventions, such as local treatment, debridement, dressing removal or replacement, is the main reason for chronic wound pain (Fletcher 2010). Improper dressing selection can lead to dressing adherence to the wound bed, which may lead to trauma and suffering when the dressing is removed, and some dressings may also leave fibers on the wound which require physician cut off (Upton & Solowiej 2010). Particularly in patients with wound infections whose nervous system has become sensitive, dressing removal, wound cleaning and dressing application have been shown to cause particular pain, and patient’s past experiences may also lead to more anxiety about any intervention, even contribute to anticipatory pain (Fletcher 2010).

In addition, local skin pathological reactions can also cause pain, such as edema, ischemia and allergic reactions, as well as some psychological factors, like anxiety, stress, fear and so on, which can also aggravate pain to a certain extent.

2.3.3 Pain assessment

The most crucial reason of causing failure in treatment of chronic wound pain is the deficient assessment of pain. The characters of effective chronic wound pain management are those methods that are set based on individualized and patient-centred principles. The assessment elements should include patients' responses to pain, either verbal evidence or non-verbal evidence; the location, continuance, intensity and start of pain; the influences of pain on patients' life quality and the effectiveness of analgesia methods. (Roden & Sturman 2009.)

The most common use of pain assessment tool is the visual analog scale (VAS), Numeric Rating Scale for Pain (NRS Pain), McGill pain questionnaire (MPQ), short-form McGill pain questionnaire. (Hawker, Mian, Kendzerska & French 2011). In terms of administering these rating tools correctly, practitioners should have sufficient knowledge about how to apply and have the ability to recognize the differences between them and select the appropriate one for different kinds of patients' condition, otherwise false results may occur (Roden & Sturman 2009).

The VAS is a ruler - shaped pain assessment tool with various pain descriptor, in some cases, they are also accompanied with facial expressions. It is widely used. (Scott & Huskisson 1979.) This pain severity assessment is usually conducted by patient pointing out about how painful they are feeling currently between the two facial expressions. The pain verbal descriptors are various based on different VAS designs. (Hawker, Mian, Kendzerska & French 2011.) According to Scott and Huskisson's experimental study, it was shown that, the pain intensity score assessed by vertical scales was higher than these from horizontal ones, even though the difference is small (Scott & Huskisson 1979).

The VAS is simply used by practitioners and patients. The score is usually measured by a ruler, the higher score the more severe the pain. Even though the length of VAS is required to be exactly 10 cm long, the slight difference cannot be avoided. Thus, for getting the more accurate rating score, it is recommended that all patients should have their own scales and insist to use the same one during the whole assessment period. (Hawker, Mian, Kendzerska & French 2011.)

The numeric rating scale can be seen as a branch of VAS. It represents pain

severity by numbers from 0 to 10. 0 usually represents as “no pain” whereas 10 represents as “worst possible pain”. The benefits of using NRS include time saving, simplicity and validity. (Krebs, Carey & Weinberger 2007.) According to the experiment conducted by Krebs and his team members (2007), the result shows that the accuracy of NRS is fairly small as the dimensional NRS cannot identify the multidimensional and complicated pain from all sides.

The McGill pain questionnaire is one version of verbal rating scales. It is verified as a reliable and valid measurement tool for pain assessment. It is used to evaluate pain from four dimensions: sensory, affective, evaluative and miscellaneous. (Jacques 2018.)

The MPQ consist of two sections, three classes include 20 subclasses of pain indicators and one assessment scale of pain intensity. In each subclass, there are 2-6 descriptive pain words, the first word is valued one point, the second word is valued two points, and so on. The pain intensity scale ranges from 1 to 5. (Burckhardt & Jones 2003.)

The MPQs is administered by the interviewees choosing the most suitable words to describe their current pain. This requires that interviewers should have the capacity of explaining each of the descriptors. The points are their rank order of the words chosen by respondents in each of the 20 subclasses. (Carol, Burckhardt & Kim 2003.). The score is calculated by adding up the value of all the selected words and then it comes out as a result which is called Pain Rating Index. The higher the score the severer pain is indicated. The MPQ is not only demonstrating the quantity of pain but also the quality of pain, thus the MPQ as a reliable and valid pain measurement tool has been used widely. (Burckhardt & Jones 2003.)

Short-form McGill pain questionnaire (SF-MPQ) is a time saving version of MPQ. It only contains two subclasses-sensory and affective and a total 15 pain indicators selected from the original MPQ that patients commonly use the most, one PPI and VAS included as well. SF-MPQ targets the adult group with chronic pain and its functions are the same as the MPQ's, but the process of administration is much easier and quicker than the MPQ. (Melzack 1987.)

In addition to these pain management scales, for those people who cannot describe their pain experience verbally, there are some alternative options for

them, for example Abbey Pain Assessment of Discomfort in Dementia Protocol Checklist of Nonverbal Pain Indicators, Face, Legs, Activity, Cry, and Consolability Pain Assessment Tool, and Pain Assessment Scale for Seniors with Severe Dementia (Woo 2012).

In conclusion, according to NOPQRST principle suggested by WUWHS (2007) (Table 1), pain assessment is an unremitting work in wound pain management and the timing of assessment should be arranged before, during and after wound treatment. It is not only helping professionals get a valid and precised pain evaluation records, but also gives them the supportive evidence on adjustment of pain reduction methods. (Sharma 2016.)

N	Number of painful sites
O	Origin of pain
P	Palliative/Provocative Factors
Q	Quality of pain
R	Region/Radiation of pain
S	Severity of pain
T	Temporal aspect of pain

Table 1 The definitions of NOPQRST (adapted from WUWHS 2007)

3 THESIS QUESTIONS

The aims of this thesis are to find out what factors contribute to the increase of chronic wounds pain and to figure out what kinds of interventions can be used by nurses. The purpose of this thesis is to improve the nursing skills of chronic wound pain management for elderly people.

The following questions are going to be discussed in this literature review:

1. What are the risk factors that contribute to the increase of chronic wound pain?
2. What interventions can be used to reduce chronic wound pain?

4 METHODOLOGY

4.1 Literature review

The format of this thesis is a literature review. The literature review is an overview of a particular topic that the researchers are willing to study by synthesizing and analyzing the current literature and studies. The objective of literature review is to address these research questions that relate to the topic. (Shunda 2007.)

In this thesis, several steps were undergone. First of all, two authors have a mutual rough idea about it started by establishing a topic, then the research questions and aims, and these aims and questions were established according to the purposes of this thesis. The discussion about research questions took place over and over between the two authors until they made an mutual agreement on it. Secondly it is synthesis, also called data collection. Specifically, it is to gather the evidenced scientific studies or scholarly articles through the standards of inclusions and exclusions that the authors designed together. Lastly, data analysis, it is the process of reproduction of point-directed materials. (Zhang & Wildemuth 2018.) In this thesis, the purposes of conducting a literature review are to confine the research questions and to explore essential and relevant possibilities based on the thesis topic. (Randolph 2009).

4.2 Data collection

The data collection was conducted from the following main databases: CINAHL, JBI and Academic search elite. The key words were chosen according to the highlighting terms of the research questions: chronic wound, elderly, chronic wound pain, chronic wound pain management.

The authors used Boolean operator as a main searching model when screening the articles from the databases of Academic Search Elite, CINAHL, because, except JBI database, Boolean operator is the best research strategy for these two databases and can function very well on narrowing or expanding a search while authors input more than one keyword in separated lines (Johnson 2002). But in specific, there are still slight differences of research methods among different

databases. In Academic Search Elite and CINAHL databases, “AND”, “OR”, or “NOT” are allowed to use to narrow or expand the search results, searching by using more than one word are allowed on these two databases as well. The usage of search strategy in the third database-JBI is varied from the other two. In JBI database, basic research is recommended firstly whereas advanced research is more preferred at the beginning in other two. Authors used one or several keywords for searching in JBI as well, but only allowed to put in one line, marks “*” and “\$” play the role of narrowing or expanding the results. By understanding the various search strategies, it helped authors to sift the high quality articles more efficiently and accurately (Bolderston 2008.)

For acquiring the high quality and accurate references among a huge amount of published articles, the authors set up a series of limitations specifically for the efficiency research, which is more effective than just put truncations between the terms (Bolderston 2008). These limitations include the year of publication, written in English, full text, abstract available, free of charge.

In this thesis, the authors preferred to choose those articles published between 2007 and 2017, which guarantees to get up-to-date references, additionally, the preferences also include sources written in English only. As the consideration of chronic wound pain could happen in any ages or genders, the authors didn't make specific limitations in these areas. Also, free and full articles with accessible abstracts are listed in the inclusion criteria.

Beyond that, the authors noticed that most of key articles referenced some valued article cited in some specific organizations, the authors then hand search those articles from the topic-related authoritative institutions, associations or societies as well. In this thesis, four cathedratic organizations are found, which are Internatioanl Wound Infection Institute, World Union of Wound Healing Societies, World Health organization, international Wound Journal and Wound International website, at the end 9 articles were decided to be utilized in this thesis.

The principle of sifting references was based on setting up the inclusion and exclusion criteria. In a strict sense, the authors had already reached a consensus on these criteria before advancing the further work. (Table 2)

Inclusion criteria	Exclusion criteria
Articles published between 2007 to 2017.	Articles published before 2007.
Articles are written only in English.	Articles are written in any other languages.
Articles available in free full text.	Articles those are not available in free full text.
Relevant contents related to the highlight of research questions.	Irrelevant content, such as the management of acute wound pain or burn wound pain or any other types of wounds pain management except chronic wound pain management.
Articles with abstracts.	Articles without abstracts.

Table 2: Inclusion and exclusion criteria

For moving forward, the authors searched references on each of the three databases according to the criteria. This entire process was divided into two steps, first, usage of the key words to collect the references by conducting inclusion and exclusion criteria. After the first round of electronic search, the results were huge and contained some irrelevant information, then the authors scanned the references once again by reviewing the titles and abstracts for categorizing the valuable articles and obviously irrelevant articles (Randolph 2009). For example, all those articles focused on studying acute or infectious or malignant wound pain management that were distracted from the research questions, were not considered (Table 3).

	Academic search elite	CINAHL	JBI
Key words	94	105	28
Free full text	54	47	24
Year of publication	34	30	24
Peer review	34	30	24
Language (in English)	34	29	24
Title	17	14	5
Abstracts	17	10	2
Results	5	7	0

Table 3. The procedure of collecting and screening references

4.3 Study appraisal

As Bolderston mentioned in her article (2008) “Primary evidence is original research such as clinical trials, studies, or statistical ensures that the reader can interpret the original evidence for herself or himself and eliminates potential bias or inaccuracies from second-hand reports of other people’s work”. Hence, in order to get the most cogent evidence, when the authors were sifting the studies from the databases, primary evidence was prior to choose, secondary evidence was considered after and the quality of evidence are appraised critically as well.

Thompson (2007) advised several rating scales for nursing research, for instance, The Joanna Briggs Institute Levels of Evidence, The Johns Hopkins Nursing Evidence-based Practice Rating Scale, AACN’s levels of Evidence. In this thesis, the authors had chosen “The John Hopkins Nursing Evidence-based Practice Rating Scale” as study appraisal tool. JHNEBP is the evidence grading toolkit which contains two portions, one is quality guides, the other is the levels of evidence scale. The strength of evidence is ranked from I to V, level I is the highest whereas level V is the lowest. The evidence ranges from I to III have the same definitions of quality, whereas level IV and V have dissimilar definitions. (Thompson 2017.)

There were 21 articles which were chosen to be analyzed in this thesis, each of them was chosen and evaluated according to JHNEBP Evidence Rating Scale to check if they meet the standards of either high quality or good quality of evidence. An example of JHNEBP Evidence Rating Scale is shown in Appendix 1.

4.4 Data analysis

The process of data analysis began when the final 21 scientific articles were ascertained by the two authors. In this phase, a qualitative content analysis approach was utilized, because compared to quantitative content analysis, the qualitative content analysis requires the data is selected more goal-directed and presents the research question, which is exactly the way how the data was collected in this thesis. Additionally, the qualitative content analysis is more intend to be inductive for getting the conclusion from the theme than other content analysis. (Zhang & Wildemuth 2018.) Just as Smith (1975) advised. "qualitative analysis deals with the forms and antecedent-consequent patterns of form, while quantitative analysis deals with duration and frequency of form". (Zhang & Wildemuth 2018). Three steps involved in this process: overviewing, abstraction and category.

Step 1, the two authors went through all of the articles thoroughly and separately. Each of the authors highlighted the key words, sentence or phrases that are relevant to the research questions based on their personal understanding. Furthermore, the two authors discussed the marked content together and make a consensus perception on which content was fairly close to the thesis's aim and purposes. This process is also called coding. (Zhang & Wildemuth 2018).

Step 2, all the remarked content was simplified. The authors abstracted the main points from these content in their own words. Because different people have different opinions about the same objective, in case of the occurrence of misunderstanding, in some cases, both authors had to read and discussed the highlighted information over and over until the ambiguity was resolved and a consensus was reached. (Zhang & Wildemuth 2018.)

Step 3, the two authors grouped the codes into different subcategories

thematically. The codes that have same presentations were integrated into one subcategory, again, the subcategories having the same characteristics were grouped into one main category. (Zhang & Wildemuth 2018.) As this work was processing, the new codes emerged occasionally, the author therefore needed to verify whether these codes relevant to the thesis’s studied questions or not, kept the relevant ones and discarded irrelevant ones. Although there were other subcategories that emerged, for example, for answering the first question, there were also operative factors, such as cutting tissue and drawn-out manipulation (Fletcher 2010), due to lack of evidence and irrelevant to the research questions, thus, they were not included. The following figure shown the process of integration and category (Figure 2).

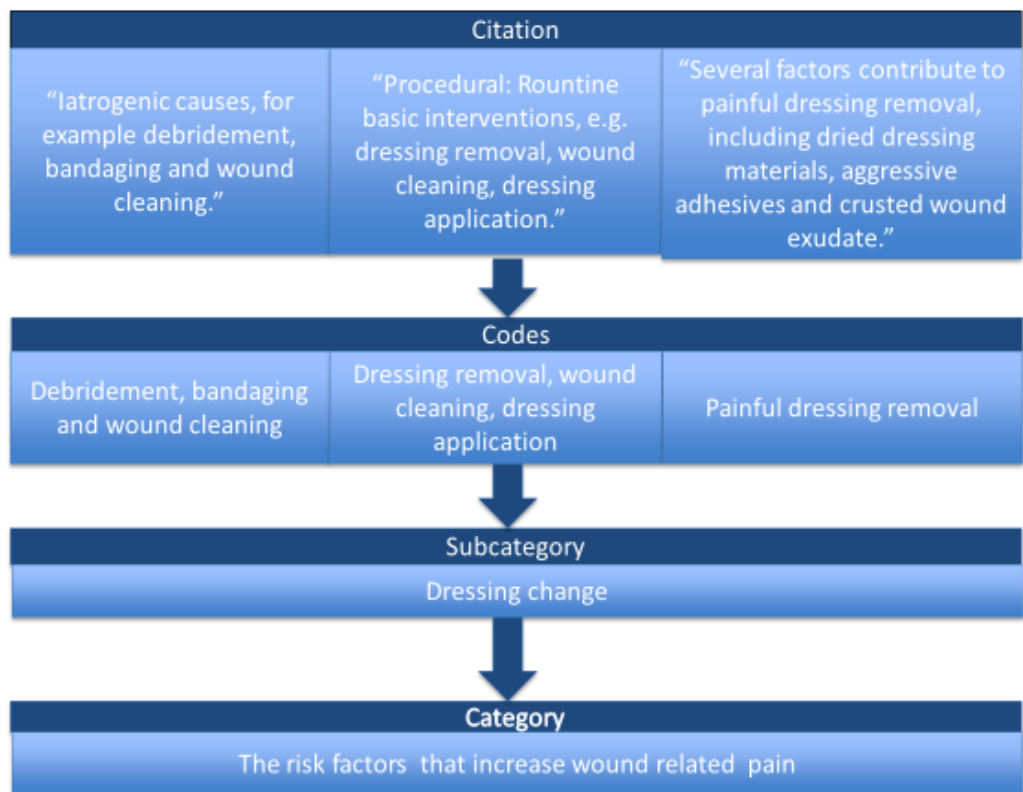


Figure 2 An example of process of integration and category.

5 RESULTS

The findings are identified in two categories for answering each of the research questions. Category one is the causes of chronic wound related pain, there are four factors which were confirmed for answering the first research question: dressing change, infection, debridement, psychological factors. Category two is the interventions of chronic wound pain. Two types of interventions are demonstrated for answering the second research question in this thesis: pharmacological interventions and non-pharmacological interventions (Figure 3).

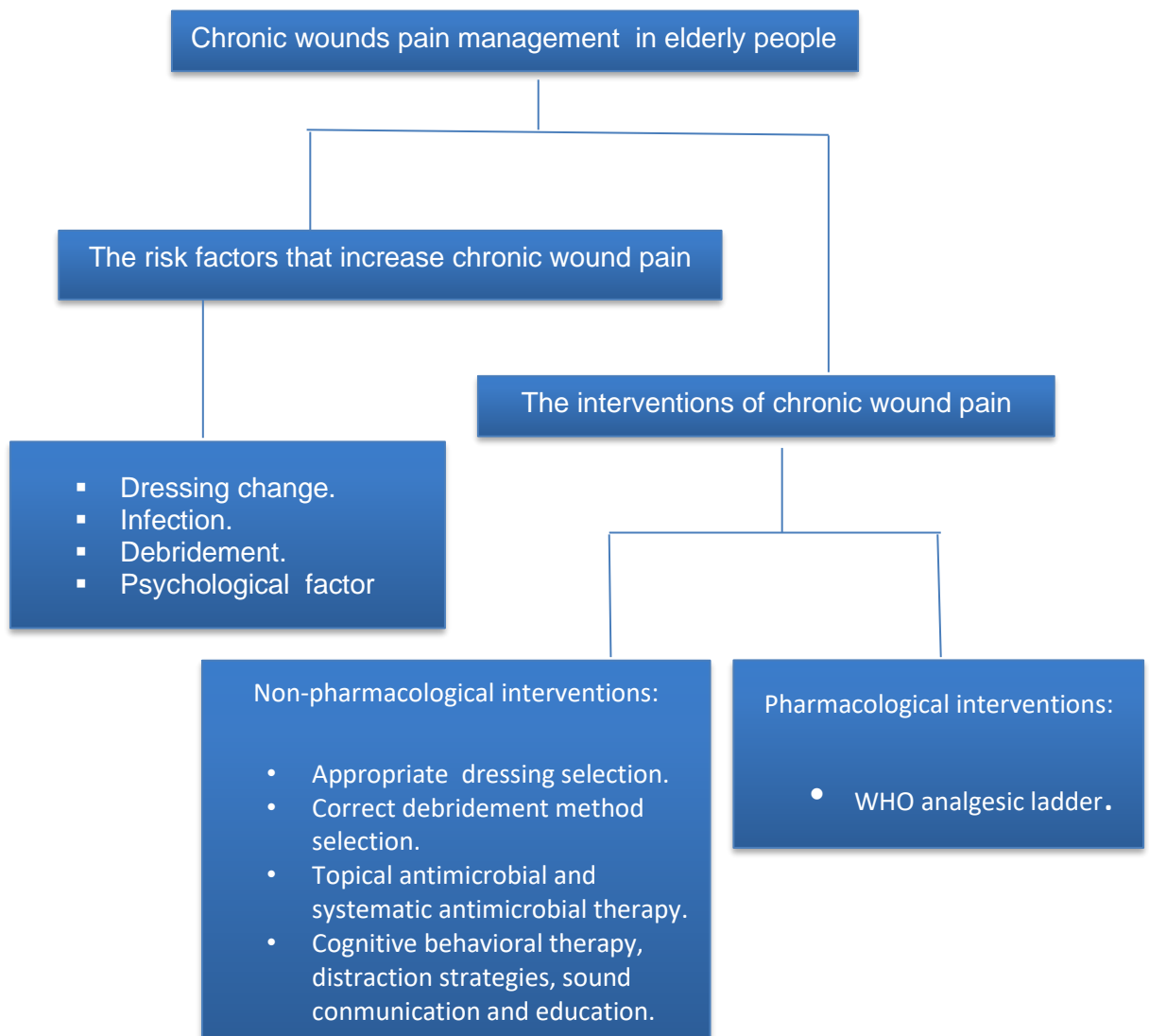


Figure 3 The summary of findings

5.1 The risk factors that increase chronic wound pain

The risk factors that increase chronic wound pain are multiple and variable. In this thesis, these risk factors are found and presented in detail by the two authors including dressing change, infection, debridement and psychological factors.

5.1.1 Dressing change

Dressing change is considered as the most painful procedural treatment of chronic wound, especially dressing removal and wound cleaning. Except above factors, other factors such as debridement, application of inappropriate dressings as well as play pivotal roles in increasing wound pain. (WUWHS 2007.)

Among those factors, dressing selection was particularly considered as an extremely urgent issue which needs to be resolved by healthcare givers. According to McCarthy and Bell's qualitative study, it was shown that dried-out dressing was ranked as number one factor of which increases pain during dressing change, adhesive dressing and wound irrigation were ranked as number two and number three respectively. That would explain why most of patients suffering more when applying inappropriate dressings. Hence, non-traumatic dressing is the first choice. (McCarthy & Bell 2010.)

Addition to that, other steps of dressing change may also increase the intensity of pain, such as removing the old dressing by using cold liquid or clean wound using non-hygiene water. Those risk factors are easily to be overlook by professionals during dressing change. (White 2008.)

5.1.2 Infection

The pathology of wound infection is complex. It is usually caused by invasive microorganisms which generally leads the tissue to respond to invader and try to defeat them (White 2009). According to Wound Infection Institute (IWII) (2016), the wound infection process can be divided into four stages. Its onset starts from called contamination, it is caused by multiple factors, such as environmental exposure or poor hand washing practice. If practitioners don't recognize and

interrupt this onset, then infection then develops into next stage-colonisation. At this this stage, the virulence of microorganism is under control and the harmful effects on patients is not overt. As the microbial organisms are gradually proliferating, the wound will present the local infectious symptoms, for instance, bleeding, hypergranulation and increasing pain. Local wound infection may develop into spreading infection which harmfully influences other tissues more than the wound itself. If the microorganism proliferation is not under control, then the infection evolves to be systemic, the entire body reaction may occur, such as organ failure, septic shock, or even death. Meantime, the pain potential is also increasing while the infection is developing.

In particular, pain has been considered as the most common forerunner of infection and one of the risk factors that may increase pain (WUWHS 2008). Additionally, wound exudate is also one of the triggers that may raise wound pain since exudation contains some specific chemicals like enzymes and matrix metalloproteinases that have destructive influence on wound healing (Mudge & Orsted 2010). Patients who experience septic wound would suffer more pain than whom experience uninfected wound because the nociceptor becomes more sensitive to inflammatory harmful stimuli. Hence, addressing the risk factor of infection is paramount part of management of chronic wound pain. (White 2009.)

5.1.3 Debridement

Debridement is the process of removing devitalized tissue from the wound bed, which can promote the growth of fresh granulation to accelerate wound healing (Atkin 2014). The types of debridement include Mechanical, Larvae, Surgical and Autolytic (Palsingh 2019). There are many debridement options, thus, how to select an appropriate debridement method for different wound types is an essential consideration in this procedure (Atkin 2014). The selection of appropriate debridement method can be defined according to the wound diagnosis, the pain intensity, the patient's age, patient's preference and authoritative guideline (Strohal, Apelqvist, Dissemond, et al 2013).

Debridement is an invasive procedure and some of them are painful procedures as well, although the pain intensity is different regarding to different types of debridement, for example, mechanical debridement causes more pain than

enzymatic and autolytic do (Strohal, Apelqvist, Dissemond, et al 2013), if the practitioner lack of sufficient debridement knowledge, for instance, what kind of pain reduction treatment should be applied during this procedure or how to make the right decision on debridement method selection may result in increasing of wound pain (Atkin 2014).

5.1.4 Psychological factor

Patients have memory about pain. Pain experience is just like unforgettable perception taking root in patient's mind, which may affect patient's expectation of pain caused by the treatment. The intensity of pain memories is quite subjective and individually difference (Sussman 2008). Specifically, patients individually have different pain threshold, pain caused by same wound treatment may be tolerable for patients with higher pain threshold whereas it may be a heavy burden for those people with lower pain threshold (Upton & solojwie 2010).

Patients living with chronic wounds complaint that they also feel living under fear, anxious, depression and isolation, especially when are facing facing to wound treatment. (Sussman 2008.) Pain has an unbreakable association with low quality of life. According to the research conducted by Elizabeth J Mudge and her group (2008), the findings showed that the reasons causing patients living with a huge psychological burden include: 1) Chronic wound pain literally decreases their mobility in daily life which lead them to feel disconnecting with their social life, and some of them may suffer insomnia that result in inability in dealing with normal life; 2) CWP may also bring to patients a lot of concerns, such as their body looking, the odour of wound, the medical expense and the safety and reliability of healthy care system; 3) the fear of dressing change procedure because most of the interviwees in this research described that dressing change caused a huge of pain that they are barely endurable, and infection also made them worry about. (Mudge, Meaume & Price 2008.)

The relationship between stress and pain are interacted on each other. Pain leads patients to experience nightmare wound treatment experience, which is the resource of stess, meanwhile, stress affect patients's hormone and immune balance system and lower patients' pain, which results in making wound worse and more severer pain. Depression and anxiety play the same role as stress does.

(Upton & solojwie 2010.)

5.2 Interventions of chronic wound pain

There are two themes included in chronic wound pain interventions. These are pharmacological interventions and non-pharmacological interventions. The detailed results of the two themes are illustrated below.

5.2.1 pharmacological interventions

A pivotal intervention in treating elderly with chronic wound pain is the application of analgesic. The three-step analgesic ladder developed by World Health Organization (WHO) (2018) (Figure 4) can be used as a guideline for treating chronic wound pain. This WHO analgesic ladder generally starts from non-opioid analgesic, if this method cannot achieve therapeutic effect, then the treatment will move to next step and so on. Topical treatment is optimal first because it is less likely to cause the side-effects, these treatments include the application of local anesthesia, such as putting on anesthetic cream before painful procedure, the use of dressings releasing ibuprofen or acupuncture. (Coutts 2008.)

Three principles recommended by WHO (2018) should be considered when administration analgesic:

- By mouth—Oral administration is preferred to parenteral administration.
- By the clock---Analgesics should be given on a regular basis by the clock rather than on demand.
- For the individual, with attention to detail---The dose of an analgesic should be determined on an individual basis. the dose of an analgesic should be determined on an individual basis.

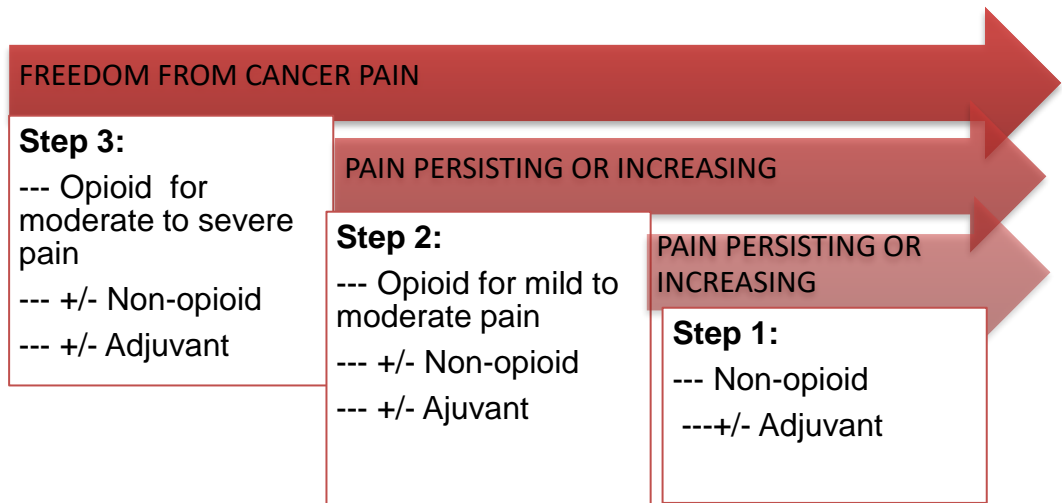


Figure 4. WHO analgesic Ladder (adapted from WHO 2018)

Systemic analgesic treatment is usually applied for nociceptive pain and neuropathic pain. Because the causes of nociceptive pain and neuropathic pain are conceptually different, the administration of analgesia plan should be considered respectively. Analgesia for neuropathic pain is usually applied with adjuvant medicines such as anticonvulsants and tricyclic antidepressants, these can be a beneficial intervention for neuropathic pain because neuropathic pain often associates with symptoms like anxiety or depression, the pharmacological activity of those medications aims at halting the passing of pain transmitters. Also, this kind of intervention should be performed under specialist supervisors. (Coutts 2008.) Nociceptive pain can be interrupted by the non-steroidal anti-inflammatory drug (NSAID) and paracetamol. But the contraindications of NSAID should be kept in mind by practitioners when applying these kinds of medication to patients. (Coulling 2007.)

Additionally, there are several factors need to be taken into account when applying analgesics. The analgesic management should be tailored individually. Specifically, the analgesic's onset, duration, dosing intervals and side effects should be evaluated, the patient's age, gender and coexisting disease should not be neglected. Especially for the elderly people, the dose should start from as lower as possible which aims to prevent side effects. (Woo 2012.)

5.2.2 Non-pharmacological interventions

Dressing change has been considered as the most suffering process in wound care. This process literally includes three steps: dressing removal, wound cleaning, dressing application, each of them has the possibility to increase pain. (Fletcher 2010.)

Patients who have experienced poor wound treatment may more likely to produce fear, which may arise patient's anticipatory pain. (Fletcher 2010). Hence, before the wound care procedure, sound communication and interpersonal skills, such as to inform patients how the procedures are going to be done, can help decrease pain effectively since this beforehand work may help patients fully prepared for the treatment and help them adjust their pain expectations in a reasonable scope. Adhesive dressing has been identified as the one of the most significant risk factors that can worsen the wound pain, thus, selection of non-traumatic and non-adherent dressing appears to be very essential at this point. (White 2008.) The judicious choice of dressing should base on the types of wound (Coulling 2007), such as Hydrofiber is suitable for excessive exudative wound while hydrogel particularly benefit the dryness of wound (WUWHS 2007).

Irrigation before removing dressings is a effective method to ease the pain. Soft silicone adhesive remover is recommended. (WUWHS 2007.) Showering the wound by using warm sterile instead of cold one also shows the positive outcome during wound cleaning. According to the suggestions given by WUWHS (2007), "Avoid any unnecessary stimulus to the wound such as prolonged exposure while waiting for specialist advice, and handle wounds gently to avoid tactile pain", which is, in other words, improving the caregivers' awareness of the external environmental risk factors can be extremely helpful for procedural pain reduction. (White 2008.)

Devitalised tissue, also called non-viable tissue is the tissue that lost its life and cannot be resurgence with any interventions. The effects of devitalized tissue, such as slough, exudation or eschar could prevent the health tissue from growing, therefore, the debridement is particularly needed at this point. (Atkin 2014.)

For improving life quality of patients who are living with chronic wound,

debridement cannot be performed without any assessment beforehand. According to the World Union of Wound Healing Societies (WUWHS) (2008), a holistic assessment should contain:

- Determine the cause of the wound.
- Identify any comorbidities/complications that may contribute to the wound or delay healing.
- Assess the status of the wound.
- Help develop the management plan.

Furthermore, the decision making about debridement requires practitioners to concentrate on the wound itself. By utilizing wound assessment tools could help practitioners set realistic goals select appropriate debridement methods and apply effective interventions. Such as the Triangle of Wound Assessment developed by WUWHS (2016), it allows practitioners to assess the wounds from three dimensions:

- Wound bed: tissue type, exudate or infection.
- Wound edge: maceration, dehydration, undermining or rolled.
- Periwound skin: maceration, excoriation, dry skin, hyperkeratosis, callus or eczema.

With the detailed and specific results collected from those assessments, practitioners would aware that different situation should be applied different debridement method, it is not a once for all intervention. According to the Wound Management Association (EWMA) (2013), the debridement methods embrace mechanical debridement, larvae debridement, sharp debridement, surgical debridement, chemical debridement and hydrosurgery. Each of debridements has its indications, merits and limitations, for achieving the clinical and reaching the best outcomes, these elements place a huge influence on practitioners' decision making and practitioner should seriously consider them before they offer any actions to patients. The below table (Table 4) is a summary of several debridement method based on EWMA document in 2013.

C	Mechanical debridement	Larvae debridement	Sharp debridement	Surgical debridement	Chemical debridement	Hydro surgery
E	Monofilament fibre pad, wet to dry gauze, paraffin tulle.	Also called as maggot debridement therapy or biosurgery.	Performance with a scalpel or scissors.	Can be done with various instruments.	Autolytic dressing; enzymatic dressing; absorptive dressings.	The substitution is jet lavage
I	Wounds with necrotic, infection or exudation.	Wounds with infection, eschar.	Necrotic tissue with boundaries between health tissue	Necrotic tissue with boundaries between health tissue; infectious wound.	Wounds with necrosis, slough, exudation or infection.	Wound with necrosis, slough and biofilm.
A	Fast completion, easy performance, safety, less specific skills requirements.	Wound healing acceleration, safety, less pain effectiveness, easy and fast performance.	Time saving; Low cost; selective; pain free.	Effectiveness; wound healing improvement;	Easy to performance, Safety Less pain.	Precision Multifunctionality
L	Pain, non-selective.	Not suitable for wounds with bleeding disorder or patients are allergic to larva.	Experienced skills requirement.	Pain; Anaesthetic requirement; High cost; high demands for the performance environment.		Pain; Anaesthesia demanding Contaminated risk

Table 3 The summary of debridement methods (adapted from EWMA)

C=Categories

E=Examples of subcategories

I=Indication(s)

A=Advantage(s)

L=Limitation(s)

Wound infection has been proved as one of the resources of pain (WUWHS 2007). The risk factors of wound infection are multifactorial and the managements should be holistic and multidisciplinary (IWII 2016). The core goals of wound infection treatment are to decrease the microorganism load and to lead to reduction in pain (Mudge & Orsted 2010). There are three strategies aiming to achieve the highlighted treatment goals of wound infection advised by both WUWHS (2008) and IWII (2016) which include holistic management, topical antimicrobial therapy and systematic antimicrobial therapy.

Holistic management includes optimizing host response by eliminating the original causes of chronic wound and improving the patients' capacities to resist infection and decreasing the load of microorganism by applying high standard of hygiene. In addition, wound drainage, debridement and cleaning can be used as microorganism control treatment. (IWII 2016.) (Figure 3)

Topical antimicrobial therapy includes topical antiseptic therapy and topical antibiotic therapy. (WUWHS 2008 & IWII 2016). The mechanism of this intervention is to unload the numbers of microorganism. Topical antimicrobial therapy is generally utilized on local wound infection. Antiseptics are administrated widely and effectively whereas antibiotics are applied with a consideration of resistance. (WUWHS 2008.) (Figure 3)

Systemic antibiotic therapy is used for spreading or systemic wound infection (WUWHS 2008). Although the risk of drug resistance brought by systemic antibiotic is higher than topical antimicrobial therapy, it still plays an essential role on those wound infection which other interventions are insufficient to treat them (IWII 2016) (Figure 5).

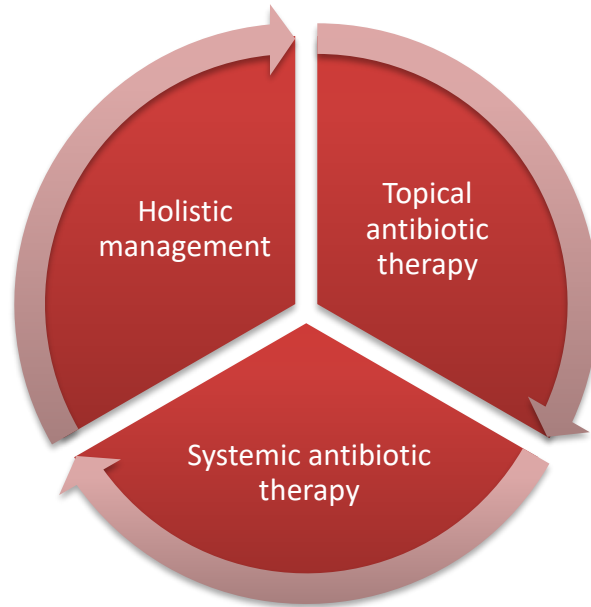


Figure 5 The interventions of chronic wound infection (adapted from IWII)

The negative emotion truly affects patient's psychological well being and further affect their physical health, thus, psychological interventions can be applied considerably during chronic wound pain management. Pain and emotion are subjectively different to each of patients, so psychological assessment is necessarily to be administrated during the whole treatment process accordingly. (Upton & solowiej 2010.) There are a plenty of assessment tools allowing healthcare givers to gather and analyze patient's psychological situations, for instance, The Hospital Anxiety and Depression Scale (HADS), Perceived Stress Scale (PSS), The State Trait Anxiety Inventory (STAI) and The General Health Questionnaire (GHQ).

Regarding to psychological interventions, relaxation techniques, such as hypnosis have been proved more effective than stress reduction techniques on easing pain and anxiety during dressing change. Cognitive behavioral therapy (CBT) which aims to turn the negative thinking, inaccurate thoughts, depressed attitudes or appropriate expectations into be more optimistic and reasonable, has shown the effectiveness on pain management. Furthermore, transcutaneous electrical nerve stimulation and other distraction strategies, for example music, imagery and breathing therapy also present a positive outcome on pain decrease. (White 2008, Roden 2009, Fletcher 2010.) Feedback from patient who were joining some wound-related organizations have yielded a positive effect on pain alliviation.

(WUWHS 2007,8) Except that, education also plays an essential role on pain reduction. Specifically, patients should be seen as one of participants in the entire treatment procedure and they should be encouraged to participate in decision-making on their pain treatment. (Woo 2012.)

6 DISCUSSION

The findings of this study present that there are four risk factors which increase chronic wound pain: dressing change, infection, debridement and psychological factors. The study of WUWHS (2007) has proved that dressing change is considered as the most painful wound care procedure caused by inappropriate dressing selection, dressing removal and dressing cleansing. Likewise, as the IWII (2016) demonstrates in its document, the damage caused by infection is the main source of wound pain increasing as well. According to Atkin (2014), debridement is a wound treatment that invades the wound site and enhance the pain to varying degrees without doubt. Additionally, based on the research conducted by Mudge (2008), patients will feel stressed, anxious and fearful once they have experienced painful wound care, and these memories can not be erased until they are treated correctly and properly (Mudge 2008). Hence, those risk factors should be fully recognized by the professionals when they make any chronic wound care decisions.

Likewise, the findings reveal two types of chronic wound pain interventions: pharmacological interventions and non-pharmacological interventions. Pharmacological treatments always cannot be absent in chronic wound pain management in elderly. The findings suggest that WHO analgesic ladder could be a very useful guideline when there is a need of analgesic application for chronic wound pain. The caregivers should be able to make a discreet decision on whether administration of systematic analgesic treatment or topical treatment is needed. In consideration of the opiate drugs may lead to addiction or abuse, the caregivers should have sufficient clinical pharmacological knowledge to eliminate the patient's reluctance and it would be better to cooperate with specialists. (WHO 2018.)

Furthermore, according to the findings, many surveys have found that non-pharmacological treatments present positive outcomes on chronic wound pain and most of the articles referred in this thesis prove that as well. The strategies around dressing change are required, for instance sound communication with patients (White 2008), selection of appropriate dressing based on different wound type and paying attention on wound cleaning, for instance, the temperature of cleaning liquid, the method of cleaning (WUWHS 2007). In addition to that, other psychological interventions such as cognitive behavioral therapy, relaxation

techniques, distraction techniques are also proved as effective interventions on pain reduction (White 2008, Roden 2009, Fletcher 2010).

6.1 Reliability, validity and ethical consideration

The reliability and validity are appreciated in this thesis. The reliability is demonstrated through whether the outcomes are consistent, in other words, by using the same test methods, the results are always yielded the same through repeated examinations more than one time. The reliability can be examined from three dimensions: stability, equivalence and homogeneity. In this thesis, the authors used the same keywords to collect researched information on the reliable databases and analyzed data with the same scientific method, which means these material was literally tested twice, all of the work yielded similar outcomes, although there were some varieties, the differences didn't affect the findings substantially and can be overlooked. (University of Wisconsin-Madison 2017.)

This literature review had some limitations as well. The samples of studies were not unlimited because only free articles were referred in this thesis. Beyond that, neither the English nor Finnish are the authors' mother tongue and only English studies were selected in this thesis, therefore there must be some subtle misunderstanding about the original studies. Some of the findings were devoid of evidence, because there was limited data demonstrated in the researched studies, such as music therapy and imagery therapy. To evidence these kinds of perspectives, the results need more research in the future.

Validity can be considered as the criteria to define the strength of results. The scientific methodology which was conducted throughout the study gave a promise to the validity of this thesis. There is a very close relationship between reliability and validity, the reliability more consistent the reliability, the stronger the validity. According to Dudovskiy (2017), the validity can be ensured by meeting some requirements, such as "appropriate time scale for the study has to be selected" or "selection the most suitable methodology based on the features of the study".

Ethical consideration is the guarantee for the participant's confidentiality. In this thesis, a literature review was conducted. The whole process of data collection and data analysis is objective. According to A practical Model of the Sel-Regulation of

Academic Integrity published by TENK in 2019, the authors did their best to follow the codes of responsible conduct of research (RCR), such as integrity, meticulousness and accuracy instead of fabrication, falsification, plagiarism and misappropriation refers (TENK 2019). Additionally, all the articles of other authors used in this thesis were referenced according to the referencing system of Lahti University of Applied Sciences. The findings were presented without any biased understanding. (Dudovskiy 2019.)

7 CONCLUSION

In this thesis, the authors are trying to figure out what are the risk factors that contribute to increase chronic wound pain and what interventions can be used to reduce the pain. For achieving this goal, a comprehensive data research and data analysis were done. The four most common chronic wound types were presented in detail in this thesis. By analyzing these studies, the results have shown that the risk factors that contribute to increase in pain including dressing change, infection, debridement and psychological factors. The interventions of reducing chronic wound pain include pharmacological management of using analgesics according to WHO analgesic ladder and non-pharmacological management, such as improving healthcare givers' dressing change skills during the wound care procedure, choosing the appropriate dressings and cognitive behavioral therapy, distraction strategies, and some other psychological interventions.

The topic of this thesis and research questions were discussed and then decided by the two authors firstly, once the topic and research questions were confirmed and approved by the supervisor, the first round of screening data was carried out immediately by key words from certain databases. Due to the broad and extensive screening results, the authors went through all of the data by using inclusion and exclusion criteria. 21 articles were fitting these criteria and were marked with the symbol of "*" in the list of references, the authors read through all of them to make sure that they were perfectly relevant to the topic and answered the research questions. The evidence based on collection methods and analysis methods was allowed to be conducted. Once the thesis draft was completed, the authors submitted it to the thesis supervisor, got feedback from her and adjusted the thesis in accordance with discussion happening between two authors and the supervisor.

The authors of this thesis are quite satisfied with the achieved results and believe this literature review will be very useful to registered nurses, nursing students, wound care nurses and other health care professionals. The authors recommend that chronic wound pain has significant influences on wound healing and the quality of patient's life. Recognition of the risk factors for causing pain is key in pain management. The process of planning pain management should be holistic, from a physical to psychological aspect. Chronic wound pain can be addressed by analgesia in either systematic way or topical way and non-medication treatments.

In addition, a successful chronic wound pain management also requires the healthcare professions have the capacity for making appropriate decision on pain treatment and comforting the patients.

According to the findings, the studies about pharmacological interventions of chronic wound pain are abundant and widely practiced, but the studies about psychological interventions for chronic wound pain are limited and offer less evidence- based data to support this point. Therefore, more studies related to this topic are needed and a follow-up study about psychcological interventions for reducing chronic wound pain is recommended in the future.

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APPENDIX 1

The John Hopkins Nursing Evidence-based Practice Rating Scale

JHNEBP EVIDENCE RATING SCALES

STRENGTH of the Evidence	
Level I	Experimental study/randomized controlled trial (RCT) or meta analysis of RCT
Level II	Quasi-experimental study
Level III	Non-experimental study, qualitative study, or meta-synthesis.
Level IV	Opinion of nationally recognized experts based on research evidence or expert consensus panel (systematic review, clinical practice guidelines)
Level V	Opinion of individual expert based on non-research evidence. (Includes case studies; literature review; organizational experience e.g., quality improvement and financial data; clinical expertise, or personal experience)

QUALITY of the Evidence		
A High	Research	consistent results with sufficient sample size, adequate control, and definitive conclusions; consistent recommendations based on extensive literature review that includes thoughtful reference to scientific evidence.
	Summative reviews	well-defined, reproducible search strategies; consistent results with sufficient numbers of well defined studies; criteria-based evaluation of overall scientific strength and quality of included studies; definitive conclusions.
	Organizational	well-defined methods using a rigorous approach; consistent results with sufficient sample size; use of reliable and valid measures
	Expert Opinion	expertise is clearly evident
B Good	Research	reasonably consistent results, sufficient sample size, some control, with fairly definitive conclusions; reasonably consistent recommendations based on fairly comprehensive literature review that includes some reference to scientific evidence
	Summative reviews	reasonably thorough and appropriate search; reasonably consistent results with sufficient numbers of well defined studies; evaluation of strengths and limitations of included studies; fairly definitive conclusions.
	Organizational	Well-defined methods; reasonably consistent results with sufficient numbers; use of reliable and valid measures; reasonably consistent recommendations
	Expert Opinion	expertise appears to be credible.
C Low quality or major flaws	Research	little evidence with inconsistent results, insufficient sample size, conclusions cannot be drawn
	Summative reviews	undefined, poorly defined, or limited search strategies; insufficient evidence with inconsistent results; conclusions cannot be drawn
	Organizational	Undefined, or poorly defined methods; insufficient sample size; inconsistent results; undefined, poorly defined or measures that lack adequate reliability or validity
	Expert Opinion	expertise is not discernable or is dubious.

**A study rated an A would be of high quality, whereas, a study rated a C would have major flaws that raise serious questions about the believability of the findings and should be automatically eliminated from consideration.*

Newhouse R, Dearholt S, Poe S, Pugh LC, White K. The Johns Hopkins Nursing Evidence-based Practice Rating Scale. 2005. Baltimore, MD, The Johns Hopkins Hospital; Johns Hopkins University School of Nursing.

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