THE IMPACT OF CLINICAL FACTORS AND SOCIODEMOGRAPHIC VARIABLES ON HEALTH-RELATED QUALITY OF LIFE IN VENOUS LEG ULCERATION

by

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Abstract

Leg ulceration negatively affects quality of life (QOL). The relationship between important clinical attributes such as ulcer severity, pain and health related quality of life (HRQL) is poorly understood. The Wilson and Cleary model of Health Related Quality of Life (WC model) is a guiding framework that links clinical measures to QOL.

Thesis Objectives: I describe the relationship between ulcer severity, comorbidity, etiology and pain and HRQL.

Methods: An integrative mixed-methods approach was used: a systematic review of studies that examined the relationship between clinical variables and HRQL or QOL as outlined in the WC model (n=22); a review of studies (n=11) that compared the HRQL of persons with leg ulcers to population normative scores; and, an analysis of the relationship between clinical factors and HRQL in a cohort of 564 persons with venous leg ulcers drawn from two randomized control trials.

Results: There is empirical support for the causal linkages between disease severity, symptoms, function, health perception and QOL that comprise the causal pathway as outlined in the WC model. Venous ulcers are associated with a poor quality of life, and numerous aspects of functioning are impaired, in particular physical function. In 564 individuals with venous ulcers, pain was present in 78.8%. Those younger than 65 years were 1.5 times more likely to be in the higher pain group compared to those 65 and older. Physical HRQL was significantly impaired. Predictors of poor physical HRQL included venous-arterial ulcers, a more severe ulcer, arthritis and a higher level of pain. Poor mental HRQL was associated with the younger age group, a comorbid condition and a higher level of pain. Increasing ulcer duration negatively affected mental state, but the findings were of borderline significance.

Conclusion: The WC model is a clinically useful framework to select variables to represent HRQL and to base hypotheses about causal associations between clinical variables and QOL. Future research should focus on specifying the measurement models to represent disease severity, symptom status and functional status. Clinically the WC model is a useful bedside heuristic to explore the impact on leg ulceration on daily life and wellbeing.

Co-Authorship

Maureen Buchanan is the first and primary author of the three manuscripts within this thesis. Contributions of the thesis committee (Dr. Margaret B. Harrison, Dr. Elizabeth VandenKerkhof and Wilma Hopman) are acknowledged through co-authorship of the proposed manuscripts. As the Principal Investigator, Maureen Buchanan was responsible for the conception and design of the thesis studies, analysis plan, analysis and interpretation of the data and drafting of the manuscripts. Margaret Harrison, Elizabeth VanDenKerkhof and Wilma Hopman contributed to the conception and study design, analysis plan and critically reviewed and suggested revisions to drafts of the manuscripts.

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Chapter 1

Introduction

Venous ulceration is a chronic recurrent wound of the lower leg. Although improved rates of healing are associated with the utilization of evidence-based protocols and the reorganization of care, after three months of good care, greater than 40% of ulcers will remain unhealed (Harrison et al., 2005; Harrison et al., 2008). By 12 months about one fifth of ulcers will fail to heal and a smaller proportion may persist for a number of years (Nelson, 2008). Recurrence rates range from 22% to 34% (Harrison et al., 2008; Morrell et al., 1999; Barwell et al., 2004) and may be as high as 51% at five years, even with specialist follow-up (Nelson et al., 2006). In addition to delayed healing and recurrence, the burden of symptoms associated with venous ulceration is no less discouraging. Lower limb swelling, wound drainage, odor, pain, itching and recurrent infection exert a profound effect on all aspects of daily life including mobility, choice of footwear, employment, social roles, physical activity and quality of life. Healing is an important outcome, however, the proportion healed by three months, reveals little about the individual's perspective about the impact of ulceration, chronicity or recurrence on their life. This critically important perspective is captured by a self-reported outcome such as health-related quality of life (HRQL).

QOL of life is important in leg ulcer care (Royal College of Nurses, 2006). An Ontario guideline recommends "that the client's estimate of the QOL should be included in the initial discussion of (treatment), throughout treatment and when the ulcer has healed" (RNAO, 2007, p11). QOL assessment however, has not been widely integrated into clinical practice generally (Higginson & Carr, 2001). The assessment of HRQL in leg ulcer care has not been well-defined.

HRQL has been widely adopted as an outcome in venous leg ulcer research (Anand et al., 2003). Most studies do not use a conceptual model of HRQL. In the absence of a conceptual

model, there is an insufficient basis to interpret the impact of person, disease or treatment factors on the HRQL score (Haase & Braden, 1998), and therefore the score has limited clinical utility at the point of care. A clinically relevant model would guide clinician assessments and inform supportive interventions at a client level to optimize HRQL for people with chronic wounds (Haase & Braden, 1998; Wilson & Cleary, 1995).

The focus of this thesis is the impact of venous leg ulcers on QOL using the Wilson and Cleary model (WC model) as a guiding framework (Wilson & Cleary, 1995). I am particularly interested in the causal pathway purported to link traditional clinical indicators of disease severity and symptom status with QOL. Clinically, QOL may be negatively affected by pain and older and larger ulcers. Age as well may be an important consideration in light of the emerging evidence that adults younger than 65 years may have a worse HRQL in comparison to older adults (Franks & Moffatt, 1998b). The causal linkages outlined in the WC model provide the conceptual basis to test these relationships.

Format of Thesis

This is a manuscript style thesis. The manuscripts follow in Chapters 2, 3 and 4. For the purpose of the thesis, citation style has been standardized to APA, however the format of each manuscript reflects the guidelines of the respective journals to which the manuscripts will be submitted. Each manuscript contains a reference list. Relevant tables and figures are appended to each chapter. The chapters are as follows:

Chapter 1: General Introduction

Chapter 2: Systematic review of the Wilson and Cleary Model of HRQL

Chapter 3: Review of the impact of leg ulceration on HRQL

Chapter 4: The influence of sociodemographic and clinical factors on HRQL of persons with venous ulceration

Chapter 5: Summary and Implications for practice and future research.

Description of the Problem

The prevalence of leg ulceration is 0.6 to 3.6 per 1,000 in Western countries (Graham et al., 2003). Although there are numerous etiologies of lower limb chronic wounds, venous ulcers account for the largest proportion at approximately 70%. The onset of ulceration may occur as early as the second decade and the peak prevalence is typically in the age range of 70 to 85 (Graham et al., 2003). The predominance of the older adult group has led health care providers to define venous ulcers as a problem of aging even though there is a small group of younger adults living with ulcers. Annual expenditures at 2002 Canadian prices, for nursing visits and supplies for 192 leg ulcer clients in a Canadian home care setting was estimated to be $1.3 million (Friedberg et al., 2002). Little research has been published regarding the indirect costs of leg ulceration.

The classical presentation of venous ulcers is one or more partial thickness skin ulcers located around the medial malleoli. Depending on the distribution and severity of the underlying venous insufficiency, ulcers may be present on one or both legs. Ulcer size varies significantly and can range from less than 1 cm^2 to circumferential leg wounds greater than 10 cm^2. Ulcer duration tends to be less than 1 year with a median or mean duration of 8 to 10 months (Harrison et al., 2005; Moffatt et al., 2004; Nemeth et al., 2003b); however, a prolonged duration may extend two decades or more in a small number of cases (Callam et al., 1987). Lower leg edema is frequently associated with chronic venous insufficiency and typically worsens through the day and is reversed with leg elevation at night. There may be associated inflammatory changes in the peri-ulcer skin including lipodermatosclerosis, hyper-pigmentation, atrophe blanche and stasis dermatitis. Untreated ulcers or infected ulcers are associated with copious drainage associated with a foul odor (Moffatt & Harper, 1997). Pain is highly prevalent (Nemeth et al., 2003b; Phillips et al., 1994; Hofman et al., 1997) and may be undertreated (Husband, 2001). Pain may contribute to functional impairment such as impaired mobility, role function and social isolation,

and have a negative impact on HRQL (Ebbeskog & Ekman, 2001; Husband, 2001; Krasner, 1998; Walshe, 1995; Wissing et al., 2002). Individuals living with ulceration have reported feelings of anger, depression, a negative body image, powerlessness and isolation (Phillips et al., 1994).

There is a cumulative body of evidence that leg ulceration is associated with a poorer HRQL in comparison to population norms (Franks et al., 1999; Franks & Moffatt, 1998b; Jull et al., 2004; Lindholm, 1996; Price & Harding, 1996). The experience of ulceration may also be different depending on age. Preliminary findings suggest that those who are younger than 65, particularly men, have a poorer HRQL in comparison to the predominantly elderly group (Franks & Moffatt, 1998). The influence of ulcer severity and pain, on the impairment of HRQL has had limited study.

The Wilson and Cleary Model

QOL is inherently subjective. It is an appraisal of one's well-being and is an expression of deeply held beliefs and values (Revicki et al., 2000). Health is not the sole determinant of QOL although within the context of aging, illness or chronic disease, one's health may have a greater impact on QOL (Anderson & Burckhardt, 1999). Wilson and Cleary (1995) define HRQL as that aspect of QOL affected by one's health.

Wilson and Cleary proposed a model of HRQL (WC model) comprised of commonly measured health outcomes linked by way of a causal pathway. Figure 2-1 displays the model (Wilson & Cleary, 1995). The causal pathway is comprised of five conceptually distinct "levels" of health outcomes: biological factors, symptom status, functional status, general health perception and overall QOL. Each construct on the causal pathway is influenced by the preceding construct, except biological factors. The dominant direction of causal influence moves from the level of biology to the more complex, integrative constructs of general health perception and

overall QOL. Causal relationship may however, occur in either direction (Wilson & Cleary, 1995).

Conceptualization of Disease Severity

Biological factors are those factors that are commonly assessed in clinical practice and whose effect on health is mediated by changes in cell, organ or organ system function (Wilson & Cleary, 1995). Numerous studies have defined biological factors as disease severity. Disease severity refers to the presence or extensiveness of a disease and may be evaluated by objective measures (Finlayson et al., 2004), symptom report, functional impairment and may have prognostic value (Boyd et al., 2007). Venous ulceration is a physical sign of chronic venous insufficiency (CVI). Once the ulcer heals, the underlying condition of CVI persists. Widely accepted CVI disease severity scales rate an open or healed ulcer as the most severe form of the disease (Kistner & Eklof, 2001). The definition of ulcer severity is not as clear. Ulcer size and ulcer duration are valid and reliable prognostic indicators for delayed healing of ulcers even with appropriate care (Margolis et al., 2000). Nurses routinely measure ulcers and record the client's estimate of duration as part of evidence-based practice protocols (Van Hecke et al., 2008). Ulcer size and severity are highly feasible measures of prognostic importance and have been treated as an indicator of severity by other researchers (Franks & Moffatt, 2006; Franks, 1999; Margolis et al., 2000). For the purpose of this research, ulcer size and ulcer duration are indicators of ulcer severity.

Conceptualization of Symptom Status

Wilson and Cleary (1995) define symptoms as a "patient's perception of an abnormal physical, emotional or cognitive state" (p. 61). Pain is multidimensional and consists of physiological, sensory, affective, cognitive, behavioral and socio-cultural aspects (Melzack, 1987). Pain is prevalent in venous leg ulceration and the clinical presentation of pain is complex.

Ulcer pain may be acute or chronic and exhibit nociceptive or neuropathic qualities or a combination of both (Briggs et al., 2007). Pain may be related to inadequate treatment, arise as an adverse effect of treatment or represent infection (Nemeth et al., 2003b; Hollinworth & Collier, 2000; Moffatt et al., 2000). A visual analogue scale (VAS) or numeric rating scale (NRS) are valid, reliable quick and simple methods often used in clinical practice and research to assess pain intensity in venous leg ulceration (Nemeth et al., 2003a). For the purpose of this research, the symptom of interest is pain intensity.

Thesis Aim and Objectives

The central concern of this thesis is the impact of venous leg ulcers on HRQL. The body of work falls into three phases of research. In the first phase the aim is to explore the utility of the WC model. The performance of this model in empirical studies is an important consideration in assessing the usefulness of the model for both research and practice. I conduct a systematic review of empirical studies that used the WC model as a guiding framework. This review focuses on the explanatory performance of the model as measured by regression and structural equation modeling in a variety of chronic diseases.

In the second phase, the aim is to identify patterns of impairment of important domains of HRQL associated with leg ulceration. I review studies that compare HRQL in leg ulcer patients with population normative scores as well as studies that report the strength of relationship, if any, between disease severity, gender, age and HRQL.

The aim of the last phase of research is to describe the impact of leg ulcers on HRQL and explore the relationship between age, gender, commonly measured clinical indicators and HRQL in a large cohort of individuals with venous ulcers. The WC model is the guiding framework for this research study.

Ethics

The Queen's University Health Sciences and Affiliated Teaching Hospitals Ethics Board approved the thesis research proposal. A copy of the ethics approval is appended in appendix A. The author carried out data collection for the review of the Wilson and Cleary Model as well as the review of HRQL and venous ulceration. The research study database was comprised of baseline data collected in two randomized control trials. The original research questions examined the impact of the reorganization of health services on rates of healing and compared two types of compression bandaging. An ethics review board approved each study (CIHR #MCT-110636, 2005 and CIHR # MOP42497, 2000). The primary investigator gave permission to use data collected in the two trials in this analysis. The study dataset did not contain any identifying information about the original participants.

Chapter 2: A Systematic Review of the Wilson and Cleary Model of HRQL

The WC model is both a taxonomy of health outcomes and a model of HRQL (Wilson & Cleary, 1995). The taxonomy is comprised of five conceptually distinct health outcomes: biological variables, symptom status, functional status, general health perception and overall QOL. As a model of HRQL, the five levels of health outcomes are linked in a series of causal relationships. This series of causal linkages constitute a "pathway" and integrate what have been traditionally two paradigms of health, the medical model and the QOL model (Wilson & Cleary, 1995). Chapter 2 is a systematic review of empirical studies (n=22) that examined this causal pathway. In light of the importance of symptom management in nursing practice, a focused exploration was undertaken regarding the relationship between disease severity and symptom status, the influence of symptom status on more distal health outcomes such as functional status, general health perception and overall QOL.

The specific objectives of the review were to:

1) Develop a methodology to capture empirical studies with evaluative data on the WC model.

2) Summarize the empirical findings regarding the relationships within the causal pathway.

The 1995 theoretical paper by Wilson and Cleary was cited at least 679 times in the health literature. Twenty-two empirical studies met the inclusion criteria. The study samples were diverse chronic disease groups including HIV/AIDS, heart failure, hypertension, neck pain and COPD. There were no studies that evaluated the performance of the model in a chronic wound population. Of particular interest was the extent to which disease severity and symptom status predicted the outcome variable. Fifteen studies examined the impact of symptom status on more distal outcomes including physical function, QOL or HRQL. Symptom status was a significant predictor of the outcome variable with a unique R^2 ranging from .05 to .26, and as high as .56 in the case of physical function in HIV patients. This group of studies suggested that clinically relevant variables such as disease severity and symptom status influence HRQL and provided a theoretical basis to explore the relationship of disease severity, pain intensity and HRQL in venous ulceration.

Chapter 3: Venous leg ulcer disease burden and HRQL

Based on the WC model, HRQL may be influenced by clinical variables and individual and environmental factors. I reviewed studies that compared baseline HRQL scores of persons with leg ulcers to population normative scores or examined the strength of relationship between routinely measured clinical factors and HRQL. The following objectives guided this phase of the research:

1) Identify patterns of impairment of HRQL domains associated with lower leg ulcers.

2) Examine the empirical evidence of causal associations between ulcer severity, symptoms and HRQL.

3) Catalogue definitions of disease severity and symptom status in leg ulcers.

The HRQL of persons with lower limb ulceration is poor in comparison to population norms or matched controls (Franks et al., 1999; Franks & Moffatt, 1998b; Jull et al., 2004; Lindholm, 1996; Price & Harding, 1996). Many clinical factors associated with ulceration are reported to negatively affect HRQL, including wound size, chronicity, pain, swelling, wound drainage, odor, immobility and social isolation (Bland, 1996; Charles, 1995; Chase et al., 1997; Douglas, 2001; Krasner, 1998; Walshe, 1995). Only a few studies have explored the relationship between clinical factors and HRQL (Phillips et al., 1994; Pieper et al., 2000). In addition to clinical factors, age and gender may influence the experience of ulceration. Preliminary findings suggest that those who are younger than 65, particularly men, have a poorer HRQL in comparison to the predominantly older adult group (Franks & Moffatt, 1998b). Despite significant impairment of HRQL, the influence of ulcer-related factors, age, gender and pain on HRQL has had limited study.

Chapter 4: Clinical and sociodemographic factors and HRQL in venous ulcers

The WC model is a guiding framework for this descriptive cross-sectional study. I explored the causal associations between biological variables (ulcer severity, etiology and comorbidity), symptom status (pain) and individual factors (age and gender) and HRQL in a cohort of patients (n=564). The study dataset is comprised of cases with complete outcome data drawn from two RCTs. The specific objectives of the study were to:

1) Describe the clinical and sociodemographic characteristics of a cohort of individuals with leg ulcers.
2) Describe the relationship between ulcer severity, comorbidity, pain as well as age and gender and HRQL.

The mean age was 66 years and 47% were male. There were no significant differences in pain or HRQL between men and women. Over 31.7% of the participants reported moderate to

severe pain and half of the ulcers were at risk for delayed healing even with appropriate care. The younger adult group had 1.5 times the risk of higher pain levels than older adults. The mean score for physical HRQL (PCS) was 38.0, well below population norms, and mental HRQL (MCS) was 50.5. Four percent of the variance of pain was accounted for by age, living circumstances, prognostic score and arthritis. Ten percent and approximately 8% of the variance of physical and mental HRQL, respectively, were accounted for by disease severity, comorbidity, pain and age. Based on these findings, the clinical assessment of HRQL should be informed by important clinical factors such as disease severity and pain. However, to more fully assess HRQL, other factors need to be incorporated. According to the Wilson and Cleary model, functional status likely affects HRQL. Future research should incorporate measures of functional status and disease-specific symptoms and explore the influence of age on HRQL. This study addresses some of the limitations in earlier descriptive studies including 1) the lack of an explicit conceptual framework of HRQL; 2) poorly defined case definitions that combined ulcers of all etiologies; and 3) the inadequate number of participants younger than 65.

Chapter 5: Summary and Implications for practice

I discuss in Chapter 5 the clinical relevance of HRQL in light of the current recommendation to incorporate QOL assessment into clinical practice (RNAO, 2007). The development of supportive clinical interventions to improve HRQL is based on a comprehensive understanding of the burden of disease and the factors that likely influence HRQL during an episode of ulceration. Routinely measured clinical indicators identified in evidence-based guidelines may only partially reflect those factors that influence QOL during ulceration. The WC model is a useful, clinically-relevant heuristic to guide a more comprehensive assessment of HRQL. A fruitful avenue for future research is the development of measurement models of leg ulcer disease severity, symptoms and functional status.

Contribution to Knowledge

This thesis adds to the body of knowledge in several domains. Although the WC model has been frequently cited in the literature, to date there has not been an overview of empirical studies. In order to conduct the review I overcame two barriers: The development of a sensitive search strategy; and, the development of inclusion criteria that limited studies to those that used the model in an *a priori* fashion as a conceptual basis for the study. The review contributed to knowledge about the WC model with some methodological implications for the conduct of reviews of a conceptual model.

The thesis also contributes to the emerging body of knowledge concerning QOL in venous disease. Clinicians require a clinically relevant approach or method to integrate the assessment of HRQL into care planning and evaluation. The WC model provides a framework to identify important content areas of assessment. Leg ulceration is associated with a pattern of impairment of HRQL domains. The clinician's assessment should be informed by this pattern, especially in the domain of physical function. The findings of this research study suggest that ulcer duration, comorbidity, pain and age are clinically important predictors of HRQL, but in isolation are insufficient. Future research is needed to deepen our understanding of the impact of ulceration on HRQL domains in order to ultimately develop supportive interventions that will promote function and well-being while living with ulceration. This is particularly important in light of the chronic recurrent natural history of venous leg ulcers.

Reference List

Anand, S. C., Dean, C., Nettleton, R., & Praburaj, D. V. (2003). Health-related quality of life tools for venous-ulcerated patients. *British Journal of Nursing, 12,* 48-59.

Anderson, K. L. & Burckhardt, C. S. (1999). Conceptualization and measurement of quality of life as an outcome variable for health care intervention and research. *Journal of Advanced Nursing, 29,* 298-306.

Barwell, J. R., Davies, C. E., Deacon, F., Harvey, K., Minor, J., & Sassano, A. (2004). Comparison of surgery and compression with compression alone in chronic venous ulceration (ESCHAR study): Randomized controlled trial. *Lancet, 363,* 1854-1859.

Bland, M. (1996). Coping with leg ulcers. *Nuring New Zealand, 2,* 13-14.

Boyd, C. M., Weiss, C. O., Halter, J., Han, K. C., Ershler, W. B., & Fried, L. P. (2007). Framework for evaluating disease severity measures in older adults with comorbidity. *Journal of Gerontology, 62A,* 286-295.

Briggs, M., Bennett, M. I., Closs, S. J., & Cocks, K. (2007). Painful leg ulceration: a prospective, longitudinal cohort study. *Wound Repair and Regeneration, 15,* 186-191.

Callam, M. J., Harper, D. R., Dale, J. J., & Ruckley, C. V. (1987). Chronic ulcer of the leg: clinical history. *British Medical Journal, 294,* 1389-1391.

Charles, H. (1995). The impact of leg ulcers on patients' quality of life. *Professional Nurse, 10,* 574.

Chase, S. K., Melloni, M., & Savage, A. (1997). A forever healing: The lived experience of venous ulcer disease. *Journal of Vascular Nursing, 15,* 73-78.

Douglas, V. (2001). Living with chronic leg ulcer: An insight into patients' experiences and feelings. *Journal of Wound Care, 10,* 355-360.

Ebbeskog, B. & Ekman, S. L. (2001). Elderly persons' experiences of living with venous leg ulcer: living in dialectical relationship between freedom and imprisonment. *Scandinavian Journal of Caring Science, 15,* 243.

Finlayson, T. L., Moyer, C. A., & Sonnad, S. S. (2004). Assessing symptoms, disease severity, and quality of life in the clinical context: a theoretical framework. *The American Journal of Managed Care, 10,* 336-344.

Franks, P. J. (1999). Quality of life for leg ulcer patients. In C.V. Ruckley, A. Bradbury, & F. G. R. Fowkes (Eds.), *Venous Disease: Epidemiology, Management and Delivery of Care* (pp. 254-261). London: Springer-Verlag London Ltd.

Franks, P. J., Bosanquet, N., Brown, D., Straub, J., Harper, D. R., & Ruckley, C. V. (1999). Perceived health in a randomised trial of treatment for chronic venous ulceration. *European Journal of Vascular and Endovascular Surgery, 17,* 159.

Franks, P. J. & Moffatt, C. J. (1998). Who suffers most from leg ulceration? *Journal of Wound Care, 7,* 383-385.

Franks, P. J. & Moffatt, C. J. (2006). Do clinical and social factors predict quality of life in leg ulceration? *The International Journal of Lower Extremity Wounds, 5,* 236-243.

Friedberg, E. H., Harrison, M. B., & Graham, I. D. (2002). Current home care expenditures for persons with leg ulcers. *Journal of Wound Ostomy and Continence Nursing, 29,* 186-192.

Graham, I. D., Harrison, M. B., Nelson, E. A., Lorimer, K., & Fisher, A. (2003). Prevalence of lower-limb ulceration: a systematic review of prevalence studies. *Advances in Skin & Wound Care, 16,* 305-316.

Haase, J. E. & Braden, C. J. (1998). Guidelines for achieving clarity of concepts related quality of life. In C.R.King & P. S. Hinds (Eds.), *Quality of Life* (pp. 54-73). Toronto: Jones and Bartlett Publishers.

Harrison, M. B., Graham, I. D., Lorimer, K., Friedberg, E., Pierscianowski, T., & Brandys, T. (2005). Leg-ulcer care in the community, before and after implementation of an evidence-based service. *Canadian Medical Association Journal, 172,* 1447-1452.

Harrison, M. B., Graham, I. D., Lorimer, K., Vandenkerkhof, E., Buchanan, M., Wells, P. S. et al. (2008). Nurse clinic versus home delivery of evidence-based community leg ulcer care: A randomized health services trial. *BMC Health Services Research, 8,* 243-253.

Higginson, I. J. & Carr, A. J. (2001). Measuring quality of life: Using quality of life measures in the clinical setting. *British Medical Journal, 322,* 1297-1300.

Hofman, D., Ryan, T. J., Arnold, P., Cherry, G. W., Lindholm, C., & Bjellerup, M. (1997). Pain in venous leg ulcers. *Journal of Wound Care, 6,* 222-224.

Hollinworth, H. & Collier, M. (2000). Nurses' views about pain and trauma at dressing change: results of a national survey. *Journal of Wound Care, 9,* 369-373.

Husband, L. L. (2001). Venous ulceration: The pattern of pain and the paradox. *Clinical Effectiveness in Nursing, 5,* 35-40.

Jull, A., Walker, N., Hackett, M., Jones, M., Rodgers, A., Birchall, N. et al. (2004). Leg ulceration and perceived health: a population based case-control study. *Age and Ageing, 33,* 236-241.

Kistner, R. L. & Eklof, B. (2001). Classification and diagnostic evaluation of chronic venous disease. In P.Glovickzki & J. S. T. Yao (Eds.), *Handbook of Venous Disorders* (2nd ed., pp. 94-103). London: Arnold.

Krasner, D. (1998). Painful venous ulcers: Themes and stories about living with the pain and suffering. *Journal of Wound Ostomy and Continence Nursing, 25,* 158-168.

Lindholm, C. (1996). The Nottingham Health Profile. *Journal of Wound Care, 5,* 143-144.

Margolis, D. J., Berlin, J. A., & Strom, B. L. (2000). Which venous leg ulcers will heal with limb compression bandages? *American Journal of Medicine, 109,* 15-19.

Melzack, R. (1987). The short-form McGill Pain Questionnaire. *Pain, 30,* 191-197.

Moffatt, C. J., Franks, P. J., Doherty, D. C., Martin, R., Blewett, R., & Ross, F. (2004). Prevalence of leg ulceration in a London population. *The Quarterly Journal of Medicine, 97,* 431-437.

Moffatt, C. J., Franks, P. J., & Hollinworth, H. (2000). Understanding wound pain and trauma: an international perspective. *European Wound Management Association,* 2-7.

Moffatt, C. J. & Harper, P. (1997). *Leg Ulcers*. New York: Churchill Livingstone.

Morrell, C. J., Walters, S. J., Dixon, S., Collins, K. A., Brereton, L. M. L., & Peters, J. (1999). Cost effectiveness of community leg ulcer clinics: Randomized controlled trial. *British Medical Journal, 316,* 1487-1491.

Nelson, E. A. (2008). *VenUS III venous ulcer studies III: ultrasound for venous leg ulcers. Details of HTA project in progess*.

Nelson, E. A., Harper, D. R., Prescott, R. J., Gibson, B., Brown, D., & Ruckley, C. V. (2006). Prevention of recurrence of venous ulceration: a randomized controlled trial of class 2 and class 3 elastic compression. *Journal of Vascular Surgery, 44,* 803-808.

Nemeth, K. A., Graham, I. D., & Harrison, M. B. (2003a). The measurement of leg ulcer pain: Identification and appraisal of pain assessment tools. *Advances in Skin & Wound Care, 16,* 260-267.

Nemeth, K. A., Harrison, M. B., Graham, I. D., & Burke, S. (2003b). Pain in pure and mixed aetiology venous leg ulcers: a three-phase point prevalence study. *Journal of Wound Care, 12,* 336-340.

Phillips, T., Stanton, B., Provan, A., & Lew, R. (1994). A study of the impact of leg ulcers on quality of life: Financial, social and psychologic implications. *Journal of the American Academy of Dermatology, 31,* 49-53.

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,* 227-239.

Price, P. & Harding, K. (1996). Measuring health-related quality of life in patients with chronic leg ulcers. *Wounds, 8,* 91-94.

Revicki, D. A., Osoba, D., Fairclough, D., Barofsky, I., Berzon, R., Leidy, N. K. et al. (2000). Recommendations on health-related quality of life research to support labeling and promotional claims in the United States. *Quality of.Life Research, 9,* 887-900.

RNAO (2007). Assessment and management of venous leg ulcers. RNAO Nursing Best Practices Guidelines Program. Retrieved September 1, 2009, from http://www.rnao.org/Storage/30/2469_RNAO_Venous_Leg_Ulcer_Supplement.pdf .

Royal College of Nurses (2006). *The nursing management of patients with venous leg ulcers*. (2nd ed.) Oxford: RCN Institute.

Van Hecke, A., Grypdonck, M., & Defloor, T. (2008). Guidelines for the management of venous leg ulcers: a gap analysis. *Journal of Evaluation in Clinical Practice, 14*, 812-822.

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

Wilson, I. B. & Cleary, P. D. (1995). Linking clinical variables with health-related quality of life. A conceptual model of patient outcomes. *JAMA, 273*, 59-65.

Wissing, U., Ek, A. C., & Unosson, M. (2002). Life situation and function in elderly people with and without leg ulcers. *Scandinavian Journal of Caring Science, 16*, 59-65.

Appendix A

QUEEN'S UNIVERSITY HEALTH SCIENCES AND AFFILIATED TEACHING HOSPITALS
ANNUAL RENEWAL

Queen's University

Queen's University, in accordance with the "Tri-Council Policy Statement, 1998" prepared by the Medical Research Council, Natural Sciences and Engineering Research Council of Canada and Social Sciences and Humanities Research Council of Canada requires that research projects involving human subjects be reviewed annually to determine their acceptability on ethical grounds.

A Research Ethics Board composed of:

Dr. A.F. Clark	Emeritus Professor, Department of Biochemistry, Faculty of Health Sciences, Queen's University (Chair)
Rev. T. Deline	Community Member
Dr. M. Evans	Community Member
Prof. L. Keeping-Burke	Assistant Professor, School of Nursing, Queen's University
Ms. S. Marlin	Director, Office of Research Services (Ex Officio)
Dr. J. Low	Emeritus Professor, Department of Obstetrics and Gynaecology, Queen's University and Kingston General Hospital
Dr. W. Racz	Emeritus Professor, Department of Pharmacology & Toxicology, Queen's University
Dr. H. Richardson	Assistant Professor, Department of Community Health & Epidemiology Project Coordinator, NCIC CTG, Queen's University
Dr. B. Simchison	Assistant Professor, Department of Anaesthesiology, Queen's University
Dr. A.N. Singh	WHO Professor in Psychosomatic Medicine and Psychopharmacology Professor of Psychiatry and Pharmacology Chair and Head, Division of Psychopharmacology, Queen's University Director & Chief of Psychiatry, Academic Unit, Quinte Health Care, Belleville General Hospital
Dr. E. Tsai	Assistant Professor, Department of Paediatrics and Office of Bioethics, Queen's University
Rev. J. Warren	Community Member
Ms. K. Weisbaum	LL.B. and Adjunct Instructor, Department of Family Medicine (Bioethics)

has reviewed the request for renewal of Research Ethics Board approval for the project **"Health-Related Quality of Life and Venus Ulceration: An Exploration of Influencing Factors"** as proposed by Ms. Maureen Buchanan and Dr. Margaret B. Harrison of the School of Nursing, at Queen's University. The approval is renewed for one year, effective January 24, 2008. If there are any further amendments or changes to the protocol affecting the subjects in this study, it is the responsibility of the principal investigator to notify the Research Ethics Board. Any unexpected serious adverse event occurring locally must be reported within 2 working days or earlier if required by the study sponsor. All other adverse events must be reported within 15 days after becoming aware of the information.

Albert Clark
Chair, Research Ethics Board

Dec 11, 2007
Date

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Renewal 1[x] Renewal 2 [ ] Extension [ ]
REB# NURS-193-07

Chapter 2

Review of the Wilson and Cleary Model of Health Related Quality of Life

[Prepared for submission to Journal of Nursing Scholarship]

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Abstract

Background: The Wilson and Cleary model (WC model) posits causal associations between clinical variables and dimensions of health-related quality of life (HRQL). This guiding framework may be a clinically relevant model of HRQL.

Aim: We evaluate the empirical support for the causal associations posited in the model.

Method: A systematic review of empirical research that tested the Wilson and Cleary model.

Results: Twenty-two studies tested causal associations between disease severity, symptoms status, functional status, health perceptions and HRQL or quality of life in diverse chronic health conditions. Descriptive evidence supported the causal associations posited by the WC model. Symptoms status and functional status are particularly important in mediating the impact of chronic conditions and quality of life. The model met goodness of fit tests as well.

Conclusion: The model is a useful conceptualization of HRQL. Causal linkages between routinely measured clinical variables and quality of life form the theoretical rationale to generate testable hypotheses to explore interventions to improve HRQL across chronic conditions.

Clinical Relevance: This model of HRQL provides a conceptual basis for the clinical assessment of domains important to HRQL including symptom management, promotion of function and the individual's unique adaptation to their dynamic state of health and HRQL.

Background

Individuals with chronic diseases experience a complex array of symptoms and functional impairments that may affect their day-to-day living and create seismic-like change in self-perception and perceptions of health and quality of life (QOL). The burden of one disease may be complicated by the burden of other health conditions. In addition, characteristics such as age, gender and socioeconomic status may attenuate or worsen the impact of chronic conditions upon QOL.

Health-related quality of life (HRQL) conceptualizes the synthesis of this impact on day-to-day living. HRQL is a complex concept, inherently subjective, and not directly measureable. It is an outcome, perhaps the most important, for individuals living with chronic conditions. As nurses, we are concerned about human responses to health. We endeavor to help individuals manage symptoms, maintain or improve functional abilities and navigate their unique adaptation to the dynamic state of health or illness. These concerns have an affinity with concepts that comprise HRQL. Despite this affinity, HRQL has had limited translation into day-to-day clinical practice (Higginson & Carr, 2001).

There are numerous generic and disease-specific instruments designed to measure both the broader concept of QOL and HRQL (Gill & Feinstein, 1994; McDowell, 2006). The definition of both concepts varies greatly depending upon the instrument employed (Gill & Feinstein, 1994). Gill and Feinstein and others (Sevenhuysen & Trumble-Waddell, 1997) observed that the underlying theoretical basis for the measurement of QOL is often neglected and the measurement instrument is treated as a de facto proxy for theory. However, the score as an abstract number does not reveal the relationship between disease, person or environmental variables (Haase & Braden, 1998; Sousa et al., 1999). Therefore, the clinical relevance of the score is unclear. In order to address this limitation the Wilson and Cleary model of HRQL (WC

model) (Wilson & Cleary, 1995) may be a useful guiding framework. The framework poses linkages between commonly measured clinical factors such as disease severity and symptoms and constructs such as functional status and health perceptions. These constructs, in combination, comprise HRQL. The utility of the model is that it orders the complex phenomenon of the effect of health on QOL, provides the theoretical basis for hypothesis testing and the development of interventions, and may be a useful template to guide the clinical assessment of HRQL.

Although the WC model was recently characterized as " not widely used" (Ferrans et al., 2005), the seminal paper (Wilson & Cleary, 1995) was cited in the health sciences literature 679 times (Web of Science July 16, 2007). Given the apparent impact factor, we undertook a comprehensive review of studies evaluating this conceptualization to determine the empirical support for the relationships posited by the model. Of particular interest was the basis of support for the causal associations linking biological factors, symptoms status, functional status, general health perception and quality of life, herein referred to as the "causal pathway".

The following plan was pursued: 1) Develop a search and retrieval methodology that captures empirical studies with evaluative data on the WC model; 2) Describe how the WC model has been used in empirical research to date with populations with chronic diseases; and 3) Summarize the empirical findings regarding the relationships within the causal pathway. The model is depicted in figure 2-1.

Wilson and Cleary define HRQL as those "aspects of quality of life that relate specifically to a person's health" (p. 60). Four health outcomes comprise HRQL: biological variables, symptom status, functional status, and general health perception. Wilson and Cleary (1995) define biological variables as changes in cell or organ systems commonly measured in clinical practice. Symptom status is defined as a patient's perception of an abnormal physical, emotional or cognitive state. Functional status is the ability of an individual to perform defined tasks in a minimum of four domains –physical, social, role and psychological function. General health perceptions represent an appraisal of all previous health concepts, influenced by the

individual's values, social and psychological supports, and are an important point of integration. QOL is a broader concept than HRQL. Wilson and Cleary do not explicitly define QOL, but imply QOL measures capture a stable synthesis of a wide range of experiences and feelings understood to represent wellbeing or QOL. QOL is also influenced by multiple non-medical factors (Wilson & Cleary, 1995).

The four health outcomes that constitute HRQL are organized along a causal pathway. With the exception of biological variables, each outcome is influenced by the preceding outcome, from left to right, as well as individual and environmental characteristics. Bidirectional influences are possible. Each level of outcome represents increasing complexity and integration of multiple influences. Wilson and Cleary do not define individual characteristics or environmental factors, although both concepts are included in the schematic representation of the model. The model schema suggests that symptom amplification or an appraisal of symptom burden influences symptom status; personality and motivation influence functional status; and value preferences influence general health perception and QOL. Environmental characteristics include psychological supports that influence symptom status, general health perception and QOL and social and economic supports influence functional status. Figure 1 displays the dominant direction of associations; however, Wilson and Cleary also note that reciprocal associations and associations between nonadjacent levels of the model may occur.

Search, Retrieval and Appraisal Procedures

There is no gold standard method to conduct a sensitive and specific search for conceptual models in computerized indexes. We conducted exploratory searches of 11 electronic indexes spanning the period of 1995 to October 30, 2007. We used keywords compiled from complete references of articles known to cite the model. From this we identified three sensitive search strategies: 1) a title keyword search, 2) keyword search of the phrase "Wilson and Cleary", and, 3) in addition to these, a *cited by* search tool was used in Medline. If available in the specific

index, we applied limits to exclude reviews, dissertations and non-empirical articles such as letters and editorials. References were downloaded into bibliographic software and duplicate citations were eliminated. Abstracts were screened to exclude non-research papers, pediatric research, and pilot, qualitative, psychometric and non-English studies.

During the next phase, we applied inclusion criteria. Health science disciplines have not identified acceptable reporting standards of studies that evaluate conceptual models. One convention is that authors include a citation to the relevant theory or model in the background or literature review section of a research report (Krainovich-Miller , 1998). The presence of a reference to the 1995 paper in any section of the research report was a sensitive criteria, but nonspecific and resulted in numerous irrelevant studies. We then undertook a qualitative assessment to exclude studies that did not use the model as the conceptual basis for the study.

This qualitative assessment was as follows: The authors' purpose for citing the 1995 paper was determined by reading the context for each in-text citation. If the purpose for the citation was limited, for example to define a concept such as symptom, the study was excluded. Through this process irrelevant studies were excluded and more importantly several exemplary studies were identified that became the set from which inclusion criteria were derived.

Exemplary studies were those that unequivocally adopted the model in an *a priori* fashion and had at least one research question that involved testing the model or relationships in the causal pathway. Inclusion criteria were based on the defining characteristics of these exemplary studies. The inclusion criteria were:

1) A variable table or list that explicitly linked the study variables to concepts in the WC model.

2) The strength of relationship between the independent and dependent variable or the performance of the overall model was reported.

3) The research question concerned an outcome selected from the causal pathway.

We sought studies that met these criteria. Figure 2 summarizes the search process to produce the final set that we reviewed.

Results

There were 667 unique citations retrieved across 11 bibliographic indexes. Twenty-two studies met the inclusion criteria. General information about the final set of studies is summarized in Table 1. The studies focused on cohorts with diverse chronic diseases including HIV/AIDS (n=12), heart failure or heart disease (n=6), hypertension (n=1), neck pain (n=1), COPD (n=1), and xerostomia or chronically dry mouth (n=1). Seventeen studies were cross sectional.

Nine studies were secondary analyses of research data. There were no intervention studies, and all studies were exploratory and descriptive. Seventeen studies were cross sectional. Five studies used longitudinal designs to test the WC model in prospective analysis (see Table 1) (Sousa & Williamson, 2003; Wilson & Cleary, 1997; Janz et al., 2001; Mathisen et al., 2005; Hofer et al., 2005). The relationships between predictor variables and dependent variables were consistent with the model and stable over time. All studies used regression to examine the explanatory power of the model or structural equation modeling (SEM) to test the overall model. There are no gold standard criteria for the critical appraisal of regression analyses or SEM. However, internal and external validity are threatened by 1) outliers or influential cases that may have exerted undue influence on the variability of the distribution; 2) highly correlated predictors that lead to collinearity; and, 3) insufficient observations per variable entered into the model that may lead to Type II error. The authors generally did not report efforts to evaluate the influence of outliers, collinearity or the calculation of a minimum sample size.

Most studies provided information about the validity and reliability of the measurement instruments. Few studies used study-specific tools. Biological variables were composite measures based on definitions including disease severity (Arnold et al., 2005; Hofer et al., 2005); prognostic indicators; (Baker et al., 2007; Corless et al., 2000; Cosby et al., 2000; Erickson et al.,

2004; Sousa & Kwok, 2006; Sousa et al., 1999; Wilson & Cleary, 1996; Wilson & Cleary, 1997); duration of disease; (Corless et al., 2000; Wilson & Cleary, 1996; Wilson & Cleary, 1997); and, comorbid conditions (Luo et al., 2004; Orfila et al., 2006; Phaladze et al., 2005; Portillo et al., 2005; Heo et al., 2005; Janz et al., 2001). Symptom status was measured using disease-specific or symptom-specific instruments. Functional status was measured using both objective, observed measures and patient self-report instruments, for example, the six-minute walk test and the self-perceived physical function SF-36 subscale. General health perceptions are self-reported and captured by a global measure or subscale of a generic HRQL tool or the Health worries subscale of an HIV HRQL instrument.

Although one study explicitly distinguished HRQL from QOL (Sousa & Williamson, 2003) the remainder used the terms interchangeably. Seventeen studies measured either QOL (11) or HRQL (6). HRQL was measured using both generic (Erickson et al., 2004; Sousa & Williamson, 2003) and disease specific instruments (Clingerman, 2004; Heo et al., 2007; Heo et al., 2005). Studies of QOL in HIV used disease-specific QOL instruments. Studies of QOL in other health conditions were captured by generic measures, and in one instance, the Hospital Anxiety Depression Scale was used to capture subjective wellbeing.

Individual characteristics were defined as sociodemographic variables, health behaviors (drinking, smoking), individual value preferences (Janz et al., 2001), and more theoretically driven concepts such as perceived health competence (Arnold et al., 2005) or locus of control (Hofer et al., 2005). Anxiety and depression were defined as individual factors or symptom status or overall QOL. Environmental variables were defined as social support, financial worries, HIV disclosure worries, living arrangements, employment status, and income. Measures of social support varied from living alone to more comprehensive and psychometrically sound measures such as Medical Outcome Study Social Support survey (Janz et al., 2001).

In the 22 studies, two analytic approaches were used. Fifteen studies used regression to test unidirectional relationships between predictor variables and a single outcome. Seven studies

used structural equation modeling to test more complex and comprehensive sets of relationships including indirect and bi-directional relationships along the causal pathway.

Regression Models

The regression models reflected the direction of causation as outlined in the causal pathway, with the exception of one cross sectional study (Cosby et al., 2000). The odds of cytopenia in advanced AIDS were estimated based upon the presence of symptoms or functional status or health perceptions or QOL. This study was analytically distinct from the 14 other regression studies. The other studies focused on one of five possible outcomes: functional status, health perception, HRQL and QOL.

Regression modeling of the causal pathway explained a substantial amount of variance in the outcomes. The overall model R^2 ranged from 35% to 56% of functional status, 47% to 54% of health perception, 21% to 56.2% of HRQL and 20% to 53.2% of overall QOL. Given the exploratory descriptive nature of many of the studies, the size of the model R^2 is notable. The five studies with an R^2 of less than 30% measured overall HRQL or QOL. The low R^2 may be due to several factors including low sample size, heterogeneity of participants, inadequate theory underlying the regression models, issues related to the measurement of variables (Musil et al., 1998) or the influence of factors not accounted for by the study instruments. Wilson and Cleary note that distal constructs will exhibit greater heterogeneity due to the complexity of factors that influence the outcome.

Unique Contribution of Predictor Variables

The unique contribution of predictor variables was reported as an R^2 or a standardized beta coefficient. Table 2 contains the overall model R^2 and/or the R^2 contribution of the predictor variables, grouped according to the level of health outcome as reflected in the causal pathway.

Biological Factors as predictors

According to the WC model, biological factors have the greatest impact on symptom status and a diminishing relative impact on more distal variables along the causal pathway. A biological factor as a predictor of symptom status was not examined in any study. Eight studies reported the unique contribution of biological variables to the R^2 of outcomes distal to symptom status. In six, a minor proportion of the outcome, less than 5%, was accounted for by biological factors. In two studies, biological factors accounted for notably larger proportion of the outcome variable. Biological variables accounted for 13% of QOL in women with heart disease (Janz et al., 2001) and 29% of physical function in patients with AIDS (Wilson & Cleary, 1997). In both cases, the R^2 contributed by biological variables was relatively smaller than the R^2 contributed by more distal predictors.

Symptom Status as a predictor

Symptom status was a key predictor of health outcomes and accounted for upwards of 56% of the outcome of interest: 26% to 56% of functional status; and 20% and 36% of HRQL; and 1% and 26% of QOL. The influence of symptoms on physical function and HRQL were stable over time (Wilson & Cleary, 1997; Sousa & Williamson, 2003).

According to the model, there are multiple influences upon HRQL or QOL. Therefore, symptom status is likely to account for less of the total variance of HRQL or QOL than functional status or health perception. However, the contribution of symptom status to HRQL and QOL was larger than more distal variables. Heo et al. (2007) found that dyspnea , fatigue and anxiety were a key predictors of HRQL in heart failure. Symptoms related to GI bleeding accounted for a large proportion of physical HRQL and mental HRQL at baseline and one month later in a convenience sample of adults with GI bleeding (Sousa & Williamson, 2003).Twenty six percent of QOL in women with heart disease was accounted for by a patient-weighted scale of cardiovascular symptoms in combination with depressive symptoms (Janz et al., 2001). The full model

accounted for 47% of QOL. In persons with AIDS, an HIV symptom-specific checklist accounted for 24% of the variance of QOL, a large proportion relative to more distal variables (Sousa et al., 1999).

Three studies (Sousa & Williamson, 2003; Wilson & Cleary, 1997; Janz et al., 2001) tested the WC model in longitudinal studies and found that relationships between predictor and outcome variables were consistent with the model and stable over time. In women with heart disease, baseline general health perception (GHP) and improvement of GHP over time was significantly associated with maintaining or improving QOL at 12 months (Janz et al., 2001). An improvement in symptoms associated with GI bleeding explained 33% of the variance in physical and 42% of the variance in mental HRQL one month after presentation to the ER with GI bleeding. Finally, worsened fatigue and neurological symptoms and deterioration in biological factors (incident candida esophagitis and other comorbid conditions and a weight drop of 10 kg) explained 56% of physical function at 8 months in persons with AIDS in an outpatient setting.

In contrast to the above studies, symptom status accounted for less than 5% of the variance in QOL in culturally diverse AIDS patients (Portillo et al., 2005; Phaladze et al., 2005). In both studies, an HIV symptom checklist captured the frequency and intensity of 64 HIV-related signs and symptoms. An HIV-disease specific QOL tool measured functional status, health perceptions and life satisfaction. According to Phaladze, collinearity between measures of symptom status and functional status accounted for the limited explanatory power of symptom status. The overall model however, accounted for 53% of QOL. Portillo et al suggested that a culture-bound conceptualization of QOL and floor-effects of the HAT-QOL may have contributed to difficulties with the overall measurement model. This model accounted for 23% of the variance in QOL.

Functional Status as a Predictor

Functional status predicted health perception, HRQL and QOL in seven studies. Physical functioning predicted health perception in COPD and CHF (Arnold et al., 2005). The NYHA functional status classification, predicted physical HRQL but not emotional or total HRQL in older adults with heart failure (Heo et al., 2005). In a second study of HRQL in CHF using a similar measurement model, the NYHA classification was not retained in the final model of HRQL. The same authors found that self-reported daily functional status predicted HRQL in a group of healthy older adults (Heo et al., 2007). In most studies, symptom status accounted for a greater proportion of the outcome variable in comparison to functional status. The exception was Phaladze et al. (2005) in which functional status accounted for 31% of QOL in persons with advanced HIV in sub-Saharan Africa, over half of the total variance explained by the model overall.

General Health Perception as a predictor

General health perception is an integration or synthesis of all previous health concepts. The influence of general health perception on QOL was equivocal. General health perception accounted for 5% of the variance in QOL in advanced HIV (Phaladze et al., 2005). GHP accounted for 38% of the variance in QOL of older women with heart disease and the full model accounted for 46.8%. GHP was also a significant predictor of HRQL in individuals with heart failure (Heo et al., 2007; Heo et al., 2005). GHP was not a significant coefficient in two studies that modeled QOL in HIV (Sousa et al., 1999; Portillo et al., 2005).

Individual and Environmental Variables

Demographics accounted for a minor proportion of the outcome variable in most regression models. Aging however was associated with worse HRQL in hypertension (Erickson et al., 2004), heart failure (Heo et al., 2007; Heo et al., 2005; Arnold et al., 2005) and COPD

(Arnold et al., 2005). Concepts other than demographics demonstrated some linkages. Work status accounted for neck disability functional status (Luo et al., 2004). A psychometrically sound measure of social support accounted for 10% of the variance in QOL in women with heart disease. Poorer financial status was linked to worse QOL in persons with advanced HIV in ethnic minority persons in a multisite international study and in Sub-Saharan Africa (Phaladze et al., 2005; Portillo et al., 2005)

Structural Equation Modeling Studies

Wilson and Cleary (1995) acknowledge that causal associations may occur between nonadjacent constructs (indirect models) and that reciprocal relationships may occur. Several studies used structural equation modeling (SEM) to explore these possibilities (Hofer et al., 2005; Arnold et al., 2005; Baker et al., 2007; Sousa & Kwok, 2006; Sullivan et al., 2000; Orfila et al., 2006). Best fitting models were those that specified causal linkages between nonadjacent constructs (see Table 5). Two trends were the linkage between symptoms and health perception (Sullivan et al., 2000; Arnold et al., 2005; Baker et al., 2007; Sousa & Kwok, 2006) and between disease severity and functional status (Arnold et al., 2005; Baker et al., 2007; Sullivan et al., 2000). The association between general health perception and QOL may be reciprocal (Mathisen et al., 2005). A reciprocal effect within the Wilson and Cleary model suggests that overall QOL can influence as well as be an outcome of general health perception.

Discussion

Our results support the causal associations specified in the WC model. Each level of the causal pathway influenced the outcomes of interest. Biological factors accounted for a small proportion of variance of outcomes at all levels of the causal pathway. Symptom status was an important, if not key predictor in most regression models. Symptom status contributed to functional status, but in some models also accounted for a greater proportion of the variance in

HRQL and QOL than functional status. The definition of symptom status ranged from frequency counts, ratings of intensity as well as patient estimations of the extent that symptoms interfered with daily activities. In the latter conceptualization, symptom status and functional status are linked, and there may be some collinearity if both constructs are measured using disease specific tools. The R^2 of the final models was less than 30% in a small number of studies. Overall, the final R^2 for highly complex and integrative health outcomes was impressive. The SEM studies provided further confirmatory evidence of the validity of this conceptualization of HRQL, especially if indirect or mediated relationships between variables were specified. These results are notable given the broad array of chronic conditions, the diverse selection of measurement instruments and the post hoc analysis.

The WC conceptualization is a clinically relevant model of HRQL as it provides a basis to translate the multidimensional concept of HRQL into domains of assessment and intervention that clinicians can explore with patients. As a multidimensional concept, assessing only one domain of HRQL will provide a limited understanding of the client's experience of their health condition. Expanding the assessment to include symptoms and functional status will likely provide a more complete picture about outcomes important to patients living with chronic conditions.

There are limitations to this review. The systematic review of a conceptual model has received little scholarly attention. In light of the lack of clear methodologies we utilized an inductive approach to the development of both the search strategy and inclusion criteria. We made intensive efforts to locate published studies across 11 bibliographic indexes in consultation with academic librarians. Although non-English studies were excluded, these were a small proportion of the total number of citations. The validity and reliability of the inclusion criteria were assessed by a committee of three academic advisors. Participation of a second reviewer would have further grounded the validity of the inductive approach used in the review. We think

that our inclusion criteria is a reasonable set to test in the development of standardized criteria that will strengthen the validity of future reviews of conceptual models.

Conclusion

The Wilson and Cleary Model is a useful conceptualization of HRQL, a critically important outcome to persons living with chronic conditions. Although the body of empirical evidence is descriptive and cannot prove causal associations, there is evidence to support the use of the model to guide future research. Even at this preliminary level of evidence, the associations between symptom status, functional status and HRQL have important implications for clinical practice.

Reference List

Arnold, R., Ranchor, A. V., Koeter, G. H., de Jongste, M. J. L., & Sanderman, R. (2005). Consequences of chronic obstructive pulmonary disease and chronic heart failure: The relationship between objective and subjective health. *Social Science & Medicine, 61,* 2144-2154.

Baker, S. R., Pankhurst, C. L., & Robinson, P. G. (2007). Testing relationships between clinical and non-clinical variables in xerostomia: A structural equation model of oral health-related quality of life. *Quality of Life Research, 16,* 297-308.

Corless, I. B., Bakken, S., Nicholas, P. K., Holzemer, W. L., McGibbon, C. A., Inouye, J. et al. (2000). Predictors of perception of cognitive functioning in HIV/AIDS. *Journal of the Association of Nurses in AIDS Care, 11,* 19-26.

Cosby, C., Holzemer, W. L., Henry, S. B., & Portillo, C. J. (2000). Hematological complications and quality of life in hospitalized AIDS patients. *AIDS Patient Care and STDs, 14,* 269-279.

Erickson, S. R., Williams, B. C., & Gruppen, L. D. (2004). Relationship between symptoms and health-related quality of life in patients treated for hypertension. *Pharmacotherapy, 24,* 344-350.

Ferrans, C. E., Zerwic, J. J., Wilbur, J. E., & Larson, J. L. (2005). Conceptual model of health-related quality of life. *Journal of Nursing Scholarship.2005, 37,* 336-342.

Gill, T. M. & Feinstein, A. R. (1994). A critical appraisal of the quality of quality-of-life measurements. *JAMA, 272,* 619-626.

Haase, J. E. & Braden, C. J. (1998). Guidelines for achieving clarity of concepts related quality of life. In C.R.King & P.S. Hinds (Eds.), *Quality of Life* (pp. 54-73). Toronto: Jones and Bartlett Publishers.

Heo, S., Moser, D. K., Lennie, T. A., Zambroski, C. H., & Chung, M. L. (2007). A comparison of health-related quality of life between older adults with heart failure and healthy older adults. *Heart Lung, 36,* 16-24.

Heo, S., Moser, D. K., Riegel, B., Hall, L. A., & Christman, N. (2005). Testing a published model of health-related quality of life in heart failure. *Journal of Cardiac Failure, 11*, 372-379.

Higginson, I. J. & Carr, A. J. (2001). Measuring quality of life: Using quality of life measures in the clinical setting. *British Medical Journal, 322,* 1297-1300.

Hofer, S., Benzer, W., Alber, H., Ruttmann, E., Kopp, M., Schussler, G. et al. (2005). Determinants of health-related quality of life in coronary artery disease patients: A prospective study generating a structural equation model. *Psychosomatics, 46,* 212-223.

Janz, N. K., Clark, N. M., Dodge, J. A., Schork, M. A., Mosca, L., & Fingerlin, T. E. (1999). The impact of a disease-management program on the symptom experience of older women with heart disease. *Women & Health, 30,* 1-24.

Janz, N. K., Janevic, M. R., Dodge, J. A., Fingerlin, T. E., Schork, M. A., Mosca, L. J. et al. (2001). Factors influencing quality of life in older women with heart disease. *Medical Care, 39,* 588-598.

Krainovich-Miller, B. (1998). Literature Review. In G. LoBiondo-Wood & J. Haber (Eds.), Nursing Research (pp 93-132). St. Louis, Missouri: Mosby, Inc..

Luo, X. M., Edwards, C. L., Richardson, W. & Hey, L. (2004). Relationships of clinical, psychologic, and individual factors with the functional status of neck pain patients. *Value in Health, 7,* 61-69.

Mathisen, L., Andersen, M. H., Hol, P. K., Tennoe, B., Lund, C., Russell, D. et al. (2005). Preoperative cerebral ischemic lesions predict physical health status after on-pump coronary artery bypass surgery. *Journal of Thoracic and Cardiovascular Surgery, 130,* 1691-1697.

McDowell, I. (2006). *Measuring health*. New York: Oxford University Press.

Musil, C. M., Jones, S. L., & Warner, C. D. (1998). Structural equation modeling and its relationship to mulitple regression and factor analysis. *Research in Nursing & Health, 21,* 271-281.

Orfila, F., Ferrer, M., Lamarca, R., Tebe, C., Domingo-Salvany, A., & Alonso, J. (2006). Gender differences in health-related quality of life among the elderly: The role of objective functional capacity and chronic conditions. *Social Science & Medicine, 63,* 2367-2380.

Phaladze, N. A., Human, S., Dlamini, S. B., Hulela, E. B., Mahlubi Hadebe, I., Sukati, N. A. et al. (2005). Quality of life and the concept of "living well" with HIV/AIDS in sub-Saharan africa. *Journal of Nursing Scholarship, 37,* 120-126.

Portillo, C. J., Mendez, M. R., Holzemer, W. L., & Corless, I. B. (2005). Quality of life of ethnic minority persons living with HIV/AIDS. *The Journal of Multicultural Nursing & Health, 11,* 31-37.

Sevenhuysen, G. P. & Trumble-Waddell, J. (1997). A new perspective on quality of life. *Journal of Clinical Epidemiology, 50,* 231-232.

Sousa, K. H., Holzemer, W. L., Henry, S. B., & Slaughter, R. (1999). Dimensions of health-related quality of life in persons living with HIV disease. *Journal of Advanced Nursing, 29,* 178-187.

Sousa, K. H. & Kwok, O. M. (2006). Putting wilson and cleary to the test: Analysis of a HRQOL conceptual model using structural equation modeling. *Quality of Life Research, 15,* 725-737.

Sousa, K. H. & Williamson, A. (2003). Symptom status and health-related quality of life: clinical relevance. *Journal of Advanced Nursing, 42,* 571-577.

Sullivan, M. D., Kempen, G. I. J. M., Van Sonderen, E., & Ormel, J. (2000). Models of health-related quality of life in a population of community-dwelling Dutch elderly. *Quality of Life Research, 9,* 801-810.

Wilson, I. B. & Cleary, P. D. (1995). Linking clinical variables with health-related quality of life. A conceptual model of patient outcomes. *JAMA, 273,* 59-65.

Wilson, I. B. & Cleary, P. D. (1996). Clinical predictors of functioning in persons with acquired immunodeficiency syndrome. *Medical Care, 34,* 610-623.

Wilson, I. B. & Cleary, P. D. (1997). Clinical predictors of declines in physical functioning in persons with AIDS: results of a longitudinal study. *Journal of .Acquired Immune Deficiency Syndrome Human Retrovirology, 16,* 343-349.

Figure 2-1 Wilson and Cleary Model of HRQLFigure[1].

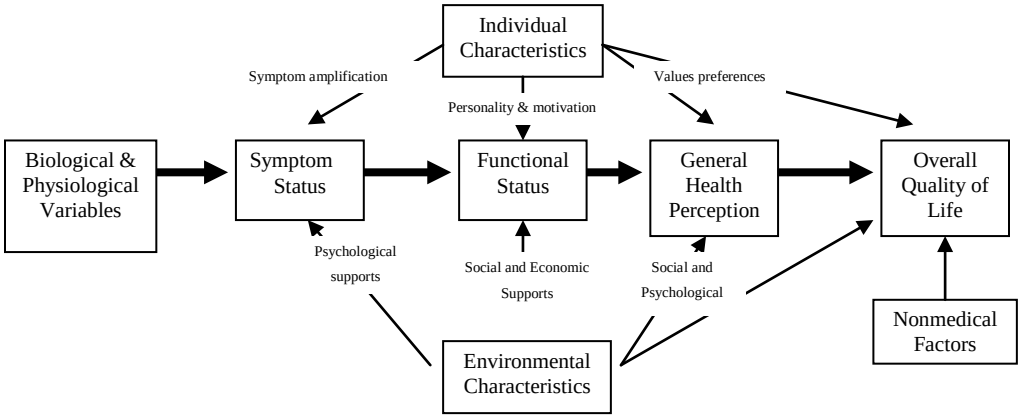

Figure 2-1 Conceptual model of the relationship between various health outcomes and overall quality of life. Arrows represent the causal relationships between the various levels of health outcome with an overall impact on quality of life. Individual and environmental factors may modulate health outcomes along the causal pathway.

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[1] From "Linking Clinical Variables with Health Related quality of life: A conceptual model of patient outcomes" by I.B. Wilson and P.D. Cleary, 1995, *JAMA, 273*, p. 60. Used with permission

Figure 2-2 Search Strategy

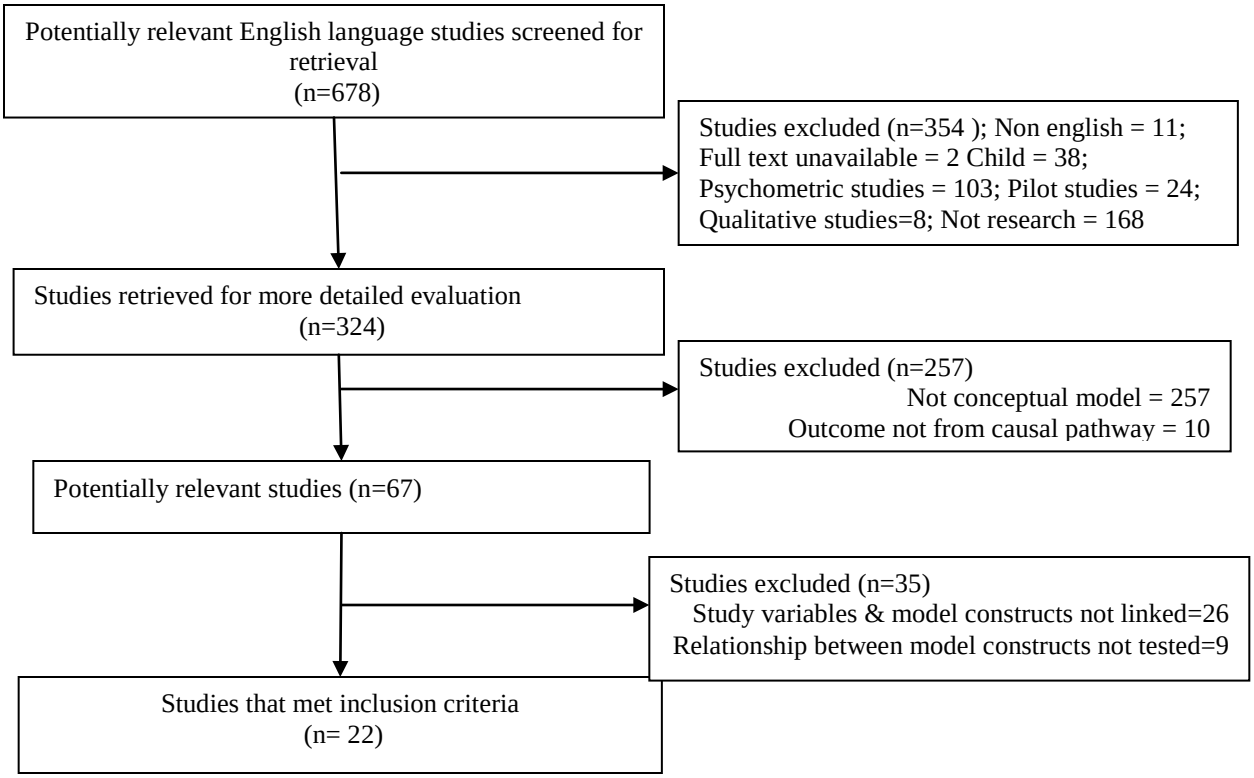

Table 2-1 Included Studies (n=22)

Study	*Design*	*n*	*Condition*	*Outcome*
Arnold et al. (2005)	Cross section	93 88	COPD CHF	GHP
Baker et al (2006)	Cross section	85	Chronic dry mouth	HRQL
Clingerman et al (2004)	Cross section	78	HIV/AIDS	HRQL
Corless et al (2000)	Cross section	728	HIV/AIDS	Functional Status
Cosby et al (2000)	Cross-section 2° Analysis	146	HIV/AIDS	Biological factor
Erickson et al (2004)	Cross section	125	Hypertension	HRQL
Heo et al. (2005)	Cross section 2°Anaysis	293	CHF	HRQL
Heo et al., (2007)	Cross section 2° Analysis	206	Heart Failure	HRQL
Höfer, et al. (2005)	Prospective	465	Coronary Artery Disease	HRQL
Janz, et al., (2001)	Prospective 2° Analysis	570	Coronary artery disease	QOL
Luo et al. (2004)	Cross section	537	Neck pain	Functional status
Mathisen, et al (2007)	Prospective 2° analysis	108	Heart Surgery	QOL
Orfila et al., (2007)	Cross section 2° Analysis	544	Elderly	HRQL
Phaladze et al., (2005)	Cross section	522	HIV/AIDS	QOL
Portillo et al (2005)	Cross section 2° Analysis	861	HIV/AIDS	QOL
Sousa, et al., (1999)	Cross section 2° Analysis	142	HIV/AIDS	QOL
Sousa & Williamson (2003)	Prospective	99	GI Bleeding	HRQL
Sousa & Kwok (2006)	Cross section 2°Analysis	917	HIV/AIDS	QOL
Sullivan et al (2000)	Cross-section	5279	Healthy aging	QOL

Study	*Design*	*n*	*Condition*	*Outcome*
Vidrine et al (2005)	Cross section	348	HIV/AIDS	QOL
Wilson & Cleary (1996)	Cross section	305	HIV/AIDS	Functional Status
Wilson & Cleary (1997)	Prospective	201	HIV/AIDS	Functional Status

Table 2-2 Summary of Unique R2 and Overall Model R2 (n=13)

Study	Predictors	R^2	Model R^2
	Functional Status (FS)		
Corless et al., 2000 Cross section	Individual Biological Symptom Status	<0.05 <0.05 0.27	0.36
Luo et al., 2004 Cross section	Individual Symptom status	0.12 0.36	0.60
	Individual Symptom Status	0.16 0.09	0.35
Wilson & Cleary, 1996 Cross section	Biological Symptom Status	0.29 0.56	0.56
Wilson & Cleary, 1997 prospective	Biological Symptom status	~ [a]	0.56
	General Health Perception (GHP)		
Arnold et al., 2005 Cross section	Individual Symptom status Physical functioning Psychological factor[b]	~	0.54
	Individual Physical functioning Psychological factor[b]	~	0.47
	HRQL		
Erickson et al., 2004 Cross section	Individual Biological Symptom Status	~	PCS/MCS 0.31 / 0.41
	Biological Symptom Status	~	PCS/MCS 0.22 / 0.40
Heo et al., 2005 Cross section	Individual (age) Symptom Status GHP	~	0.29
Heo et al., 2007 Cross section	Age Symptom Status Anxiety	0.07 0.36 <0.05	0.47
	Social Support Comorbidities Symptom Status Functional status GHP	<0.05 <0.05 0.36 0.11 <0.05	0.56
Sousa & Williamson, 2003 prospective	Symptom status at baseline at one month	 0.20 0.23	PCS 0.27 baseline 0.33 one month
	Symptom status baseline one month	 0.10 0.29	MCS 0.23 baseline 0.42 one month

Study	Predictors	R^2	Model R^2
	Quality of Life		
Janz et al., 2001 Cross section	psychosocial support Biological variables Symptom status Functional status GHP	0.10 0.13 0.26 0.19 0.38	0.47
Phaladze et al., 2005 Cross section	Environmental Individual Physiological Symptom status Functional status GHP	0.10 0.05 <0.05 <0.05 0.31 0.05	0.53
Portilla et al., 2005 Cross section	Environment Individual Physiological Symptom status Functional status GHP	0.16 <0.05 <0.05 <0.05 <0.05 <0.05	0.23
Sousa et al., 1999 Cross section	Biological Symptom status Functional status GHP	~ ~ ~ ~	0.21

Note. [a] ~ = R^2 not reported; [b] Psychological factor = perceived health competence; MCS= SF-12 Mental Component Score; PCS = SF-12 Physical Component Score

Table 2-3 Structural Equation Modeling Studies (n=8)

Study	Basic model	Indirect Model
Sullivan et al, 2000 Cross section	Poor fit	Good fit
Arnold et al, 2005 Cross section	-	Good fit
Hofer et al, 2005 prospective	Poor fit	Good fit
Vidrine et al , 2005 Cross section	Good fit	-
Baker et al, 2006 Cross section	Poor fit	Good fit
Sousa & Kwok, 2006 Cross section	Good fit	Improved fit
Mathisen et al, 2007 prospective	Reciprocal	-
Orfila et al, 2007 Cross section	-	Good fit

Note: Basic model refers to causal associations between adjacent constructs of the causal pathway. Indirect model refers to causal associations between non-adjacent constructs. A single dash in a table cell indicates that the basic or indirect model was not tested.
Good fit indicates no difference between predicted and actual fit of data based on any of the following statistical tests RMSEA <0.5 <0.8; SRMR <0.5; CFI >0.9

Chapter 3

Review of the impact of leg ulceration on health related quality of life

Prepared for submission to JWOCN

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Abstract

Clinicians widely believe that venous leg ulcer signs and symptoms negatively affect HRQL. A recommendation in a recent clinical practice guideline is that nurses assess their clients' quality of life. The relationship between routinely measured clinical indicators of ulcer severity or pain and HRQL is unclear. According to the Wilson and Cleary model of health outcomes (WC model), routinely measured clinical factors, functional status and health perception influence HRQL. We undertook a focused review (11 studies in final set) of leg ulcer studies that compared HRQL scores to population normative scores. A limited number of studies examined the relationship between HRQL and ulcer size, duration, pain, age or gender. The HRQL of persons with leg ulcers was poor and the greatest negative impact was on physical function, physical role function, followed by social function and bodily pain. Ulcers larger than 10 cm^2 may negatively influence HRQL. In comparison to age adjusted normative scores there is limited evidence that ulceration has a greater negative impact on those younger than 65.

Introduction

A common saying amongst wound care practitioners is "*treat the whole person, not the hole in the person*". This play on words is a reminder of the limitations of disease-focused assessment to capture the concerns clients living day-to-day with a chronic wound, including venous leg ulcers. Individuals may be confronted with excessive malodorous wound drainage that saturates bandages and leaves visible marks on shoes, bed sheets, floors and rugs. Although excessive drainage may alert the clinician to infection, to the individual, the drainage may induce deep feelings of embarrassment and cause them to avoid social contact. Lower limb swelling, a common sign, may affect choice of clothing, footwear, contribute to pain and limit physical activity. Painful burning itching is often associated with stasis dermatitis and if scratched, can worsen skin breakdown. Finally, pain (Nemeth et al., 2003b; Nemeth et al., 2003a) profoundly affects many aspects of daily life including mobility, work and psychosocial function (Krasner, 1998; Charles, 1995).

Clinicians widely believe that the burden of symptoms and indolent and recurrent ulcers negatively influences quality of life (Franks & Moffatt, 2006; Lindholm, 1996; Bland, 1996; Chase et al., 1997). In recognition of the negative impact of ulceration on daily life there is wide agreement that nursing assessment should explore quality of life issues and symptom management (Briggs & Flemming, 2007; Bland, 1996; Moffatt & Harper, 1997). A recent review (Van Hecke et al., 2008) identified a Canadian nursing best practice guideline (RNAO, 2007) as one of two international guidelines that recommends the integration of QOL assessment into clinical bedside practice. Health related quality of life (HRQL) is a widely accepted concept that captures the relationship between health and QOL and focuses on the specific ways that illness, health and healthcare interventions influence quality of life (Harrison et al., 1996). HRQL is defined as those aspects of quality of life that relate specifically to a person's health (Wilson & Cleary, 1995). The parameters that constitute an adequate clinical assessment of HRQL are less

clear. We compare the findings of studies that have measured HRQL during periods of active ulceration in order to 1) explore what is believed by clinicians, that HRQL is impaired during ulceration and 2) to identify patterns of impairment, if any exist, that might inform clinical practice. In addition we explore a smaller number of studies that estimate the relationship between routinely measured clinical indicators and HRQL.

Background

The most severe manifestation of chronic venous insufficiency (CVI) is venous ulceration (Carpentier et al., 2003; Kistner & Eklof, 2001). Generally ulcers that are larger and older are considered more severe (Franks & Moffatt, 2006) and have a poorer prognosis at six months (Margolis et al., 1999). Clinically, lower limb swelling and excessive wound drainage frequently co-occur and are associated with pain, impaired mobility and an enlarging ulcer. This nexus of signs and symptoms has been described in several qualitative accounts and conveys a picture of the pervasive impairment of quality of life (Walshe, 1995). Clinically a reduction in swelling and drainage are early signs of an improving clinical picture even in the absence of a measureable difference in wound size, and may contribute to an improvement in quality of life (Charles, 2002).

Individuals identify pain as one of the worst aspects of leg ulceration (Hofman et al., 1997). Locally, we have found that pain was reported by 48 to 54% of individuals upon initial assessment (Nemeth et al., 2003b). The natural history of pain during venous ulceration has had limited study (Briggs et al., 2007) and is not well understood (Nemeth et al., 2003b; Charles, 2002). Neuropathic and/or nociceptive mechanisms underlie ulcer pain (Briggs et al., 2007). Pain is caused by infection, lower limb swelling (Cooper et al., 2003) and may be worsened or relieved with compression bandaging (Ebbeskog & Ekman, 2001; Wissing et al., 2002). After a period of self care, pain is often the symptom that causes an individual to seek care (Husband, 2001). Unfortunately, pain may be undertreated (Briggs & Flemming, 2007; Persoon et al., 2004). Pain

is not always associated with ulcers. The relationship between pain and ulcer severity is unclear (Iglesias et al., 2005). Ulcer severity is frequently defined by size and duration, however small ulcers may be associated with severe pain (Franks, 1999). There is qualitative evidence that pain may amplify the negative impact of ulceration on day-to-day life and contribute to social isolation, at least in the elderly (Ebbeskog & Ekman, 2001). The impact of pain on day-to-day life in younger individuals has had limited study, however, pain may interfere with work and influence the decision to retire (Phillips et al., 1994). Ulceration may also have a significantly greater negative psychological impact on younger persons, including depression, anxiety and anger (Phillips et al., 1994).

Routinely measured clinical factors such as swelling and ulcer size may also influence HRQL (Pieper et al., 2000). Mobility was an important aspect of QOL identified by 62 patients with leg ulcers and the impairment of mobility was associated with swelling (Phillips et al., 1994). Neither ulcer size nor duration, both accepted proxies of ulcer severity, affected mobility. In a second small cross sectional study (n=32) large wound area (β=-.352, $p<.05$ one tail) and pain interference (β=-.570, $p<.05$) negatively affected disease-specific QOL (Pieper et al., 2000). Drawing firm conclusions is not possible as both studies are methodologically limited due to non standardized instrumentation, cross sectional design and limited sample size. However making use of routinely measured clinical indicators such as swelling and ulcer size to further evaluate the influence on QOL or dimensions of HRQL is warranted.

Wilson & Cleary model of Health-Related Quality of Life

A useful and comprehensive model to guide an inquiry into the relationship between clinical factors and HRQL is the Wilson and Cleary model (Wilson & Cleary, 1995). The model has been used as a guiding framework in research with populations with chronic conditions (Buchanan, Harrison, Hopman & Vandenkerkhof, 2009). To date it has had limited use in a chronic wound population but appears promising (Ribu et al., 2008). A premise of the model is

that health outcomes are causally linked such that disease severity influences symptom status, symptom status influences functional status, functional status influences general health perceptions, and general health perceptions influences QOL. This complexity is likely holds true with chronic wounds. Importantly, non medical factors are viewed as influencing overall quality of life and are outside the influence of healthcare providers. The model is the guiding framework for this enquiry regarding the impact of leg ulceration on HRQL

Objective

The objective of this review was to examine the HRQL for persons with leg ulceration and explore the effect, if any, of commonly measured clinical factors on HRQL. We reviewed studies that compared baseline HRQL scores with population normative scores or examined the strength of relationship between routinely measured clinical factors and HRQL.

Review Method

We sought published studies that met the following criteria: 1) English language quantitative studies, 2) use of psychometrically sound generic instruments to measure HRQL and 3) inclusion of baseline data regarding sociodemographic and clinical factors of persons with active ulceration. A multi-step process was undertaken to search and retrieve relevant studies. A key word search using the search terms “leg ulcer” and “quality of life” was conducted in the CINAHL bibliographic database. First, titles and abstracts were screened and eligible abstracts were downloaded into Reference Manager Version 11 software. Full copies of each citation were obtained either electronically or in hard copy. Each article was scanned to determine that the inclusion criteria had been met.

Population normative scores of generic instruments provide a context to gauge the effect of health conditions on HRQL at an aggregate or group level. In order to assess the impact of ulceration on HRQL, we estimated difference scores between mean scores and population

normative scores. We calculated the difference score by subtracting the norm-based score from the mean study score for each domain or summary score. The difference scores were compiled into synthesis tables for comparative analysis with a view to identifying patterns of impairment with dimensions of HRQL if any existed. Effect sizes or other estimates of the relationship between clinical factors and HRQL were also examined, if available.

Results

Eleven research reports met the inclusion criteria and constituted the final set of papers. Two reports (Franks & Moffatt, 2006; Franks & Moffatt, 1998b) were generated from one study for a total of 10 unique studies. Characteristics of the studies are summarized in Table 1. Five studies utilized a cross sectional design (Price & Harding, 1996; Franks & Moffatt, 1998b; Franks & Moffatt, 2006; Jull et al., 2004; Lindholm, 1996) and six were prospective studies including a randomized control trial (RCT) (Franks et al., 1999), one secondary analysis of RCT data (Iglesias et al., 2005), one before and after design (Harrison et al., 2005) and three prospective descriptive studies (Franks & Moffatt, 2001; Franks et al., 2003; Walters et al., 1999). We focused on the baseline measurements of HRQL and clinical factors.

Studies were conducted in 4 countries; Canada, Sweden, Australia and the UK. All but one study (n=55) had sample sizes greater than 100 (Price & Harding, 1996). Participants were recruited from community-based settings such as home care in Ontario (Harrison et al., 2005), community trusts in the UK (Franks & Moffatt, 1998b; Iglesias et al., 2005), primary care settings in Australia (Jull et al., 2004) and vascular or dermatology specialist clinics (Lindholm, 1996; Franks et al., 1999; Price & Harding, 1996). In five studies (Franks et al., 1999; Franks & Moffatt, 2001; Harrison et al., 2005; Iglesias et al., 2005; Walters et al., 1999) leg ulceration was due to venous disease, and in the remaining studies leg ulceration was due to various aetiologies, including but not limited to venous disease. Women constituted the larger proportion of participants in comparison to men (range 59% to 74%) which is consistent with prevalence

studies (Graham et al., 2003). The median or mean age was typically over 70 years. The minimum age, where reported, ranged from 23 to 46 years. The predominance of the older adult group is consistent with the relatively higher prevalence of leg ulceration amongst older adults (Harrison et al., 2005).

Instruments

All studies used one of three generic HRQL instruments, the Medical Outcome Study 36-Item Short Form Health Survey (SF-36) (4 studies), the 12-Item Short Form Health Survey (SF-12) (2 studies) and the Nottingham Health Profile (NHP) (5 studies) (see Table 1). The instruments are based on a multidimensional definition of HRQL. The SF-36 has eight domains and the NHP six. Between the two instruments, there are similar domains including bodily pain, physical function or physical mobility, social function, emotional function and vitality or energy. The domains of both generic instruments are displayed in Table 2. The SF-36 yields eight domain scores ranging from 0 (worst) to 100 (best) and two summary scores the Physical Component Summary (PCS) and the Mental Component Summary (MCS), which are standardized to a mean of approximately 50, with scores below and above 50 representing poorer than average and better than average scores respectively. The NHP yields six domain scores ranging from 0 (best) to 100 (worst) (McDowell, 2006). The SF-12 is derived from the SF-36. The SF-12 is reported as two summary scores, the PCS and the MCS. Version 2 of the SF-12 may also be reported as eight domain scores (McDowell, 2006).

No study estimated the relationship between venous ulcer-related symptoms, such as pain, and HRQL scores. Eight studies compared mean HRQL scores to normative scores. Normative scores were derived from a number of different sources. Adult population norms were derived from Canadian and American population normative data. Adjusted normative scores for age and sex (Franks & Moffatt, 1998b) and age, sex and social class (Franks et al., 1999) were used in two studies. Three studies also used UK and US norm-based scores for 70 to 74 year olds

(Price & Harding, 1996) and those 75 years and older (Iglesias et al., 2005; Harrison et al., 2005). Finally, Jull (2004) adjusted for age, sex and confounding comorbidities by compiling control scores derived from an age-stratified randomly selected population sample.

Ulceration had a negative impact in seven of eight domains of HRQL in three studies (Franks et al., 2003; Jull et al., 2004; Price & Harding, 1996) as measured by the SF-36. Table 3 displays difference scores for the eight domains of SF-36. The largest difference score was -26 to -30 points in physical functioning and -21.5 to -32 points in physical role limitations. Listed in descending order of the size of difference scores, was emotional role limitations at -16 to -28, social functioning at -14 to -22, then bodily pain at -12 to -16 points. The difference score in mental health was small.

Table 4 displays the difference scores for the PCS and MCS scores (Harrison et al., 2005; Jull et al., 2004; Iglesias et al., 2005). The PCS score ranged from 31.6 to 35.9, signifying a much poorer physical HRQL in comparison to the US population norm. The MCS score ranged from 47.9 to 54.2 and was similar to the US population normative score of 50.

Table 5 displays the difference scores for the six domains of the NHP in two studies (Franks et al., 1999; Franks & Moffatt, 1998b). For the NHP, higher scores represent poorer QOL, therefore positive difference scores indicate a poor sample score compared to the population normative score. Bodily pain and physical mobility were negatively affected by ulceration with difference scores ranging from 22 to 25 points and 17 to 33 points respectively. The difference scores for the remaining four domains of energy, emotional reactions, sleep and social isolation did not show similar patterns of deviation when the two studies were compared. One of the two studies was a large community-based sample of individuals with ulcers due to different etiologies including venous disease (n=758) (Franks & Moffatt, 1998b). In this study, all domain scores were significantly poorer compared to age/gender matched norms. In the second specialist clinic study (n = 200) there was no statistically significant difference between sample scores and age/sex/class adjusted norms except in the domains of bodily pain and physical

mobility (see Table 5). In addition the difference score for social isolation suggested that the venous ulcer group experienced less social isolation in comparison to the general adult population.

Age, Gender and HRQL

Older adults and women tend to have poorer mean raw scores in comparison to younger men. Five studies used four distinct approaches to adjust for age and gender in the estimate of the impact of leg ulceration on HRQL. Franks (1998b) calculated a difference score for each raw score relative to the respective age/sex norm score, and found that men younger than 65 scored more poorly in the domains of energy, bodily pain, sleep and social isolation but there were no differences in emotional reactions and mobility based on gender. After adjusting for age, those younger than 65 reported significantly worse energy, bodily pain, emotional reactions, sleep, social function and mobility compared to those 65 years and older. The only exception was the mean mobility difference score which was similar between the younger adult group and the oldest old group of 85 years and older (Franks, 1999).

Lindholm (1996) adjusted for age and gender by reporting scores as percentages of the expected age and sex norm score in a sample of 51 men and 74 women. A score of 100% indicated that the raw score was equivalent to the age/sex adjusted norm score. If over 100%, then the individual had a “worse HRQL”. Using this method of analysis, Lindholm found that men had worse scores in all domains of HRQL. The separate impact of age was not reported. Price and Harding (1996) reported better physical function ($p=.066$), vitality ($p=.028$) and social functioning ($p = .017$) in men, however this was based on a test of difference between raw scores. Iglesias (2005) and Harrison (2005) compared the SF-12 PCS and MCS mean scores to the normative score for those 75 years and older. Iglesias found that the negative impact of ulceration virtually disappeared. In contrast, Harrison found a difference score of 9.3 between the mean PCS

of the leg ulcer group as compared to the normative score of those between 75 to 80 years. No statistical test of significance was carried out.

Mobility and HRQL

Impaired mobility was associated with a pervasive negative impact upon HRQL. Three studies (Walters et al., 1999; Iglesias et al., 2005; Franks & Moffatt, 2001) compared those who were fully mobile and those with mobility limitations. The specific definitions of mobility are displayed in Table 6. Impaired mobility was associated with a small to moderate negative effect on bodily pain, sleep and social isolation as measured by NHP (Franks & Moffatt, 2001). Using the SF-36, impaired mobility was associated with a worse physical function, physical role limitations, vitality and social function (Walters et al., 1999). As measured by the SF-12 impaired mobility was associated with poorer general health perception, physical function and greater emotional role limitations due to emotional function (Iglesias et al., 2005). It is unclear if impaired mobility was related to other clinical or sociodemographic parameters such as ulcer severity, pain, comorbid conditions, age or gender.

Relationship between ulcer size and duration and HRQL

Four studies examined the impact of ulcer size and duration on HRQL (Iglesias et al., 2005; Walters et al., 1999; Franks & Moffatt, 2006; Franks & Moffatt, 2001). The median score differentiated large from small ulcers and old ulcers from recent ulcers in three of four studies (see Table 6). One study defined a large ulcer as greater than 10 cm^2 based on an estimation of the wound to a circle of 10 cm^2 diameter (Franks & Moffatt, 2001). Ulcer size had a limited impact on HRQL. There were no significant differences in the SF-12 PCS or MCS associated with ulcers 4 cm^2 or smaller compared to larger ulcers (Iglesias et al., 2005). A better mental health score (ES = -0.31, p =0.02) was associated with ulcers larger than 5.61 cm^2 (Walters et al., 1999). Franks et al (Franks & Moffatt, 2001) found less energy, more bodily pain, more negative

emotional reaction, greater social isolation and poorer physical mobility associated with ulcers larger than 10 cm^2.

The influence of ulcer duration on HRQL was equivocal (Franks & Moffatt, 2001; Iglesias et al., 2005; Walters et al., 1999). There were no significant differences in SF-12 domain scores associated with ulcers less than three months duration compared to older ulcers (Iglesias et al., 2005). Ulcers older than 7 months were associated with greater social isolation (ES = .27, p=.013) (Franks & Moffatt, 2006) and impairment of physical mobility (ES=.41, p=.001) as measured by NHP (Franks et al., 1999). In contrast Walters found that those with ulcers older than 7 months reported better general health perception (ES=-0.33, p=.01) and mental health (ES=-0.30, p=0.02) as measured by SF 36. A specialist clinic study (Price & Harding, 1996) examined the impact of mixed etiology ulcers older than 2 years and paradoxically found less bodily pain and better health perception associated with ulcers of longer duration.

Discussion

There is emerging evidence that leg ulceration is associated with poorer HRQL as compared to overall adult population norms. This analysis of 10 studies where valid and reliable HRQL measures were used suggests a pattern of impairment across HRQL domains. Physical function or mobility appears to be most adversely affected, followed by challenges to other aspects of functioning including social functioning and physical and emotional limitations on role performance. Younger adults and those 85 years and older exhibit the greatest deviation from age adjusted normative scores.

Based on the WC conceptualization we anticipated an association between ulcer severity and HRQL scores. The best way to aggregate biological variables is unclear (Sousa et al., 1999), and there is no accepted definition of ulcer severity (Franks, 1999). In these studies, ulcer severity was defined by size and duration based on the median score. Ulcers larger than 10 cm^2 were associated with a poorer HRQL. It may be that ulcer size must reach a threshold before there is a

measureable negative impact on HRQL. According to the model, symptoms such as pain, may mediate this negative impact; however, the relationship between ulcer severity, symptoms and HRQL was not tested. The impact of ulcer duration was equivocal and contradictory. Ulcers older than 7 months either had no impact as measured by the SF-36 (Walters et al., 1999) or were associated with a small to moderate effect on mobility and social isolation as measured by the NHP (Franks & Moffatt, 2001). Ulcers older than 2 years appeared to be associated with less pain and improved health perceptions despite clinical experience that suggests older ulcers may be more severe. Improved health and less pain may be explained by psychosocial adaptation (Price & Harding, 1996), however, this theory has not been tested.

Limitations

The review focused on baseline measures in order to describe the impact of ulceration on HRQL. HRQL was defined as a multidimensional concept (Price & Harding, 1996) and measured using validated and reliable instrumentation. Generic HRQL instruments allow for contrast and evaluation relative to population norms and to findings from other studies. Although there are disease-specific instruments (Walters et al., 1999), we were interested in the comparison to normative scores. The analytic approach was premised on describing any differences between normative and sample mean scores as a valid basis to infer impairment due to ulceration. Sample heterogeneity prevented aggregating difference scores across studies and calculating an effect size. However, the differences between sample HRQL domain means and normative scores were statistically significant in the original studies. The magnitude of difference scores in several domains was quite large and clinically important. The search strategy was limited to a single bibliographic index, and we may not have located all relevant studies.

Research Implications

The WC model is a useful framework to guide inquiry into the relationship between quality of life and clinically relevant factors. Future research should use a clinically defined and statistically robust definition of ulcer severity and symptom status in a clinically validated venous ulcer population. Margolis et al. (2000) proposed a prognostic score based on the relationship of ulcer size and duration and rates of healing after six months of compression therapy. The assessment of the ulcer size and duration are widely accepted ulcer assessment parameters in best practice guidelines (Van Hecke et al., 2008). Pain is believed to be a centrally important symptom to patients with leg ulcers (Hofman et al., 1997; Briggs & Flemming, 2007; Persoon et al., 2004) and pain interference in age normative role performance may contribute to the greater deviation of HRQL scores from age corrected norms for younger adults. Nemeth et al (2003a) recommended that the measurement of pain intensity or quality constitutes a minimum acceptable clinical assessment practice. The pain VAS or the McGill pain questionnaires are likely robust measures of pain associated with venous leg ulcers. Although function is not routinely assessed in clinical practice, a robust measure of functional status would strengthen evaluation of the WC model as a guiding framework in venous ulceration.

Clinical Practice Implications

The disease burden of leg ulcers appears to adversely affect most domains of HRQL, particularly physical function (SF-12 or 36) or mobility (NHP) and bodily pain. A nine-point difference in physical functioning is considered clinically meaningful (Stewart et al., 1988). In our study we found a range of 26 to 30 point difference. This difference means impairment in daily activities such as ability to bend or kneel, carry groceries, climb stairs or to bathe or dress. The assessment of functional status is an area of practice that has not received much attention, and according to the WC model, a minimum of four areas should be assessed. In clinical practice, an open-ended question about the impact of the ulcer on daily activities may yield valuable client-

centered perspectives on HRQL. This information may be useful in goal setting and negotiating compression and other treatment options that will optimize and not further impair physical function.

Conclusion

Leg ulceration has the greatest impact on physical aspects of HRQL, particularly physical function and other aspects of functional status. There is limited evidence that ulcer severity may influence HRQL. Several studies controlled for the effect of aging on HRQL, and there is preliminary evidence that HRQL of those 65 years and younger is more impaired relative to the older group. The WC model is a useful framework to further understanding our how clinical and individual/environmental factors may affect quality of life with chronic wound populations.

Key Points

- Use of a conceptual model of HRQL is useful to guide clinical practice and future research.
- Venous leg ulceration has a pervasive negative impact on HRQL.
- Key indicators of HRQL include self-perceived physical function, role function, social function and bodily pain and are a starting point for the clinical assessment of the impact of ulceration on an individual's HRQL.
- There is preliminary evidence that ulcers larger than $10cm^2$ may be have a greater negative impact on HRQL.
- The HRQL of younger individuals may be more adversely affected by an episode of ulceration in comparison to that of the older individuals

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Reference List

Bland, M. (1996). Coping with leg ulcers. *Nursing New Zealand, 2,* 13-14.

Briggs, M., Bennett, M. I., Closs, S. J., & Cocks, K. (2007). Painful leg ulceration: a prospective, longitudinal cohort study. *Wound Repair and Regeneration, 15,* 186-191.

Briggs, M. & Flemming, K. (2007). Living with leg ulceration: a synthesis of qualitative research. *Journa lof Advanced Nursing, 59,* 319-328.

Carpentier, P. H., Cornu-Thenard, A., Uhl, J., Partsch, H., & Antignani, P. L. (2003). Appraisal of the information content of the C classes of CEAP clinical classification of chronic venous disorders: A multicenter evaluation of 872 patients. *Journal of Vascular Surgery, 37,* 827-833.

Charles, H. (1995). The impact of leg ulcers on patients' quality of life. *Professional Nurse, 10,* 574.

Charles, H. (2002). Venous leg ulcer pain and its characteristics. *Journal of Tissue Viability, 12,* 154-158.

Chase, S. K., Melloni, M., & Savage, A. (1997). A forever healing: The lived experience of venous ulcer disease. *Journal of Vascular Nursing, 15,* 73-78.

Cooper, S. M., Hofman, D., & Burge, S. M. (2003). Leg ulcers and pain: A review. *The International Journal of Lower Extremity Wounds, 2,* 189-197.

Ebbeskog, B. & Ekman, S. L. (2001). Elderly persons' experiences of living with venous leg ulcer: living in dialectical relationship between freedom and imprisonment. *Scandinavian Journal of Caring Science, 15,* 243.

Franks, P. J. (1999). Quality of life for leg ulcer patients. In C.V.Ruckley, A. Bradbury, & F. G. R. Fowkes (Eds.), *Venous Disease: Epidemiology, Management and Delivery of Care* (pp. 254-261). London: Springer-Verlag London Ltd.

Franks, P. J., Bosanquet, N., Brown, D., Straub, J., Harper, D. R., & Ruckley, C. V. (1999). Perceived health in a randomised trial of treatment for chronic venous ulceration. *European Journal of Vascular and Endovascular Surgery, 17,* 159.

Franks, P. J., McCullagh, L., & Moffatt, C. J. (2003). Assessing quality of life in patients with chronic leg ulceration using the Medical Outcomes Short Form-36 Questionnaire. *Ostomy/Wound Management, 49,* 26-37.

Franks, P. J. & Moffatt, C. J. (1998a). Quality of life issues in patients with chronic wounds. *Wounds, 10,* 1E-9E.

Franks, P. J. & Moffatt, C. J. (1998b). Who suffers most from leg ulceration? *Journal of Wound Care, 7,* 383-385.

Franks, P. J. & Moffatt, C. J. (2001). Health related quality of life in patients with venous ulceration: use of the Nottingham health profile. *Quality of Life Research, 10,* 693-700.

Franks, P. J. & Moffatt, C. J. (2006). Do clinical and social factors predict quality of life in leg ulceration? *The International Journal of Lower Extremity Wounds, 5,* 236-243.

Graham, I. D., Harrison, M. B., Nelson, E. A., Lorimer, K., & Fisher, A. (2003). Prevalence of lower-limb ulceration: a systematic review of prevalence studies. *Advances in Skin & Wound Care, 16,* 305-316.

Harrison, M. B., Graham, I. D., Lorimer, K., Friedberg, E., Pierscianowski, T., & Brandys, T. (2005). Leg-ulce care in the community, before and after implementation of an evidence-based service. *Canadian Medical Association Journal, 172,* 1447-1452.

Harrison, M. B., Juniper, E. F., & Mitchell-DiCenso, A. (1996). Quality of life as an outcome measure in nursing research. "May you have a long and healthy life". *Canadian Journal of Nuring Research, 28,* 49-68.

Hofman, D., Ryan, T. J., Arnold, P., Cherry, G. W., Lindholm, C., & Bjellerup, M. (1997). Pain in venous leg ulcers. *Journal of Wound Care, 6,* 222-224.

Husband, L. L. (2001). Venous ulceration: The pattern of pain and the paradox. *Clinical Effectiveness in Nursing, 5,* 35-40.

Iglesias, C. P., Birks, Y., Nelson, E. A., Scanlon, E., & Cullum, N. A. (2005). Quality of life of people with venous leg ulcers: A comparison of the discriminative and responsive characteristics of two generic and a disease specific instrument. *Quality of Life Research, 14,* 1705-1718.

Jull, A., Walker, N., Hackett, M., Jones, M., Rodgers, A., Birchall, N. et al. (2004). Leg ulceration and perceived health: a population based case-control study. *Age and Ageing, 33,* 236-241.

Kistner, R. L. & Eklof, B. (2001). Classification and diagnostic evaluation of chronic venous disease. In P.Glovickzki & J. S. T. Yao (Eds.), *Handbook of Venous Disorders* (2nd ed., pp. 94-103). London: Arnold.

Krasner, D. (1998). Painful venous ulcers: Themes and stories about living with the pain and suffering. *Journal of Wound Ostomy and Continence Nursing, 25,* 158-168.

Lindholm, C. (1996). The Nottingham Health Profile. *Journal of Wound Care, 5,* 143-144.

Margolis, D. J., Berlin, J. A., & Strom, B. L. (1999). Risk factors associated with the failure of a venous leg ulcer to heal. *Archives of Dermatology, 135,* 920-926.

Margolis, D. J., Berlin, J. A., & Strom, B. L. (2000). Which venous leg ulcers will heal with limb compression bandages? *American Journal of Medicine, 109,* 15-19.

McDowell, I. (2006). *Measuring health*. New York: Oxford University Press.

Moffatt, C. J. & Harper, P. (1997). *Leg Ulcers*. New York: Churchill Livingstone.

Nemeth, K. A., Graham, I. D., & Harrison, M. B. (2003a). The measurement of leg ulcer pain: Identification and appraisal of pain assessment tools. *Advances in Skin & Wound Care, 16,* 260-267.

Nemeth, K. A., Harrison, M. B., Graham, I. D., & Burke, S. (2003b). Pain in pure and mixed aetiology venous leg ulcers: a three-phase point prevalence study. *Journal of Wound Care, 12,* 336-340.

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

Phillips, T., Stanton, B., Provan, A., & Lew, R. (1994). A study of the impact of leg ulcers on quality of life: Financial, social and psychologic implications. *Journal of the American Academy of Dermatology, 31,* 49-53.

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,* 227-239.

Price, P. & Harding, K. (1996). Measuring Health-related quality of life in patients with chronic leg ulcers. *Wounds, 8,* 91-94.

Ribu, L., Hanestad, B. R., Mourn, T., Birkeland, K., & Rustoen, T. (2008). Health-related quality of life among patients with diabetes and foot ulcers: association with demographic and clinical characteristics. *Journal of Diabetes and its Complications, 21,* 227-236.

RNAO (2007). Assessment and management of venous leg ulcers. RNAO Nursing Best Practices Guidelines Program [On-line].

Sousa, K. H., Holzemer, W. L., Henry, S. B., & Slaughter, R. (1999). Dimensions of health-related quality of life in persons living with HIV disease. *Journal of Advanced Nursing, 29,* 178-187.

Stewart, A. L., Greenfield, S., Hays, R. D., Wells, K., Rogers, W. H., Berry, S. D. et al. (1988). Functional status and well-being of patients with chronic conditions. *JAMA, 262,* 907-913.

Van Hecke, A., Grypdonck, M., & Defloor, T. (2008). Guidelines fo rthe management of venous leg ulcers: a gap analysis. *Journal of Evaluation in Clinical Practice, 14,* 812-822.

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

Walters, S. J., Morrell, C. J., & Dixon, S. (1999). Measuring health-related quality of life in patients with venous leg ulcers. *Quality of Life Research, 8,* 327-336.

Wilson, I. B. & Cleary, P. D. (1995). Linking clinical variables with health-related quality of life. A conceptual model of patient outcomes. *JAMA, 273,* 59-65.

Wissing, U., Ek, A. C., & Unosson, M. (2002). Life situation and function in elderly people with and without leg ulcers. *Scandinavian Journal of Caring Science, 16,* 59-65.

Figure 3-1 Wilson and Cleary Model of HRQL[1].

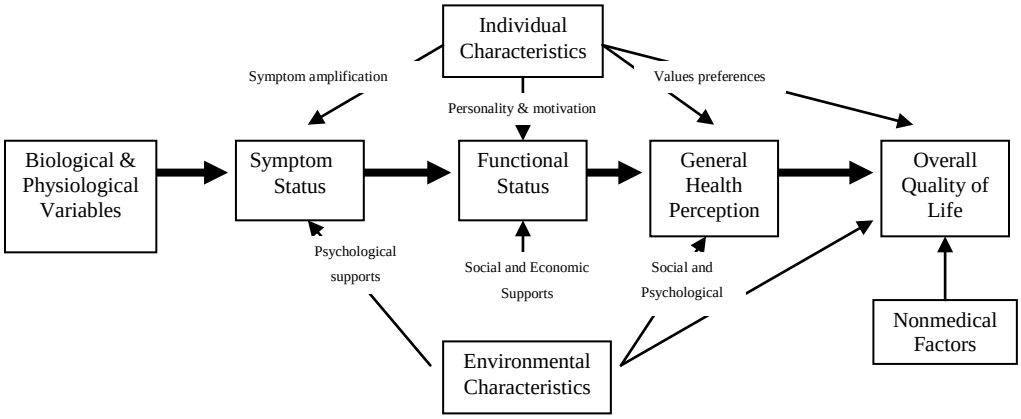

Figure 3-1 Conceptual model of the relationship between various health outcomes and overall Quality of Life. Arrows represent the causal relationships between the various levels of health outcome culminating on an overall impact on quality of life. Individual and environmental factors may modulate health outcomes along the causal pathway.

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[1] From "Linking Clinical Variables with Health Related quality of life: A conceptual model of patient outcomes" by I.B. Wilson and P.D. Cleary, 1995, *JAMA, 273,* p. 60. Used with permission.

Table 3-1 Summary of studies, (n=11)

Study	Design Setting N	Sample characteristics	Clinical characteristics	HRQL Instrument & Relationships tested
(Franks & Moffatt, 1998b)	758 UK community Audit Cross section	74.6y mean age Women 64%	Different etiologies	NHP Population age/ sex matched norms
(Franks & Moffatt, 2006)	758 UK, Community Audit Cross section	Women (64%) 76.9 y (mean) Men (36%) 70.5 (mean)	Different aetiologies Ulcer size <10 cm^2 = 409 ≥10cm^2 = 269 Ulcer duration <6 months = 234 ≥6 months = 411	NHP Age/sex adjusted difference score for ulcer size, duration and other clinical factors
(Franks et al., 1999)	200 UK, Two specialist clinic RCT	69.6y (mean) 35-94 (range) Women 66%	Venous aetiology	NHP Age/sex/social class population norms
(Franks & Moffatt, 2001)	383 UK Community Prospective Cohort	74y (median) IQR 64.6, 81.5 Women 63.4%	Venous aetiology Ulcer size <10cm^2 = 192 (55.7%) >10cm^2 = 153 (44.3%)	NHP ES for age, mobility, ulcer size, ulcer duration & HRQL
(Franks et al., 2003)	118 UK Community Prospective cohort	78y (mean age) 42- 96y (range) Women 73.7%	Leg ulcer Ulcer size ≤10cm^2 = 65 (%) >10cm^2 = 31 (32.3%)	SF-36 Estimated age/sex UK norms
(Harrison et al., 2005)	103 Canada Community Before & After study	103 72.7y (mean) Women 66.7%	Venous aetiology Before =73.1% After = 60.9% Ulcer size Before = 6.9cm^2 After = 10.9cm^2	SF-12 Comparison to Canadian general population norms & to Canadian norms > 75 years.
(Iglesias et al., 2005; Iglesias et al., 2005)	387 UK Community & Hospital-Clinics; Multicenter	71.6y (mean) 23 - 97y (range) Women 59% Men	Venous aetiology Ulcer size 4 cm^2(median) Ulcer duration 3 mo (median)	SF-12 Comparison to US general population norm and to 75 and older population norm. ES between person and

Study	Design Setting N	Sample characteristics	Clinical characteristics	HRQL Instrument & Relationships tested
	RCT			ulcer-related variables & HRQL
(Jull et al., 2004)	241 case 224 control NZ community Cross section population case control	Case 40 - 99 (range) Women Case 134 (58.3) Control 119 (54.6)	Different aetiologies	SF-36 Comparison of HRQL domain and summary scores with population controls.
(Lindholm, 1996)	125 Sweden Specialist Cross section	77 (median) - y (range) Women 74	Chronic leg ulcer Ulcer duration 3 y (median) 1 mo – 63 y (range)	NHP (shortened) Compared scores to age/sex matched norms
(Price & Harding, 1996)	55 UK Specialist clinic Cross section	70.4 (mean) 80% > 60 years Women 67%	Different aetiologies Ulcer duration: < 24 months = 31 >24 months = 24	SF-36 Comparison to UK norms 70 to 74 years old
(Walters et al., 1999)	233 UK Community leg ulcer clinic	75 (median) Women 66.5%	Venous Ulcer Size 5.6 cm^2 (median) Ulcer Duration 7 months (median)	SF-36 ES between person and ulcer-related variables & HRQL

Abbreviations: UK, United Kingdom; US, United States; NZ, New Zealand; ES, effect size; HRQL, Health Related Quality of Life; VAS, Visual Analog Scale,

Table 3-2 Comparison between the SF-36 and NHP domains

Concept	SF 36/SF-12 domain	NHP
Pain	Bodily pain (2 items – 6 point likert scale)	Bodily Pain (8 items – yes/no)
Physical function	Physical functioning (10 items)	Physical mobility (8 items)
Psychological status	Mental health (5 items) vitality (4 items)	Emotional reactions (9 items) Energy (3 items)
Social activity	Social functioning (2 items)	Social isolation (5 items)
Other	General health (5 items) Physical role (4 items) Emotional role (3 items)	Sleep (5 items)

Table 3-3 SF-36 domain difference scores

Domain	(Price & Harding, 1996) n=55	(Franks et al., 2003) n=118	(Jull et al., 2004) n=134
Physical Function			
Case	29.8	29.6	49.5
Norm or control[a]	59	50.7	75.7
Difference[b]	-29.2	-30.1	-26.2
Role Limitations Physical			
Case	21.8	41.5	43.2
Norm or control	54	63	72.7
Difference	-32.2	-21.5	-28.5
Bodily Pain			
Case	55.9	53.3	55.3
Norm or control	69	65.5	72.9
Difference	-12.2	-12.2	-16.0
General Health Perception			
Case	46.2	54.9	59.2
Norm or control	58	58.2	73.5
Difference	-11.6	-3.3[c]	-13.3
Vitality			
Case	43.1	46.3	53.2
Norm or control	60	48.7	67.6
Difference	-16.9	-2.4[c]	-14.4
Social Function			
Case	51.5	56.5	69.9
Norm or control	76	78.6	87.6
Difference	-14.5	-22.1	-17.7
Role Limitation Emotional			
Case	46.4	57.1	68.9
Norm or control	73	84.9	85.3
Difference	-26.6	-27.8	-16.4
Mental Health			
Case	66.2	69.1	76.2
Norm or control	68	69.1	82.2
Difference	-1.8[c]	0[c]	-6.0

Abbreviation: NA, not applicable.

[a] Price & Harding age adjusted norms 70 to 74 years; Franks & Moffatt estimated norms based on two large studies (9,332 , 18 to 64 years & 1.608 over 70 years) and calculated paired difference scores between case and estimated age and gender matched norms; Jull et al case and controls were not matched, stratified sampling based from each 10 year age band

[b] Difference score: Negative score means cases have worse domain score compared to population normative scrore

[c] Not statistically significant p>.05

Table 3-4 PCS and MCS Difference Scores

Component Summary Scores	(Harrison et al., 2005) n=151		(Jull et al., 2004) n=134	(Iglesias et al., 2005), n=341	
Norms	Adult	>75y	Matched decade	adult	>75y
PCS[a]				I	II
Case	32.7	32.7	35.8	35.9	35.9
Norm or control[a]	50.5	42.0	45.9	50.0	37.9
Difference[b]	-17.8	- 9.3	-10.1	-14.1	-2.0
MCS					
Case	48.6	48.6	50.9	48.5	48.5
Norm or Control	51.7	54.5	54.2	50	50.4
Difference	6.9	5.9	-3.3	-1.5	-1.9

Abbreviation: NA, not applicable; PCS, Physical Component Summary; MCS Mental Component Summary

[a]Jull et al. Case control design, no matching, stratified random sampling in 10 year age increments; Harrison: population norm for all Canadians and population norms for those older than 75; Iglesias et al. column I is the US normative score and column II is the normative scores based on US norms for 75 and older group.

[b] Negative score means cases have worse scores compared to population normative score

Table 3-5 NHP Difference Scores

Domain	(Franks & Moffatt, 1998a) n= 758	(Franks et al., 1999) n= 200 (95% CI)
Energy		
Case	33.7	24.3[d]
Norm [c]	11.7	20.2
Difference	22.0	4.1 (-0.9, 9.0)
Bodily Pain		
Case	31.1	32.8
Norm	5.8	10.6
Difference	25.3	22.2 (18.3, 26.1)
Emotional Reactions		
Case	17.9	10.7[c]
Norm	10.1	10.0
Difference	18.9	0.7 (-3.0, 1.5)
Sleep		
Case	28.6	24.9[c]
Norm	12.6	22.2
Difference	26.0	0.7 (-1.2, 6.7)
Social Isolation		
Case	13.3	5.1
Norm	4.0	7.4
Difference	9.3	-2.3 (-4.1, -0.7)
Physical Mobility		
Case	36.4	29.6
Norm	3.3	12.5
Difference	33.1	17.1 (14.4, 20.0)

Notes. NHP is scaled so that high scores reflect a poor quality of life, therefore a positive difference indicates a reduced quality of life.

[c]Franks & Moffat age and sex matched norms; Franks, Bosanquet et al., Age, Sex & Social Class matched norms[d] Not statistically significant p>.05

Table 3-6 Definitions of Clinical Indicators

	Ulcer size	Ulcer duration	Mobility	Age
(Franks & Moffatt, 2001) NHP	≤10 cm^2	≤7 mos	Fully mobile	≤75 y
	>10cm^2	>7 mos	Aid/chair or bed bound	>75 y
(Iglesias et al., 2005) SF-12	≤4 cm^2	≤3 mos	Fully mobile	≤71 y
	>4 cm^2	>3mos	Partially mobile	>71 y
(Walters et al., 1999) SF-36	≤5.61cm^2	≤7 mos	Fully mobile	≤75 y
	>5.61 cm^2	>7 mos	Aid/chair or bed bound	>75 y
(Franks & Moffatt, 2006) NHP	≥10 cm^2	<6 mos		
	<10 cm^2	6-36 mos		
		36+ mos		

Chapter 4

The influence of sociodemographic and clinical factors on HRQL of persons with venous ulceration

Prepared for submission to Journal of Advances in Nursing

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Abstract

Aims: To describe the relationship between clinical variables and health-related quality of life (HRQL) in venous leg ulceration.

Background: Venous leg ulceration is associated with poor HRQL. The relationship between patient-related factors, environmental factors, clinical variables and HRQL is poorly understood.

Method: We used the Wilson and Cleary model (WC model) to guide selection of variables and to identify *a priori* the relationships of interest to be tested. An analysis of baseline pain and HRQL in a large cohort of individuals with venous ulcers was carried out.

Results/Findings: For the 564 participants, the mean age was 66.4 years and 47% were male. Over half of the ulcers were at risk for delayed healing even with compression bandaging. The median pain VAS score was 2.2. The mean scores PCS score was 38.0 and MCS score was 50.5. There were no significant differences between men and women in reported pain or HRQL. The odds of experiencing a greater level of pain was associated with age less than 65 years, living with others and poor ulcer prognostic score. Poor physical HRQL (PCS) was associated with mixed venous-arterial ulcer etiology, poor prognostic score, arthritis and higher pain intensity. Poor MCS was associated with being less than 65 years, a comorbid condition and higher pain intensity. Ulcer duration approached significance and may also negatively affect mental HRQL.

Conclusions: The final models demonstrated statistically and clinically significant relationships between socio-demographic, ulcer-related factors, comorbid conditions and outcomes of pain intensity and HRQL. Future research should incorporate measures of functional status and disease-specific symptom status measures and explore the influence of age on HRQL.

Summary Statement

What is already known about this topic?

- Venous leg ulceration is associated with pain and poor HRQL. In comparison to population norms leg ulceration is associated with an impairment of functional status, particularly physical function.
- The relationship between socio-demographic characteristics, routinely measured clinical variables and HRQL is poorly understood.
- Few studies have used a conceptual model to guide investigation of HRQL during an episode of active ulceration.

What this paper adds:

- We use the Wilson and Cleary model (WC model) to guide variable selection and hypotheses about causal associations.
- Our study provides preliminary evidence that routinely measured variables in clinical practice influence, to a limited extent, HRQL during active ulceration.
- We recommend that future research specify measures at each level of the WC model causal pathway in a clinically validated population of venous ulceration. The mediating role of disease-specific symptom status and functional status on HRQL may be a particularly fruitful avenue of research and should be explored in future research.

Keywords: Wilson and Cleary Model; HRQL; pain VAS; MOS SF-12; Margolis prognostic score; Leg ulcer.

Clinical Relevance

HRQL is an important outcome in leg ulcer care. Assessment of ulcer size, duration, and pain underpin leg ulcer practice; however, in isolation, these parameters do not provide an adequate basis to assess HRQL. In order to understand the impact of ulceration on HRQL, nurses should explore the impact of symptoms on various domains of daily life. This information may be useful in goal setting and prioritizing interventions.

There is a growing consensus that venous ulcers have a negative impact on daily life (Herbert et al., 2007; Persoon et al., 2004) and that quality of life is an important outcome of care (RNAO, 2007). According to a recent clinical practice guideline, nurses should assess quality of life in venous leg ulcer patients (RNAO, 2007). Evidence is lacking of the integration of quality of life into the clinical assessment in other chronic conditions (Sousa et al., 1999; Higginson & Carr, 2001). We suspect this is also true for venous leg ulcers.

Numerous tools have been used to measure HRQL in research protocols for group level description, to evaluate the psychometric performance of measures and to evaluate clinical interventions (Anand et al., 2003). At the level of the clinical encounter however, the generic or disease specific tool presents a problem of interpretability. The HRQL score is an abstraction and does not reveal the relationship between individual factors, disease factors and environmental conditions experienced at an individual level. The score does not help us understand the relationship if any between the individual's venous disease, other comorbid conditions, symptom burden, functional strengths and impairments, nor, how they see their health or to what extent we can influence any particular variable. A necessary, albeit preliminary step is to use a conceptual model to assist in the definition of variables that are important in order to create *a priori* hypotheses about the relationships between these variables and HRQL. The Wilson and Cleary conceptual model of HRQL proposes causal relationships between key health outcomes as well as individual and environmental factors (Wilson & Cleary, 1995). Based on this model we explore relationships between clinical, individual and environmental variables and HRQL.

Background

Venous ulceration is a recurrent chronic wound located on the lower leg. The estimated rate of prevalence of active venous ulcers is 0.8 to 1 per 1000 (Callam, 1999). Prevalence peaks in the older adult group, however onset occurs as early as the 20s (Callam et al., 1987; Graham et al., 2003). Evidence based guidelines and the reorganization of care have vastly improved rates of healing (Harrison et al., 2008; Harrison et al., 2005) however, after 12 months of care, 20% will remain unhealed (Nelson, 2002) and up to 34% will have recurred (Harrison et al., 2008; Barwell et al., 2004; Morrell et al., 1999). The burden of illness for this population is considerable. Numerous symptoms profoundly affect daily life. Mobility, employment, social roles, physical activity and quality of life are negatively affected (Persoon et al., 2004; Herbert et al., 2007; Briggs & Flemming, 2007). Although ulcer healing is an important outcome, HRQL reflects the impact of chronicity, recurrence and symptom burden and is an outcome of central concern to wound care nurses.

The Wilson and Cleary Model (WC model) and Venous Ulceration

Wilson and Cleary define HRQL as those "aspects of quality of life that relate specifically to a person's health" and may be influenced by clinical intervention. According to the WC model, depicted in figure 1, four health outcomes comprise HRQL and are aligned in a causal pathway. Those outcomes are biological factors, symptom status, and functional status and health perceptions. Biological factors influence symptom status, symptom status influences functional status and functional status influences health perceptions. Quality of life (QOL), the overall outcome of the causal pathway, is influenced by non medical factors and is a larger concept than HRQL. Individual and environmental factors also influence each level of the causal pathway, except biological factors. The model explained up to 56% of the variance in HRQL in a number of chronic conditions (Buchanan et al., 2009)

Biological factors reflect cell, organ or system functioning and are frequently defined as indicators of disease severity (Buchanan et al., 2009; Buchanan et al., 2009). A valid conceptualization of venous ulcer severity is unclear. Ulcer size and duration are valid prognostic indicators (Margolis et al., 2000) and are thought to indicate severity in effectiveness studies and psychometric evaluation of HRQL instruments (Iglesias et al., 2005; Walters et al., 1999).

A complication in conceptualizing the burden of disease is the increased prevalence of comorbid conditions associated with aging. Measuring the burden of a single condition does not capture the burden of multiple conditions. The impact of comorbid conditions and HRQL in venous disease has had limited study. In one study 50% to 63% reported at least four comorbid conditions and osteoarthritis was associated with ulcer pain (Nemeth et al., 2003b). There is consensus that diabetes, arterial insufficiency and autoimmune diseases may delay healing and venous ulcers may be complicated by arterial disease.

Symptoms are the "patient's perception of an abnormal physical, emotional or cognitive state" (Wilson & Cleary, 1995)(p59). Ulceration is associated with numerous symptoms including pain, wound drainage, itching, lower limb swelling, and odor (Moffatt & Harper, 1997). The prevalence of any particular symptom is unknown. Clinicians believe pain is linked to quality of life, and pain is featured prominently in qualitative descriptions of living with leg ulceration (Briggs & Flemming, 2007). Moderate to severe pain is reported by 50% to 65% of individuals in specialist clinics (Charles, 2002; Hofman et al., 1997; Phillips et al., 1994). Locally we found that the prevalence of pain on admission to homecare was 48 to 54% . The mean pain intensity score was less than 3 out of 10 (Nemeth et al., 2003b).

Venous symptoms have a negative impact on daily living (Moffatt & Harper, 1997; Briggs & Flemming, 2007; Persoon et al., 2004) in particular physical function (Herbert et al., 2007). Functional status captures this impact. Wilson and Cleary define functional status as "an individual's ability to perform a defined task" in a minimum of four domains: physical, social, role and psychological. Qualitative accounts suggest that the impact of pain may be immense,

causing even young, otherwise able-bodied individuals to seek leaves of absence, sick days, and even early retirement (Phillips et al., 1994; Krasner, 1998). Mobility may be impaired due to swelling (Phillips et al., 1994) and pain. The impact of the wound, pain, drainage and odor may result in social withdrawal and negatively affect sexuality (Moffatt & Harper, 1997). Symptom burden may also negatively affect mental heath (Phillips et al., 1994; Franks & Moffatt, 1998a).

Wilson and Cleary define general health perception as a subjective overall rating of health and represents an integration or synthesis of biological factors, symptom status and functional status. The overall influence of venous ulceration on general health perceptions is unknown. A decline in general health perception in comparison to population normative scores ranged from 3.3 to 13.3 as measured by the SF 36 (Price & Harding, 1996; Franks et al., 2003; Jull et al., 2004).

Individual and environmental factors influence symptom status, functional status, health perceptions and quality of life (Wilson & Cleary, 1995). There has been limited exploration of individual and environmental factors in leg ulceration. Preliminary evidence suggests that younger men with ulcers may experience a worse HRQL then older individuals (Franks & Moffatt, 1998b). The impact of gender is more equivocal. Price and Harding (1996) did not find a difference between men and women in HRQL, while Lindholm (1996) and Franks et al (1998) both found that men experienced a greater impact in more domains of HRQL. There is limited study regarding the effect of social support or social class. One case control study found that ulceration was associated with poorer social support and poorer social class than controls. Living with a spouse was associated with an improved QOL score (Moffatt et al., 2006).

The purpose of this study is to explore the relationship between clinical variables and HRQL of patients with active venous ulcers. The WC model is a guiding framework to identify important variables and to base hypotheses about the relationship between variables of interest and HRQL. Two main research questions guided the enquiry:

1. Do age, gender, living conditions, comorbidity and leg ulcer size and duration affect pain intensity?

2. Do these same variables as well as pain intensity affect HRQL?

Design/Methodology

In a descriptive cross sectional study, we examined pain and HRQL outcome data drawn from two randomized control trials (RCT) carried out between 2001 and 2007 (Harrison et al., 2005; Harrison et al., 2008). All participants received evidence-based assessments by nurses in urban homecare settings in several Canadian communities. HRQL was a secondary outcome measure in both trials with ulcer healing serving as the primary outcome measure.

Sample/Participants

The sample was comprised of those cases in the original studies that had complete baseline pain and HRQL outcome data. The following criteria governed enrollment in the original studies: Participants were 18 years of age or older, able to consent and had a venous ulcer or mixed venous-arterial ulcer. A venous ulcer was defined as a 1 cm opening in the skin below the knee of at least one-week duration and an ankle brachial pressure index (ABPI) of greater than or equal to 0.8. An ABPI between 0.5 and 0.8 differentiated venous-arterial ulcers from a purely venous ulcer. The ulcer was either a first occurrence or recurrent. An exclusion criterion in one of the two trials was treatment with oral hypoglycemics or insulin. All study participants were enrolled in one of the two RCTs.

Instruments

We used the Medical Outcomes Survey Short Form-12 (SF-12) to measure HRQL (Ware, Kosinski & Keller, 1994). The SF-12 produces two scores, the Physical Component Summary score (PCS) and the Mental Component Summary score (MCS). The PCS is primarily comprised

by physical functioning, role limitations due to physical health problems, bodily pain, and self-perceived general health. Vitality, social functioning, role limitation due to emotional problems and mental health dimensions comprise the primary aspects of the MCS (Ware & Sherbourne, 1992). The instrument has demonstrated good discriminatory function in numerous health conditions (Ware, 2004) and in two venous leg ulcer samples based on age, ulcer duration and mobility (Iglesias et al., 2005) and healed status at 12 months (Walters et al., 1999). Numerous leg ulcer studies have used this instrument to measure HRQL or QOL (Franks et al., 2003; Harrison et al., 2005; Iglesias et al., 2005; Jull et al., 2004; Nemeth et al., 2003b; Price & Harding, 1996; Walters et al., 1999; Charles, 2004).

Individual and environmental characteristics were defined as age, gender, and social support. We defined social support as living alone or living with others. These data were collected using the Leg Ulcer Assessment Tool (LUAT).

The biological variable was defined by ulcer size, duration, and ulcer etiology and comorbid conditions. The ulcer cm^2 area was calculated using computer planimetry of ulcer tracings. Ulcer duration was based upon patient report. A valid prognostic score was calculated based upon ulcer size and duration (Margolis et al., 2000). Ulcers less than 5 cm^2 and less than 6 months duration had the best chance of healing with compression bandaging by six months, and had a prognostic score of 0. If either ulcer size was 5 cm^2 or larger or ulcer duration was 6 months or longer, then the prognostic score was 1, and there was a relatively greater chance of non healing at six months. If the ulcer was both 5 cm^2 or larger and six months or older, the prognostic score is 2 and there is a greater risk of non-healing at six months relative to prognostic score 0 or 1.

Clinical validation data of ulcer etiology and comorbid conditions was collected using the LUAT. Patients identified relevant comorbid conditions from a closed listed associated with different ulcer etiologies. This list of conditions included arthritis, diabetes mellitus, heart disease, hypertension, renal disease, lower limb arterial disease and inflammatory bowel disease.

Pain intensity represented symptoms status. Pain intensity was measured using two scales, the 100 mm visual analogue scale (VAS) and the present pain index (PPI). The VAS is anchored with “no pain” and “worst pain imaginable”. The score was converted to a 0 to 10 VAS scale given the usual clinician standard. The (PPI) is six number-word combinations ranging from zero=no pain to five=excruciating pain. The PPI is part of the short form McGill Pain Questionnaire and both the VAS and PPI have been used in diverse clinical populations (Bowling, 2004) including those with venous ulcers (Briggs et al., 2007; Charles, 2002; Nemeth et al., 2003b; Noonan & Burge, 1998; Walters et al., 1999). We selected the median pain VAS score to differentiate a lower pain group from a higher pain group.

Ethical Considerations

A university ethics board gave approval for the original randomized control trials as well as the current study. The primary investigator gave permission to use the baseline data.

Data Analysis

The chi square test was used to assess associations between categorical measures of individual, environmental and biological variables and high versus low pain intensity. We used the T-test to assess associations between categorical measures and HRQL. Multivariable regression was conducted for both outcomes using logistic regression for pain and linear regression for HRQL. Results are expressed as odds ratios or unstandardized coefficients with 95% CI intervals. A p value $\leq .05$ was considered statistically significant.

The linkages between the Wilson and Cleary model and the study variables are displayed in Table 1. Predictors were based on the WC model and clinical expertise. Model entry criterion was specified *a priori* at $p \leq .20$, with the exception of gender and prognostic score. Gender and prognostic score could be forced into the models if the variable did not meet the entry criterion. This decision was based on preliminary evidence that HRQL scores differed between men and

women with leg ulcers and the clinical and theoretical importance of the prognostic score as an indicator of severity. In addition to prognostic score, disease severity was defined as ulcer size and duration. We analyzed the impact of each on pain intensity and HRQL. We used logistic regression to analyze predictors of higher pain intensity (>2.2) and linear regression to analyze predictors of HRQL. All regression procedures used simultaneous entry. Variables were retained if $p \leq 0.10$. Variables were eliminated one at a time in successive regressions if $p > 0.10$. Multicollinearity was examined using the collinearity diagnostic command in SPSS. All statistical analyses were conducted using the Statistical Package for Social Sciences (SPSS) (Version 16.0).

Results / Findings

There were 564 cases. The sociodemographics and clinical characteristics of the sample are described in Table 2. The age ranged from 23 to 95 years. Forty percent were younger than 65 years. There was a greater proportion of men in the younger group at 57% and more women in the 65 and older group at 59%. The gender distribution overall was equal. Thirty six percent lived alone. Ulcers were predominantly caused by venous disease (86.5%) involving one leg. The mean ulcer size was 9.98 cm^2 and the mean duration was 8.7 months. Fifty-two percent were at risk for delayed healing based on the prognostic score. Approximately 60% had at least one comorbid condition. Arthritis was the most common comorbid condition at 37.4%.

The descriptive statistics regarding pain and HRQL scores are summarized in Table 3. Eighty percent reported pain. Thirty percent reported moderate to severe pain (VAS $\geq$ 4/10). The median score of this skewed distribution was 2.2. The median score of the VAS was 2.2 and the definition of the lower pain group was a VAS $\leq$2.2. The higher pain group was defined as a VAS > 2.2. The mean PCS score was 38.0 and the mean MCS was 50.5.

Neither person-related variables nor ulcer-related variables influenced pain intensity. However, a greater proportion of those who lived with others reported higher pain intensity (p=.01). Suffering from arthritis was associated with higher pain levels (p=.01), but other

comorbid conditions did not influence pain. Table 4 displays the bivariate analysis of pain intensity.

Table 5 displays the bivariate analysis of the PCS score. Older adults (≥65 years) had a lower mean physical HRQL score compared to the younger adult group (p = 0.04). Living condition and gender did not influence the PCS score. A comorbid condition or a venous-arterial ulcer was associated with a worse mean physical HRQL. The higher pain group also had a worse mean PCS or physical HRQL. Although the disease severity variables of ulcer size and duration were not significant, prognostic score was, those with the oldest and largest ulcers had a significantly worse PCS than ulcers with a better prognostic score (mean =35.4 vs. 38.5, p = 0.04).

Overall, few variables demonstrated a relationship to mental HRQL or the MCS. The older age group reported a better mental HRQL compared to those younger than 65 (49.0 vs. 51.5, p=0.006). The higher pain group had a worse MCS compared to the lower pain group (53.1 vs 47.9, p<0.001). Neither living conditions nor biological variables influenced mental HRQL (see Table 6)

Regression Models

The final logistic regression model for pain intensity is summarized in Table 7. The overall model explained 4% of the variance in pain intensity. Gender was not associated with pain intensity. Those with arthritis or living alone were more likely to report higher pain levels. The younger age group was 1.52 times more likely to be in the higher pain group (OR=0.66 [0.5, 0.95] p=0.025). Those with the best chance of healing their ulcer within 6 months were 2.54 times more likely to be in the higher pain group (OR= 0.79 [0.6, 1.0] p=0.046).

Multivariable Linear Regression Model of HRQL

The final regression models for HRQL, displayed in Tables 8 and 9, explained 10.5% of the variance in PCS score and 7.8% MCS score. Gender, forced into both regression models, had minimal impact on the overall model R^2. Arthritis was associated with a worse PCS score (b=-3.6 [95%CI -5.3, -1.9] p<.001). A poor prognostic score was also negatively associated with the PCS score (b=-1.9, [95% CI -3.0, -0.8] p=0.001). In a separate regression we found that ulcers older than 6 months adversely affected the PCS score (b = -2.6 [-4.5, -0.7] p=0.006), however, ulcer size had a minimal effect (p=0.094). Mixed venous-arterial ulcers had a negative impact on PCS (b = -4.5, [-6.9, -2.2] p<0.001). Greater pain intensity was associated with a 3.6 (95% CI -5.2,-1.9, p<0.001) reduction in the PCS score.

Only coefficients for age, comorbidity and pain intensity reached statistical significance in the final model of mental HRQL. A higher MCS score was associated with the older adult group (b=2.8 [1.0, 4.6], p=0.002]. Ulcer prognostic score did not reach statistical significance, however, ulcer duration approached significance (-1.9 (95% CI-3.9, 0.0, p=.053). Ulcer size had a minor impact. The presence of a comorbid condition was associated with a reduction of 2.2 points in the MCS (p=0.017). Pain intensity had the largest negative impact on the MCS score (b=-5.0, [-5.6, -3.2], p<.001) relative to other predictors in the model.

Discussion

We found support for linkages between individual, environmental and clinical variables and HRQL in venous ulceration. Both physical and mental HRQL were negatively affected by ulcer duration greater than six months and a higher pain level. Clinical variables also had a differential impact on physical and mental HRQL. A poorer Venous-arterial ulcers, a poor prognostic score, a higher pain level and arthritis negatively affected the PCS or physical HRQL. An age less than 65 years, the presence of a comorbid condition and a higher pain level

negatively affected MCS or mental HRQL. The odds of a higher pain level were predicted by membership in the younger age group, living with others, arthritis and poor prognostic score.

We had some unexpected findings. Despite statistical significant in the bivariate analysis, age did not remain in the final regression model of Physical HRQL. Physical HRQL is known to decline with age (Hopman, Towheed Anastassiades, Tenehouse, Poliquin e et al., 2000) and we therefore anticipated a relatively poor PCS in the older adult group. The large sample size ensured a good representation of the younger and older adult age categories and therefore the lack of effect is not due to homogeneity of the independent variable. One explanation is that the younger group had poorer PCS scores than expected and therefore nullified the effect of age. This would lend support to earlier findings that those younger than 65 had a greater deviation from HRQL norms than those 65 years and older (Franks & Moffatt, 1998b).

Age also had a surprising relationship to pain. Membership in the younger age group predicted a higher pain level, despite the probable increase in comorbid conditions associated with pain in the older adult group. There was no difference in ulcer characteristics between younger and older adults (chi square result not displayed) that might account for the increased risk of higher pain associated with younger adults. The age-related difference may be an indicator that older adults are more able to limit their activity level to avoid exacerbating their pain. We unfortunately cannot test this hypothesis due to the lack of a measure of functional status, a weakness in our study. A second possibility is that older and younger adults calibrate or report the intensity of their pain differently.

Ulcers with the best prognosis (smallest/shortest duration) increased the odds of a higher pain score. To our knowledge, this is the first study to explore the relationship between ulcer prognostic score and pain. There has been limited study of the relationship between size and duration with pain intensity. Pieper et al. found a moderate correlation between very large wounds and pain intensity ($r=0.44$, $p<.023$). Venous ulcers larger than 5.61 cm^2 were associated with a higher VAS daytime score (ES=-0.30), but not at other times of the 24 hour day in a large

cross sectional study (Walters et al., 1999). Our results run counter to both Pieper and Walters. One reason may be due to methodological differences. Pieper et al recruited a small number of younger adults with very large venous ulcers and who had addiction issues. It may be that the relationship of pain intensity and ulcer characteristics is neither simple nor linear. Clinically, small ulcers associated with perforator vein incompetence or hypopigmented areas of atrophe blanche may be associated with severe pain (Kunimoto, 2001) and older ulcers may be associated with less pain (Price & Harding, 1996; Husband, 2001). The relationship of ulcer characteristics or disease severity and pain merits further research.

The final regression models accounted for a limited proportion of the total R^2 of pain intensity and HRQL. This may be due to several factors. One is that the WC model causal pathway is flawed and therefore the causal associations depicted in Figure 1 are weak. Empirical evidence from other studies in diverse chronic conditions however found that the model performed well and accounted for a larger proportion of R^2 of HRQL (Buchanan et al., 2009). A second possibility is that our measures of biological variables and symptom status were inadequate. The best way to conceptualize biological variables is unclear (Sousa et al., 1999). We used ulcer size and duration, clinically well-accepted proxies of ulcer severity to calculate a validated prognostic score. The closed list of comorbid conditions, originally designed to aid in the process of differential diagnosis, may have poorly reflected the severity of co morbidity a potentially important measure in this predominantly older population. We selected pain intensity, only one indicator of the range of symptoms associated with ulcers. In addition, the VAS may not capture salient aspects of the pain experience, such as the affective experience of pain. A third possibility, which is the most likely, is that we did not measure important variables that contribute to HRQL, for example functional status. Certainly, there is ample evidence that physical function is impaired during active ulceration (Buchanan & Harrison, 2009). The inclusion of a robust measure of functional status may have increased the explanatory power of the models.

The mean PCS and MCS were similar to those in other leg ulcer studies (Buchanan & Harrison, 2009) and well below 50.5, the Canadian population norm for the PCS, but similar to the MCS normative score (Hopman, 2000). The explained variance of the models for PCS, MCS and pain was limited; however, we found clinically important relationships between sociodemographic characteristics, biological variables, pain intensity and HRQL. A clinical scenario commonly found in many nurses' caseloads best illustrates this: Consider an individual who is 67 years old and has had a venous ulcer for 8 months. Osteoarthritis complicates their pain experience and they rate their pain 4 on a 0 to 10 scale. Based on these characteristics we calculate a 14.7-point reduction in physical HRQL and a 7.6 reduction in mental HRQL. This reduction in HRQL score is clinically important and illustrates the important linkages between routinely measured clinical variables and HRQL.

Limitations

This study has several limitations. First, causation cannot be tested using a cross sectional design. Secondly, the study variables were designed to answer different questions. For example, symptom status may have been more effectively measured using a validated disease-specific symptom based tool in addition to pain intensity. Other important concepts such as functional status were not included. Finally, the sample may not be representative of clinical populations receiving treatment for venous ulcers.

Future research should define or test existing disease specific measures of symptom status as a next step in the development of a clinically relevant model of HRQL. In addition, key concepts such as comorbidity and disease severity need further conceptualization. Finally, age is an important variable to explore in future studies with a robust measure of functional status. Impairment of physical function and other aspects of functional status vis a vis age-normative expectations may play a key role in mediating the effect of age and pain on HRQL.

Clinical Relevance

The assessment of HRQL is complex. It is likely that ulcer characteristics and pain intensity, two variables that clinicians frequently measure, account for a limited proportion of HRQL. Both variables are insufficient assessment parameters of HRQL in isolation. As a starting point, the impact of ulceration on daily life is an important topic to discuss with our patients. Understanding of the impact of symptoms on function may be critically important in prioritizing goals and patient-centered evaluation of interventions.

Conclusions

Venous ulceration is associated with a negative impact on physical HRQL while mental HRQL is relatively unaffected. The Wilson and Cleary model is a promising conceptual framework to guide exploration of the relationships between person/environmental factors, clinical variables and HRQL. To our knowledge, this is one of the largest studies to explore the relationships between routinely measured clinical variables and HRQL in a clinically validated venous ulcer population. Descriptive data provide preliminary evidence of associations between age, clinically important variables such as etiology, prognostic score, ulcer duration and pain and HRQL.

Reference List

Anand, S. C., Dean, C., Nettleton, R., & Praburaj, D. V. (2003). Health-related quality of life tools for venous-ulcerated patients. *British Journal of Nursing, 12,* 48-59.

Barwell, J. R., Davies, C. E., Deacon, F., Harvey, K., Minor, J., & Sassano, A. (2004). Comparison of surgery and compression with compression alone in chronic venous ulceration (ESCHAR study): Randomized controlled trial. *Lancet, 363,* 1854-1859.

Bodian, C. A., Freedman, G., Hossain, S., Eisenkraft, J. B., & Beilin, Y. (2001). The visual analog scale for pain: Clinical significance in postoperative patients. *Anesthesiology, 95,* 1356-1361.

Briggs, M., Bennett, M. I., Closs, S. J., & Cocks, K. (2007). Painful leg ulceration: a prospective, longitudinal cohort study. *Wound Repair and Regeneration, 15,* 186-191.

Briggs, M. & Flemming, K. (2007). Living with leg ulceration: a synthesis of qualitative research. *Journal of Advanced Nursing, 59,* 319-328.

Buchanan, M. & Harrison, M. B. (2009). Review of the impact of leg ulceration on health related quality of life. *Manuscript in preparation.*

Buchanan, M., Harrison, M. B., Hopman, W. M., & Vandenkerkhof, E. (2009). Review of the Wilson and Cleary Model of Heath Related Quality of Life. *Manuscript in preparation.*

Callam, M. J. (1999). Leg ulcer and chronic venous insufficiency in the community. In C.V.Ruckley, F. G. R. Fowkes, & A. Bradbury (Eds.), *Venous Disease* (pp. 15-25). London: Springer-Verlag.

Callam, M. J., Harper, D. R., Dale, J. J., & Ruckley, C. V. (1987). Chronic ulcer of the leg: clinical history. *British Medical Journal, 294,* 1389-1391.

Charles, H. (2002). Venous leg ulcer pain and its characteristics. *Journal of Tissue Viability, 12,* 154-158.

Charles, H. (2004). Does leg ulcer treatment improve patients' quality of life? *Journal of Wound Care, 13,* 209-213.

Franks, P. J., McCullagh, L., & Moffatt, C. J. (2003). Assessing quality of life in patients with chronic leg ulceration using the Medical Outcomes Short Form-36 Questionnaire. *Ostomy/Wound Management, 49,* 26-37.

Franks, P. J. & Moffatt, C. J. (1998a). Quality of life issues in patients with chronic wounds. *Wounds, 10,* 1E-9E.

Franks, P. J. & Moffatt, C. J. (1998b). Who suffers most from leg ulceration? *Journal of Wound Care, 7,* 383-385.

Graham, I. D., Harrison, M. B., Nelson, E. A., Lorimer, K., & Fisher, A. (2003). Prevalence of lower-limb ulceration: a systematic review of prevalence studies. *Advances in Skin & Wound.Care, 16,* 305-316.

Harrison, M. B., Graham, I. D., Lorimer, K., Friedberg, E., Pierscianowski, T., & Brandys, T. (2005). Leg-ulce care in the community, before and after implementation of an evidence-based service. *Canadian Medical Association Journal, 172,* 1447-1452.

Harrison, M. B., Graham, I. D., Lorimer, K., Vandenkerkhof, E., Buchanan, M., Wells, P. S. et al. (2008). Nurse clinic versus home delivery of evidence-based community leg ulcer care: A randomized health services trial. *BMC Health Services Research, 8,* 243-253.

Herbert, O. R., Schnepp, W., & Rieger, M. A. (2007). A systematic review on the impact of leg ulceration on patients' quality of life. *Health and Quality of Life Outcomes, 5,* 44-66.

Higginson, I. J. & Carr, A. J. (2001). Measuring quality of life: Using quality of life measures in the clinical setting. *British Medical Journal, 322,* 1297-1300.

Hofman, D., Ryan, T. J., Arnold, P., Cherry, G. W., Lindholm, C., & Bjellerup, M. (1997). Pain in venous leg ulcers. *Journal of Wound Care, 6,* 222-224.

Hopman, W. M., Towheed, T., Anastassiades, T., Tenehouse, A., Poliquin, S., Berger, C. et al. (2000). Canadian normative data for the SF-36 health survey. *Canadian Medical Association Journal, 163,* 265-271.

Husband, L. L. (2001). Venous ulceration: The pattern of pain and the paradox. *Clinical Effectiveness in Nursing, 5,* 35-40.

Iglesias, C. P., Birks, Y., Nelson, E. A., Scanlon, E., & Cullum, N. A. (2005). Quality of life of people with venous leg ulcers: A comparison of the discriminative and responsive characteristics of two generic and a disease specific instrument. *Quality of Life Research, 14,* 1705-1718.

Jull, A., Walker, N., Hackett, M., Jones, M., Rodgers, A., Birchall, N. et al. (2004). Leg ulceration and perceived health: a population based case-control study. *Age and Ageing, 33,* 236-241.

Krasner, D. (1998). Painful venous ulcers: Themes and stories about living with the pain and suffering. *Journal of Wound Ostomy and Continence Nursing, 25,* 158-168.

Lindholm, C. (1996). The Nottingham Health Profile. *Journal of Wound Care, 5,* 143-144.

Margolis, D. J., Berlin, J. A., & Strom, B. L. (2000). Which venous leg ulcers will heal with limb compression bandages? *American Journal of Medicine, 109,* 15-19.

Moffatt, C. J., Franks, P. J., Doherty, R., & Martin, R. (2006). Sociodemographic factors in chronic leg ulceration. *British Journal of Dermatology, 155,* 307-312.

Moffatt, C. J. & Harper, P. (1997). *Leg Ulcers*. New York: Churchill Livingstone.

Morrell, C. J., Walters, S. J., Dixon, S., Collins, K. A., Brereton, L. M. L., & Peters, J. (1999). Cost effectiveess of community leg ulcer clinics: Randomized controlled trial. *British Medical Journal, 316,* 1487-1491.

Nelson, E. A. (2002). Health related quality of life measurement. *EWMA Journal, 2,* 5-7.

Nemeth, K. A., Harrison, M. B., Graham, I. D., & Burke, S. (2003). Pain in pure and mixed aetiology venous leg ulcers: a three-phase point prevalence study. *Journal of Wound Care, 12,* 336-340.

Noonan, L. & Burge, S. M. (1998). Venous leg ulcers: Is pain a problem? *Phebology, 13,* 14-19.

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

Phillips, T., Stanton, B., Provan, A., & Lew, R. (1994). A study of the impact of leg ulcers on quality of life: Financial, social and psychologic implications. *Journal of the American Academy of Dermatology, 31,* 49-53.

Price, P. & Harding, K. (1996). Measuring Health-related quality of life in patients with chronic leg ulcers. *Wounds, 8,* 91-94.

RNAO (2007). Assessment and management of venous leg ulcers. RNAO Nursing Best Practices Guidelines Program [On-line].

Serlin, R. C., Mendoza, T. R., Nakamura, Y., Edwards, K. R., & Cleeland, C. S. (1995). When is cancer pain mild, moderate or severe? Grading pain severity by its interference with function. *Pain, 61,* 277-284.

Sousa, K. H., Holzemer, W. L., Henry, S. B., & Slaughter, R. (1999). Dimensions of health-related quality of life in persons living with HIV disease. *Journal of Advanced Nursing, 29,* 178-187.

Walters, S. J., Morrell, C. J., & Dixon, S. (1999). Measuring health-related quality of life in patients with venous leg ulcers. *Quality of Life Research, 8,* 327-336.

Ware, J. E. (2004). SF-36 Health Survey Update. In M.E.Maruish (Ed.), *The use of psychological testing for planning and outcomes assessment* (3rd ed., pp. 693-718). Lawrence Erlbaum Associates.

Ware, J. E. & Sherbourne, C. D. (1992). The MOS 36-item short-form health survey (SF-36),I: conceptual framework and time selection. *Medical Care, 30,* 473-483.

Wilson, I. B. & Cleary, P. D. (1995). Linking clinical variables with health-related quality of life. A conceptual model of patient outcomes. *JAMA, 273,* 59-65.

Figure 4-1 Wilson and Cleary Model of HRQL

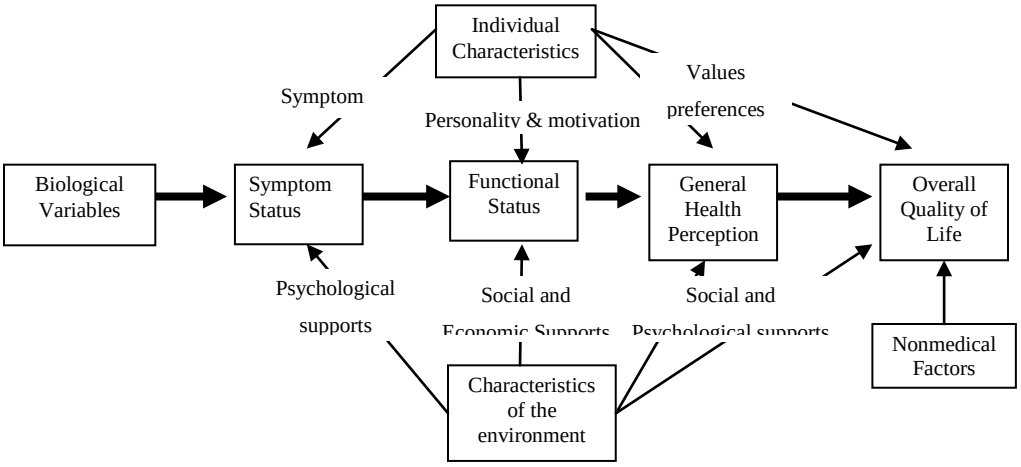

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Table 4-1 WC Model Constructs and Measured Variables

Model Construct	Measured variable
Individual	Age ≤ 65 years >
	Gender
	Smoking
Environmental	Live with others; live alone
Biological	Ulcer size cm^s, ≤5 cm^s>
	Ulcer duration ≤ 6months >
	Prognostic score: 0, 1, 2
	Aetiology: venous, venous-arterial
	Comorbidity: present
	Specific comorbidities yes/no
Symptom Status	Pain Intensity: VAS 0-10
	Lower pain ≤2.2
	Higher pain>2.2
HRQL	Physical HRQL: MOS SF-12 PCS
	Mental HRQL, MOS SF-12 MCS

Table 4-2 Sample Characteristics

Characteristic	**n=564 (%)**
CBT dataset	379 (67.2)
Male	266 (47.2)
Age, yr,	
mean	66.4
median	69
range	23 - 95
65 & older	340 (60.3)
Living alone	203 (36)
Current smoker	75 (13.3)
Comorbidity present[a]	346 (61.3)
Arthritis	211 (37.4)
Cardiovascular disease[b]	134 (23.8)
Hypertension	183 (32.4)
Diabetes[c]	48 (8.5)
Renal disease	28 (5)
Probable etiology	
Venous	488 (86.5)
Venous-mixed	76 (13.5)
Bilateral ulcers	21 (3.7)
Ulcer size cm^2	n=560

Characteristic	**n=564 (%)**
mean (95%CI)	9.98 (8.19, 11.8)
Median	3.41
Range (cm^2)	01 to 270
$\leq 5.0\ cm^2$	343 (60.8)
$> 5.0cm^2$	221 (39.2)
Ulcer duration	
Months mean (median)	8.7 (2.6)
Range	.03 to 243.8
Prognostic Score[3]	
0 = $\leq$ 6 months	272 (48.2)
1 = > 6 months OR > $5cm^2$	208 (36.9)
2 = $\geq$6 months & > $5cm^2$	84 (14.9)

[a] Vasculitis, Inflammatory Bowel Disease, Arthritis, Cardiovascular disease, hypertension, diabetes, renal disease

[b] Cerebral vascular accident, transient ischemic attack, lower extremity arterial disease, myocardial infarction, angina, congestive heart failure

[c]Diabetes treated with oral hypoglycemics or insulin was an exclusion criterion in the CBT dataset.

Prognostic categories developed by Margolis, Berlin & Strom (2000).

Table 4-3 Pain Intensity and HRQL Characteristics

Outcome	n (%)
Pain VAS[a]	
Mean (95%CI)	2.97 (2.7, 3.2)
Median	2.2
IQR	1.0-3.0
VAS Categorized	
No pain 0 to 1.0	190 (33.7)
Mild pain 1.1 to 3.9	195 (34.6)
Moderate pain 4.0 to 6.9	119 (21.1)
Severe pain 7.0 to 10.0	60 (10.6)
Pain on admission (PPI)	
Not present	114 (20.2)
Mild	157 (27.8)
Discomforting pain	194 (34.4)
Distressing,	53 (9.4)
Horrible	25(4.4)
Excruciating	21 (3.7)
MOS SF-12	
PCS, mean (95%CI)	38.0 (37.2, 8.9)
Median	37.9
Minimum, Maximum	11.6, 65.0
IQR	14.5
MCS, mean (95%CI)	50.5 (49.6, 1.4)
Median	52.3
Minimum, Maximum	20.5, 69.3
IQR	16.6

[a] 0 = no pain, 10 = worst pain

[b]See: Categories based on interference with mood, activity, sleep in patients with cancer and chronic pain (Serlin et al., 1995) Patients requested additional analgesia with VAS of greater than 3 following intra-abdominal surgery (Bodian et al., 2001)

Table 4-4. Pain Intensity and Independent Variables

Variable	n	0 to 2.2 n (%)	2.3 to 10 n (%)	x^2	p
Male	266	142 (53)	125 (47)	1.1	.302
Female	298	145 (48.7)	153 (51.3)		
<65 years	224	104 (46.4)	120 (53.6)	2.7	.099
≥65 years	340	182 (53.5)	158(46.5)		
Living Alone	203	117(57.6)	86 (42.4)	6.1	.014
Living With others	361	169 (46.8)	192 (53.2)		
Ulcer size<5cm^2	340	163 (47.9)	177 (52.1)	2.8	.094
Ulcer size≥5cm^2	224	123 (55.2)	100 (44.8)		
Ulcer duration < 6 months	411	200 (48.7)	211 (51.3)	2.5	.111
Ulcer duration ≥6months	153	86 (56.2)	67 (43.8)		
Prognostic group					
0	272	128 (47.1)	144 (52.9)	4.9	.088
1	208	107 (51.4)	101 (48.6)		
2	84	51 (60.7)	33 (39.3)		
Venous etiology	488	251 (51.4)	237 (48.6)	0.8	.383
Venous-mixed aetiology	76	35 (46.1)	41 (53.9)		
Comorbidity Yes	346	163 (47.1)	183 (52.9)	4.6	.031
No	218	123 (56.4)	95 (43.6)		
Cardiovascular Yes	134	61 (45.5)	73 (54.5)	1.9	.198
No	430	225 (52.3)	205 (47.7)		
Arthritis Yes	211	92 (32.2)	119 (42.8)	6.8	.009
No	353	194 (67.8%)	159 (57.2)		
Hypertension yes	183	97 (53)	86 (47)	.6	.450
no	381	189 (49.6)	192 (50.4)		

Table 4-5 HRQL Physical Component Summary (PCS) and Independent Variables

Variable	n (%)	Mean	Statistic	p
Male	266 (47.2)	38.9	t=1.77	.077
Female	298 (52.8)	37.3		
< 65 years	224 (49.7)	39.1	t=2.09	.037
≥65 years	340 (60.3)	37.3		
Lives Alone	203 (36)	37.5	t=-.97	.335
Lives With others	361 (64)	38.4		
Ulcer size = ≤5cm2	340 (60.8)	38.6	t=1.65	.100
Ulcer size =>5cm2	223(48.2)	37.2		
Ulcer duration ≤6months	411 (72.9)	38.5	t=1.70	.090
Ulcer duration >6 months	153 (27.1)	36.9		
Prognostic Group				
0	272 (48.2)	38.5	F=3.34	.036
1	208 (36.9)	38.5		
2	84 (14.9)	35.4		
Venous aetiology	488 (86.5)	38.7	t=.16	<.001
Venous-mixed aetiology	76 (13.5)	33.6		
Comorbidity yes	346 (61.3)	36.5	t=-4.7	<.001
No	218 (38.7)	40.5		
Cardiovascular yes	134 (23.8)	35.4	t=-3.21	.002
No	430 (76.2)	38.9		
Arthritis yes	211 (37.4)	35.3	t=-4.97	<.001
No	353 (62.6)	39.7		
Hypertension yes	183 (32.4)	36.7	t=-2.22	.027
No	381 (67.6)	38.7		
Pain= ≤ 2.2	286 (50)	39.9	t=4.56	<.001
Pain = >2.2	278 (50)	36.1		

Table 4-6 HRQL Mental Component Summary (MCS) and Independent Variables

Variable	n	Mean	Statistic	P
< 65 years	224	49.0	-2.76	.006
≥65 years	340	51.5		
Male	266	50.8	t=.516	.606
Female	298	50.3		
Live Alone	203	50	t=.732	.464
Live With others	361	50.3		
Ulcer size = <5cm^2	340	50.5	t=-.219	.827
Ulcer size = >5cm^2	223	50.7		
Ulcer duration = 6 months	411	50.9		
Ulcer duration ≥ 6 months	153	49.5	t=1.427	.155
Prognostic Group				
0	272	50.5	F=1.494	.225
1	208	51.2		
2	84	48.9		
Venous aetiology	488	50.6		.594
Venous-Mixed aetiology	76	50	t=.533	
Comorbidity Yes	346	50	t=-1.899	.058
No	218			
Cardiovascular Yes	134	50	t= -.709	.78
No	430			
Arthritis Yes	211	49.9	t=-1.121	.263
No	353			
Hypertension Yes	183	50.9	t=.562	.562
No	381			
Pain intensity = ≤2.2	286	53.1	t=6.113	<.001
Pain intensity = >2.2	278	47.9		

Table 4-7 Logistic Regression Model for Pain Intensity

	Odds Ratio	95% CI	p-value
Constant	.97		.890
Age (0= ≤ 65 years)	0.66	0.5, 0.95	.025
Gender (0 = Female)	0.87	0.6, 1.2	.429
Living circumstance (0 = alone)	1.53	1.1, 2.2	.019
Prognostic Score	0.79	0.6, 1.0	.050
Arthritis (0 = No)	1.73	1.2, 2.5	.003

Cox & Snell R Square = .040

Gender forced entry (p=.302 in bivariate analysis)

CI = Confidence Interval

Table 4-8 Linear Regression Model for Physical HRQL

PCS (adjusted R^2 = .102)	Unstandardized Coefficient	95% CI	β	p-value
Constant	42.6	40.8, 44.3		<0.001
Gender (0 = Female)	.941	-0.71, 2.6	0.05	.261
Etiology (0 = Venous)	-4.5	-6.9, -2.2	-0.14	<.001
Prognostic Score	-1.9	-3.0. -0.8	-0.15	.001
Arthritis (0 = No)	-3.6	-5.3, -1.9	-0.17	<.001
Pain (0 = <2.2)	-3.6	-5.2, -1.9	-0.18	<.001

Gender forced entry (p=.077 in bivariate analysis)

CI=Confidence Interval

Table 4-9 Linear Regression for Mental HRQL

MCS (adjusted R^2 = .077)	**Unstandardized Coefficient**	**95% CI**	**β**	**p-value**
Constant	53.2	50.8, 55.5		<.001
Age (0 ≤ 65 years)	2.8	1.0, 4.6	0.13	.002
Gender (0 = Female)	0.3	-1.4, 2.0	0.02	.718
Prognostic Score	-0.9	-2.1, 0.2	-0.1	.118
Comorbidity present (0 = No)	-2.2	-4.1, -0.4	-0.1	.017
Pain intensity (0 = < 2.2)	-5.0	-6.6, -3.2	-0.24	.<.001

Prognostic score forced (p=.225 in bivariate analysis);

Gender forced (p=.606 in bivariate analysis),

CI=Confidence Interval

Chapter 5

Summary and Implications for Practice and Future Research

Prior to graduate studies I was involved in health-related quality of life (HRQL) assessment in a large scale community study of chronic wound care. It was part of the clinical assessment for the research enquiry. I recognized there was a lack of connection between the HRQL data that I collected and the individualized care plans created in collaboration with my clients. This struck me as an oversight given the importance of self-reports of well-being that could certainly influence nursing actions. For example, while excessive wound drainage is more manageable with absorptive wound products and compression, the individual's sense of embarrassment, induced by leakage may be eased by respectful and supportive listening and timing of home visits to facilitate showering. The nursing response to quality of life issues is not a one-size fits all approach, rather, the nursing action is responsive, negotiated and client directed.

HRQL is a highly relevant concept for clinical practice in leg ulcer care. Evidence-based guidelines recommend incorporating QOL in assessment and planning (RNAO, 2007; Van Hecke et al., 2008). This research contributes to the ongoing work needed in not only implementing evidence-informed assessments but also their implications for care planning and intervention.

Overview

Venous leg ulcers negatively affect QOL. The clinical application of this understanding is challenging. The assessment of HRQL should inform our goals of care and influence how we support our clients as they work toward those goals. Each chapter of the thesis contributes toward a translation of HRQL that is clinically relevant at the point of care. At the outset, this thesis was the first application of the Wilson and Cleary model (WC model) to a wound population. In the interim the WC model has been used as a guiding framework in the study of HRQL in persons with diabetic foot ulcers (Ribu et al., 2007). The review of the WC model and the second review

of HRQL in leg ulceration demonstrated that the model has useful and promising potential in leg ulcer research and practice. The causal linkages outlined in the WC model have been examined in at least 22 studies, and there is empirical support for the causal linkages between clinical factors, functional status and health perceptions and the impact on QOL across a number of chronic conditions. In venous leg ulceration, functional status, a domain of HRQL identified in the model, was impaired in comparison to population norms. The pattern of impairment suggests that even with important differences between people such as comorbidity, age and gender, the burden of ulceration affects HRQL in characteristic fashion. Next, the enquiry shifted to a large cohort drawn from nationally funded trials where I analyzed symptoms and quality of life using the WC model as a guiding framework. There are significant associations between ulcer duration and pain intensity and HRQL. However, the regression models did not account for a large proportion of the variance. The clinical implication of this preliminary evidence is that ulcer-related characteristics and pain intensity in isolation do not adequately capture the impact of ulceration on individuals' daily lives or wellbeing.

Practice Implications for HRQL assessment

Since the start of the research, the Registered Nurses Association of Ontario (RNAO), a leader in the dissemination of evidence based practice in Ontario, featured quality of life as a guiding principle of evidence-based leg ulcer care. The recommendation states that "the client's estimate of quality of life should be included in the initial treatment plan, throughout the course of treatment and (at healing)" (p 34).It is unclear the extent to which HRQL assessment data is used in clinical judgment or care planning (Higginson & Carr, 2001). An audit of an Ontario Community Care Access Center Leg Ulcer program did not report information about QOL (Woo et al., 2006). A national sentinel audit of leg ulcer care in the UK does not collect indicators of QOL (Royal College of Nurses, 2000).

Two assessment tools are disseminated with the RNAO guideline, the Leg Ulcer Measurement Tool (LUMT) and the QOL assessment tool (QAT). The LUMT is comprised of two parts: Clinician-rated domains of leg ulcer assessment include factors such as size and the amount of exudate or drainage. Patient-rated domains capture pain and quality of life. The patient selects one of five fixed responses in response to "Quality of life as it relates to the leg ulcer". The responses are, delighted, satisfied, mixed, dissatisfied, and terrible (Woodbury et al., 2004). The second assessment tool provides two questions. The first question, "How would you describe your current health status?" has five fixed response categories (very good; good; fair; bad and very bad). The second question, "How does the leg ulcer impact your day-to-day living?", has three fixed responses (very little, moderately, and a lot). Clinical utility of HRQL measures may be judged in terms of psychometric properties (Higginson & Carr, 2001).

The RNAO guideline does not disseminate psychometric information with the tools. While the LUMT has published psychometric information about the clinician-rated domains, the patient-rated domains do not have psychometric information. A search regarding QAT did not yield any information. It appears that the psychometric information about the tools is unavailable, and therefore there is an insufficient basis to judge if the aggregation of scores could yield valid evaluative information that can be used at a service or program planning level.

The second purpose of a HRQL measure is to prioritize problems, facilitate conversation, screen for potential problems, identify preferences and monitor symptoms or response to treatment (Higginson & Carr, 2001). However, as discussed in Chapter 2, a score does not easily translate into understanding the relative weight of individual, disease or environmental factors in the person's estimation of their quality of life. The LUMT and QAT are limited in a similar way. As observed by Sevenhuysen and Trumble-Waddell (1997) "we run the risk that quality of life becomes what we measure on the tool, rather than a representation of an enormously complex patient-centered gestalt" (p 232). Higginson and Carr are concerned that an assessment tool may be used as an "alternative to communicating with patients rather than as an aid to care" (p. 1297).

The communication strategy of scaling, itself, may limit patient communications about complex subjective phenomena. A double blind randomized control trial compared the quality of pain communication of older adults with osteoarthritis when assessed with a NRS (0 – 10) pain scaling question versus the open-ended question, "tell me about your pain, aches, soreness or discomfort" (McDonald, 2009). Not surprisingly, the scaled question group responded predominantly with a numeric rating of pain intensity. The majority of the open-ended question group responded with multiple types of pain information including location, timing and intensity. Individuals in both groups provided additional pain information in response to two follow-up open-ended questions about pain. The open-ended group provided more information about pain interference with daily function and lifestyle. Open ended questions versus scaling elicit more varied and clinically important information about symptoms. This may also be true for the complex phenomenon of HRQL.

The assessment of HRQL through scaling or VAS could be enriched with open-ended questions that elicited more comprehensive client descriptions of the impact of ulceration on their life. The WC model is a useful clinically-oriented heuristic to guide discussion. For example a common problem on assessment is leg swelling. Open-ended questions might elicit descriptions leg heaviness, fatigue and pain that contribute to the impairment of mobility. For a frail older adult, this may mean the difference between climbing stairs to sleep in bed, and choosing to sleep in a chair, setting off a downward spiral of deconditioning and poor sleep quality. In a younger adult, lower leg swelling may induce pain after eight hours of standing as a service clerk at a convenience store. Their pain and state of nonhealing contributes to a sense of disablement that ultimately leads to underemployment and income instability. The identification of these important connections result in a patient-directed plan to reduce leg swelling, manage pain and regain function.

The use of open-ended questions runs counter to the standardization of assessment practices that has resulted in vastly improved healing rates in leg ulcer care. Open-ended

questions however, are more likely to capture the particular impact of ulceration on individuals' day-to-day lives. The integration of the individual's unique perspective on the challenges of living with ulceration into assessment and planning, increases the probability of supportive nursing interventions that will promote the individual's wellbeing. A focus for future research concerns the ways in which HRQL information is used by nurses in clinical judgment, care planning and evaluation.

Research Implications

The WC model served as a useful guiding framework for research about quality of life and leg ulceration in this research. The framework provides a comprehensive taxonomy of health outcomes that should be included in studies of HRQL in chronic wound populations. For example a recent randomized control trial examined the impact of a leg ulcer "club: compared to usual care on numerous health outcomes including ulcer healing, disease-specific symptoms, social support, functional status, depression, morale and QOL. Psychometrically robust measures were used and provided a more sophisticated and detailed look at the positive impact that different models of health care delivery had on QOL.

The measurement models for each level of the WC model of health outcomes should be further developed. For example, depending on the health condition, disease severity may be based on biological, symptom status or functional status measures (Boyd et al., 2007). I have suggested that leg ulcer severity is best equated with ulcer size and duration due to clinical feasibility and validity as prognostic indicators. This question of severity, however, is complicated by at least two considerations. First, there is a small subgroup of individuals whose ulcers will not heal, or will have early recurrence, even with compression. Does this group represent a more severe form of leg ulceration? Does the extensiveness of venous pathology influence ulcer severity? Further, descriptive work to explore the characteristics of the non healing cohort and those with early recurrence will deepen our understanding of disease severity.

Secondly, the current definition of ulcer severity does not take into account the impact of comorbid conditions on overall disease burden. Multiple conditions are associated with greater decrements in functioning and wellbeing than those with a single health condition (Stewart et al., 1988). Therefore, future work should focus on defining a measurement model of disease severity that also accounts for severity of comorbid conditions. A review of instruments used to capture comorbid conditions would be a useful first step.

A similar argument may be made for other levels of health outcome, particularly symptom status. In our study, pain intensity accounted for a limited proportion of the variance in physical and mental HRQL. Although pain was prevalent, over 50% of participants had pain scores less than 2.2 and about 10.6% had severe pain. The younger age group reported greater pain intensity and did not score as well in physical and mental HRQL. Further exploration of sociodemographic and clinical characteristics of the severe pain cohort may help us understand the intersection of age and pain.

In addition to pain, chronic venous insufficiency is associated with numerous symptoms. A measurement model of disease-specific symptom status will improve our understanding of the relationship between biological factors and symptom status. We might also expect that the relationship of symptoms to healing may be variable because the underlying condition of CVI is not corrected with ulcer healing. Therefore the prognostic significance of symptoms as well as the chronicity of symptoms post healing is important to define.

Leg ulceration is associated with an impairment of physical function. A common indicator of physical function is the use of mobility aids. This provides a barometer, but a robust measurement model of functional status will provide practitioners with a more meaningful and sensitive indicator of improved QOL. It may also prove to be the most useful clinical outcome measure in a chronic disease model of leg ulceration.

Summary

HRQL is a complex concept and critically important in developing client-centered leg ulcer care in the future. The WC model is a useful taxonomy to guide the selection of variables in future research studies about leg ulcers and HRQL. Valid measurement models of each level of health outcome, particularly disease severity, symptom status and functional status requires development and testing. Functional status may prove to be the most sensitive indicator of improved QOL and a desirable outcome independent of healing or as an alternative to healing in longstanding non-healing ulcers. In both research and practice, the impact of ulcers on daily life should be further explored by way of open-ended questions using the WC model as a template to capture important domains.

Reference List

Anand, S. C., Dean, C., Nettleton, R., & Praburaj, D. V. (2003). Health-related quality of life tools for venous-ulcerated patients. *British Journal of Nursing, 12,* 48-59.

Anderson, K. L. & Burckhardt, C. S. (1999). Conceptualization and measurement of quality of life as an outcome variable for health care intervention and research. *Journal of Advanced Nursing, 29,* 298-306.

Arnold, R., Ranchor, A. V., Koeter, G. H., de Jongste, M. J. L., & Sanderman, R. (2005). Consequences of chronic obstructive pulmonary disease and chronic heart failure: The relationship between objective and subjective health. *Social Science & Medicine, 61,* 2144-2154.

Baker, S. R., Pankhurst, C. L., & Robinson, P. G. (2007). Testing relationships between clinical and non-clinical variables in xerostomia: A structural equation model of oral health-related quality of life. *Quality of Life Research, 16,* 297-308.

Barwell, J. R., Davies, C. E., Deacon, F., Harvey, K., Minor, J., & Sassano, A. (2004). Comparison of surgery and compression with compression alone in chronic venous ulceration (ESCHAR study): Randomized controlled trial. *Lancet, 363,* 1854-1859.

Bland, M. (1996). Coping with leg ulcers. *Nursing New Zealand 2,* 13-14.

Bodian, C. A., Freedman, G., Hossain, S., Eisenkraft, J. B., & Beilin, Y. (2001). The visual analog scale for pain: Clinical significance in postoperative patients. *Anesthesiology, 95,* 1356-1361.

Boyd, C. M., Weiss, C. O., Halter, J., Han, K. C., Ershler, W. B., & Fried, L. P. (2007). Framework for evaluating disease severity measures in older adults with comorbidity. *Journal of Gerontology, 62A,* 286-295.

Briggs, M., Bennett, M. I., Closs, S. J., & Cocks, K. (2007). Painful leg ulceration: a prospective, longitudinal cohort study. *Wound Repair and Regeneration, 15,* 186-191.

Briggs, M. & Flemming, K. (2007). Living with leg ulceration: a synthesis of qualitative research. *Journal of Advanced Nursing, 59,* 319-328.

Buchanan, M. & Harrison, M. B. (2009). Review of the impact of leg ulceration on health related quality of life. *Manuscript in preparation.*

Buchanan, M., Harrison, M. B., Hopman, W. M., & Vandenkerkhof, E. (2009). Review of the Wilson and Cleary Model of Heath Related Quality of Life. *Manuscript in preparation.*

Callam, M. J. (1999). Leg ulcer and chronic venous insufficiency in the community. In C.V.Ruckley, F. G. R. Fowkes, & A. Bradbury (Eds.), *Venous Disease* (pp. 15-25). London: Springer-Verlag.

Callam, M. J., Harper, D. R., Dale, J. J., & Ruckley, C. V. (1987). Chronic ulcer of the leg: clinical history. *British Medical Journal, 294,* 1389-1391.

Carpentier, P. H., Cornu-Thenard, A., Uhl, J., Partsch, H., & Antignani, P. L. (2003). Appraisal of the information content of the C classes of CEAP clinical classification of chronic venous disorders: A multicenter evaluation of 872 patients. *Journal of Vascular Surgery, 37,* 827-833.

Charles, H. (1995). The impact of leg ulcers on patients' quality of life. *Professional Nurse, 10,* 574.

Charles, H. (2002). Venous leg ulcer pain and its characteristics. *Journal of Tissue Viability, 12,* 154-158.

Charles, H. (2004). Does leg ulcer treatment improve patients' quality of life? *Journal of Wound Care, 13,* 209-213.

Chase, S. K., Melloni, M., & Savage, A. (1997). A forever healing: The lived experience of venous ulcer disease. *Journal of Vascular Nursing, 15,* 73-78.

Clingerman, E. (2004). Physical activity, social support, and health-related quality of life among persons with HIV disease. *Journal of Community Health Nursing, 21,* 179-197.

Cooper, S. M., Hofman, D., & Burge, S. M. (2003). Leg ulcers and pain: A review. *The International Journal of Lower Extremity Wounds, 2,* 189-197.

Corless, I. B., Bakken, S., Nicholas, P. K., Holzemer, W. L., McGibbon, C. A., Inouye, J. et al. (2000). Predictors of perception of cognitive functioning in HIV/AIDS. *Journal of the Association of Nurses in AIDS Care, 11,* 19-26.

Cosby, C., Holzemer, W. L., Henry, S. B., & Portillo, C. J. (2000). Hematological complications and quality of life in hospitalized AIDS patients. *AIDS Patient Care and STDs, 14,* 269-279.

Douglas, V. (2001). Living with chronic leg ulcer: An insight into patients' experiences and feelings. *Journal of Wound Care, 10,* 355-360.

Ebbeskog, B. & Ekman, S. L. (2001). Elderly persons' experiences of living with vneous leg ulcer: living in dialectical relationship between freedom and imprisonment. *Scandinavian Journal of Caring Science, 15,* 243.

Erickson, S. R., Williams, B. C., & Gruppen, L. D. (2004). Relationship between symptoms and health-related quality of life in patients treated for hypertension. *Pharmacotherapy, 24,* 344-350.

Ferrans, C. E., Zerwic, J. J., Wilbur, J. E., & Larson, J. L. (2005). Conceptual model of health-related quality of life. *Journal of Nursing Scholarship, 37,* 336-342.

Finlayson, T. L., Moyer, C. A., & Sonnad, S. S. (2004). Assessing symptoms, disease severity, and quality of life in the clinical context: a theoretical framework. *The American Journal of Managed Care, 10,* 336-344.

Franks, P. J. (1999). Quality of life for leg ulcer patients. In C.V.Ruckley, A. Bradbury, & F. G. R. Fowkes (Eds.), *Venous Disease: Epidemiology, Management and Delivery of Care* (pp. 254-261). London: Springer-Verlag London Ltd.

Franks, P. J., Bosanquet, N., Brown, D., Straub, J., Harper, D. R., & Ruckley, C. V. (1999). Perceived health in a randomised trial of treatment for chronic venous ulceration. *European Journal of Vascular and Endovascular Surgery, 17,* 159.

Franks, P. J., McCullagh, L., & Moffatt, C. J. (2003). Assessing quality of life in patients with chronic leg ulceration using the Medical Outcomes Short Form-36 Questionnaire. *Ostomy/Wound Management, 49,* 26-37.

Franks, P. J. & Moffatt, C. J. (1998a). Quality of life issues in patients with chronic wounds. *Wounds, 10,* 1E-9E.

Franks, P. J. & Moffatt, C. J. (1998b). Who suffers most from leg ulceration? *Journal of Wound Care, 7,* 383-385.

Franks, P. J. & Moffatt, C. J. (2001). Health related quality of life in patients with venous ulceration: use of the Nottingham health profile. *Quality of Life Research, 10,* 693-700.

Franks, P. J. & Moffatt, C. J. (2006). Do clinical and social factors predict quality of life in leg ulceration? *The International Journal of Lower Extremity Wounds, 5,* 236-243.

Friedberg, E. H., Harrison, M. B., & Graham, I. D. (2002). Current home care expenditures for persons with leg ulcers. *Journal of Wound Ostomy and Continence Nursing, 29,* 186-192.

Gill, T. M. & Feinstein, A. R. (1994). A critical appraisal of the quality of quality-of-life measurements. *JAMA, 272,* 619-626.

Graham, I. D., Harrison, M. B., Nelson, E. A., Lorimer, K., & Fisher, A. (2003). Prevalence of lower-limb ulceration: a systematic review of prevalence studies. *Advances in Skin & Wound Care, 16,* 305-316.

Haase, J. E. & Braden, C. J. (1998). Guidelines for achieving clarity of concepts related quality of life. In C.R.King & P. S. Hinds (Eds.), *Quality of Life* (pp. 54-73). Toronto: Jones and Bartlett Publishers.

Harrison, M. B., Graham, I. D., Lorimer, K., Friedberg, E., Pierscianowski, T., & Brandys, T. (2005). Leg-ulce care in the community, before and after implementation of an evidence-based service. *Canadian Medical Association Journal, 172,* 1447-1452.

Harrison, M. B., Graham, I. D., Lorimer, K., Vandenkerkhof, E., Buchanan, M., Wells, P. S. et al. (2008). Nurse clinic versus home delivery of evidence-based community leg ulcer care: A randomized health services trial. *BMC Health Services Research, 8,* 243-253.

Harrison, M. B., Juniper, E. F., & Mitchell-DiCenso, A. (1996). Quality of life as an outcome measure in nursing research. "May you have a long and healthy life". *Canadian Journal of Nursing Research, 28,* 49-68.

Heo, S., Moser, D. K., Lennie, T. A., Zambroski, C. H., & Chung, M. L. (2007). A comparison of health-related quality of life between older adults with heart failure and healthy older adults. *Heart Lung, 36,* 16-24.

Heo, S., Moser, D. K., Riegel, B., Hall, L. A., & Christman, N. (2005). Testing a published model of health-related quality of life in heart failure. *Journal of Cardiac Failure, 11,* 372-379.

Herbert, O. R., Schnepp, W., & Rieger, M. A. (2007). A systematic review on the impact of leg ulceration on patients' quality of life. *Health and Quality of Life Outcomes, 5,* 44-66.

Higginson, I. J. & Carr, A. J. (2001). Measuring quality of life: Using quality of life measures in the clinical setting. *British Medical Journal, 322,* 1297-1300.

Hofer, S., Benzer, W., Alber, H., Ruttmann, E., Kopp, M., Schussler, G. et al. (2005). Determinants of health-related quality of life in coronary artery disease patients: A prospective study generating a structural equation model. *Psychosomatics, 46,* 212-223.

Hofman, D., Ryan, T. J., Arnold, P., Cherry, G. W., Lindholm, C., & Bjellerup, M. (1997). Pain in venous leg ulcers. *Journal of Wound Care, 6,* 222-224.

Hollinworth, H. & Collier, M. (2000). Nurses' views about pain and trauma at dressing change: results of a national survey. *Journal of Wound Care, 9,* 369-373.

Hopman, W. M., Towheed, T., Anastassiades, T., Tenehouse, A., Poliquin, S., Berger, C. et al. (2000). Canadian normative data for the SF-36 health survey. *Canadian Medical Association Journal, 163,* 265-271.

Husband, L. L. (2001). Venous ulceration: The pattern of pain and the paradox. *Clinical Effectiveness in Nursing, 5,* 35-40.

Iglesias, C. P., Birks, Y., Nelson, E. A., Scanlon, E., & Cullum, N. A. (2005). Quality of life of people with venous leg ulcers: A comparison of the discriminative and responsive characteristics of two generic and a disease specific instrument. *Quality of Life Research, 14,* 1705-1718.

Janz, N. K., Janevic, M. R., Dodge, J. A., Fingerlin, T. E., Schork, M. A., Mosca, L. J. et al. (2001). Factors influencing quality of life in older women with heart disease. *Medical Care, 39,* 588-598.

Jull, A., Walker, N., Hackett, M., Jones, M., Rodgers, A., Birchall, N. et al. (2004). Leg ulceration and perceived health: a population based case-control study. *Age and Ageing, 33,* 236-241.

Kistner, R. L. & Eklof, B. (2001). Classification and diagnostic evaluation of chronic venous disease. In P.Glovickzki & J. S. T. Yao (Eds.), *Handbook of Venous Disorders* (2nd ed., pp. 94-103). London: Arnold.

Krainovich-Miller, B. & . (1998). Nursing Research: methods, critical appraisal, and utilization. In G.LoBiondo & J. Haber (Eds.), *Nursing Research: methods, critical appraisal, and utilization* (4rth ed., pp. 93-131). St. Louis: Mosby.

Krasner, D. (1998). Painful venous ulcers: Themes and stories about living with the pain and suffering. *Journal of Wound Ostomy and Continence Nursing, 25,* 158-168.

Lindholm, C. (1996). The Nottingham Health Profile. *Journal of Wound Care, 5,* 143-144.

Luo, X. M., Edwards, C. L., Richardson, W., & Hey, L. (2004). Relationships of clinical, psychologic, and individual factors with the functional status of neck pain patients. *Value in Health, 7,* 61-69.

Margolis, D. J., Berlin, J. A., & Strom, B. L. (1999). Risk factors associated with the failure of a venous leg ulcer to heal. *Archives of Dermatology, 135,* 920-926.

Margolis, D. J., Berlin, J. A., & Strom, B. L. (2000). Which venous leg ulcers will heal with limb compression bandages? *American Journal of Medicine, 109,* 15-19.

Mathisen, L., Andersen, M. H., Hol, P. K., Tennoe, B., Lund, C., Russell, D. et al. (2005). Preoperative cerebral ischemic lesions predict physical health status after on-pump coronary artery bypass surgery. *Journal of Thoracic and Cardiovascular Surgery, 130,* 1691-1697.

McDonald, D. D. (2009). Older adults' pain descriptions. *Pain Management Nursing, 10,* 142-148.

McDowell, I. (2006). *Measuring health*. New York: Oxford University Press.

Melzack, R. (1987). The short-form McGill Pain Questionnaire. *Pain, 30,* 191-197.

Moffatt, C. J., Franks, P. J., Doherty, D. C., Martin, R., Blewett, R., & Ross, F. (2004). Prevalence of leg ulceration in a London population. *The Quarterly Journal of Medicine, 97,* 431-437.

Moffatt, C. J., Franks, P. J., Doherty, R., & Martin, R. (2006). Sociodemographic factors in chronic leg ulceration. *British Journal of Dermatology, 155,* 307-312.

Moffatt, C. J., Franks, P. J., & Hollinworth, H. (2000). Understanding wound pain and trauma: an international perspective. *European Wound Management Association,* 2-7.

Moffatt, C. J. & Harper, P. (1997). *Leg Ulcers*. New York: Churchill Livingstone.

Morrell, C. J., Walters, S. J., Dixon, S., Collins, K. A., Brereton, L. M. L., & Peters, J. (1999). Cost effectiveess of community leg ulcer clinics: Randomized controlled trial. *British Medical Journal, 316,* 1487-1491.

Musil, C. M., Jones, S. L., & Warner, C. D. (1998). Structural equation modeling and its relationship to mulitple regression and factor analysis. *Research in Nursing & Health, 21,* 271-281.

Nelson, E. A. (2002). Health related quality of life measurement. *EWMA Journal, 2,* 5-7.

Nelson, E. A. (2008). *VenUS III venous ulcer studies III: ultrasound for venous leg ulcers. Details of HTA project in progess*.

Nelson, E. A., Harper, D. R., Prescott, R. J., Gibson, B., Brown, D., & Ruckley, C. V. (2006). Prevention of recurrence of venous ulceration: a randomized controlled trial of class 2 and class 3 elastic compression. *Journal of Vascular Surgery, 44,* 803-808.

Nemeth, K. A., Graham, I. D., & Harrison, M. B. (2003a). The measurement of leg ulcer pain: Identification and appraisal of pain assessment tools. *Advances in Skin & Wound Care, 16,* 260-267.

Nemeth, K. A., Harrison, M. B., Graham, I. D., & Burke, S. (2003b). Pain in pure and mixed aetiology venous leg ulcers: a three-phase point prevalence study. *Journal of Wound Care, 12,* 336-340.

Noonan, L. & Burge, S. M. (1998). Venous leg ulcers: Is pain a problem? *Phebology, 13,* 14-19.

Orfila, F., Ferrer, M., Lamarca, R., Tebe, C., Domingo-Salvany, A., & Alonso, J. (2006). Gender differences in health-related quality of life among the elderly: The role of objective functional capacity and chronic conditions. *Social Science & Medicine, 63,* 2367-2380.

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

Phaladze, N. A., Human, S., Dlamini, S. B., Hulela, E. B., Mahlubi Hadebe, I., Sukati, N. A. et al. (2005). Quality of life and the concept of "living well" with HIV/AIDS in sub-Saharan africa. *Journal of Nursing Scholarship, 37,* 120-126.

Phillips, T., Stanton, B., Provan, A., & Lew, R. (1994). A study of the impact of leg ulcers on quality of life: Financial, social and psychologic implications. *Journal of the American Academy of Dermatology, 31,* 49-53.

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,* 227-239.

Portillo, C. J., Mendez, M. R., Holzemer, W. L., & Corless, I. B. (2005). Quality of life of ethnic minority persons living with HIV/AIDS. *The Journal of Multicultural Nursing & Health, 11,* 31-37.

Price, P. & Harding, K. (1996). Measuring Health-related quality of life in patients with chronic leg ulcers. *Wounds, 8,* 91-94.

Revicki, D. A., Osoba, D., Fairclough, D., Barofsky, I., Berzon, R., Leidy, N. K. et al. (2000). Recommendations on health-related quality of life research to support labeling and promotional claims in the United States. *Quality of .Life Research, 9,* 887-900.

Ribu, L., Hanestad, B. R., Mourn, T., Birkeland, K., & Rustoen, T. (2008). Health-related quality of life among patients with diabetes and foot ulcers: association with demographic and clinical characteristics. *Journal of Diabetes and its Complications, 21,* 227-236.

RNAO (2007). Assessment and management of venous leg ulcers. RNAO Nursing Best Practices Guidelines Program [On-line].

Royal College of Nurses (2000). *The Natrional Sentinel Audit Project for the Management of Venous Leg Ulcers*. University of Leicester: RCN Publishing Company.

Royal College of Nurses (2006). *The nursing management of patients with venous leg ulcers*. (2nd ed.) Oxford: RCN Institute.

Serlin, R. C., Mendoza, T. R., Nakamura, Y., Edwards, K. R., & Cleeland, C. S. (1995). When is cancer pain mild, moderate or severe? Grading pain severity by its interference with function. *Pain, 61,* 277-284.

Sevenhuysen, G. P. & Trumble-Waddell, J. (1997). A new perspective on quality of life. *Journal of Clinical Epidemiology, 50,* 231-232.

Sousa, K. H., Holzemer, W. L., Henry, S. B., & Slaughter, R. (1999). Dimensions of health-related quality of life in persons living with HIV disease. *Journal of Advanced Nursing, 29,* 178-187.

Sousa, K. H. & Kwok, O. M. (2006). Putting wilson and cleary to the test: Analysis of a HRQOL conceptual model using structural equation modeling. *Quality of Life Research, 15,* 725-737.

Sousa, K. H. & Williamson, A. (2003). Symptom status and health-related quality of life: clinical relevance. *Journal of Advanced Nursing, 42,* 571-577.

Stewart, A. L., Greenfield, S., Hays, R. D., Wells, K., Rogers, W. H., Berry, S. D. et al. (1988). Functional status and well-being of patients with chronic conditions. *JAMA, 262,* 907-913.

Sullivan, M. D., Kempen, G. I. J. M., Van Sonderen, E., & Ormel, J. (2000). Models of health-related quality of life in a population of community-dwelling Dutch elderly. *Quality of Life Research, 9,* 801-810.

Van Hecke, A., Grypdonck, M., & Defloor, T. (2008). Guidelines fo rthe management of venous leg ulcers: a gap analysis. *Journal of Evaluation in Clinical Practice, 14,* 812-822.

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

Walters, S. J., Morrell, C. J., & Dixon, S. (1999). Measuring health-related quality of life in patients with venous leg ulcers. *Quality of Life Research, 8,* 327-336.

Ware, J. E. (2004). SF-36 Health Survey Update. In M.E.Maruish (Ed.), *The use of psychological testing for planning and outcomes assessment* (3rd ed., pp. 693-718). Lawrence Erlbaum Associates.

Ware, J. E. & Sherbourne, C. D. (1992). The MOS 36-item short-form health survey (SF-36),I: conceptual framework and time selection. *Medical Care, 30,* 473-483.

Wilson, I. B. & Cleary, P. D. (1995). Linking clinical variables with health-related quality of life. A conceptual model of patient outcomes. *JAMA, 273,* 59-65.

Wilson, I. B. & Cleary, P. D. (1996). Clinical predictors of functioning in persons with acquired immunodeficiency syndrome. *Medical Care, 34,* 610-623.

Wilson, I. B. & Cleary, P. D. (1997). Clinical predictors of declines in physical functioning in persons with AIDS: results of a longitudinal study. *Journal of Acquired Immune Deficiency Syndrome and Human Retrovirology, 16,* 343-349.

Wissing, U., Ek, A. C., & Unosson, M. (2002). Life situation and function in elderly people with and without leg ulcers. *Scandinavian Journal of Caring Science, 16,* 59-65.

Woo, K., Lo, C., Afasaneh, A., Queen, D., Rothman, A., Woodbury, G. et al. (2006). An audit of leg and foot ulcer care in an Ontario Community Care Access Centre. *Wound Care Canada, 5,* S17-S27.

Woodbury, G., Houghton, P. E., Campbell, K. E., & Keast, D. H. (2004). Development, validity, reliability, and responsiveness of a new leg ulcer measurement tool. *Advances in Skin & Wound Care, 17,* 187-196