PAIN ASSESSMENT IN THE ELDERLY: A PSYCHOMETRIC EVALUATION OF SELF-REPORT AND BEHAVIORAL METHODS

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ABSTRACT

Pain Assessment in the Elderly: A Psychometric Evaluation of Self-Report and Behavioural Methods

Limited research has been done that examines appropriate and reliable methods to assess for pain in the elderly population. For the cognitively impaired elderly, pain assessment is further complicated by their limited communication abilities. Reliable and clinically feasible methods are desperately needed to assess pain so that it can be managed appropriately.

The purpose of this study was to examine the psychometric properties (i.e., test-retest and interrater reliability, criterion concurrent validity) of three verbal pain assessment tools (i.e., Faces scale, numerical rating scale, present pain intensity scale) and a behavioural pain assessment scale within the elderly population. This measurement study used a repeated measures design to examine the reliability and validity of these pain assessment tools across four groups of elderly participants: 1) cognitively intact, 2) mildly cognitively impaired, 3) moderately cognitively impaired, and 4) extremely cognitively impaired, using a nonrandom stratified sample of 130 elderly residents who live in long term care.

The findings support the test-retest and interrater reliability of the behavioural pain assessment tool across all four groups of the elderly whereas the same measures of reliability for the verbal pain assessment tools decrease with increasing cognitive impairment. However, the majority of elderly with mild to moderate cognitive impairment were able to complete at least one of the verbal pain assessment tools. The

Present Pain Intensity scale had the strongest criterion concurrent validity for the elderly with moderate cognitive impairment (r=0.64, p=0.001). The findings are discussed in relation to its clinical and research implications.

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CHAPTER 1

BACKGROUND

The elderly are at risk for experiencing pain considering that up to 80% of elderly people have at least one chronic health problem (Harkins, 1988a). Pain has been associated with various chronic health problems, including degenerative joint disease, osteoarthritis, skin ulcers, back pain, cancer, angina, neuralgia, diabetes, chronic sinusitis, and injuries sustained from falls and fractures (Ferrell, 1996; Marzinski, 1991; Melding, 1991; Saxon, 1991). Furthermore, the most frequently reported problems associated with pain were poor functional competence, depression, loneliness, impaired mobility, sleep disturbance, anxiety, and disatisfaction with life (Ferrell et. al, 1990; Ross & Crook, 1998; Witte, 1989).

The results of numerous studies have found high rates of pain in the elderly population, ranging from 30-80% (Desbiens et al., 1997; Ferrell, Ferrell, & Osterweil, 1990; Roy & Thomas, 1987; Simons & Malabar, 1995; Thomas & Roy, 1988). Simons and Malabar (1995) found that 78% of elderly patients experienced pain at some time during their hospital stay. In another study, 71% of nursing home residents complained of pain (Ferrell et al., 1990). Of the residents with pain, 34% indicated they lived with constant pain and 66% reported intermittent pain. In a random survey of 500 households, the morbidity associated with pain was about two times greater in subjects over age 60 (250 per thousand) compared to subjects under age 60 (125 per thousand) (Crook, Rideout & Brown, 1984). More recently, over 75% of elderly recipients of home nursing services reported that they had experienced pain within the 2 weeks prior to the interview (Ross & Crook, 1998).

These studies indicate that pain is a serious problem in the elderly. Yet, limited research has been done that examines the psychometric properties of pain assessment methods for the elderly, especially those with cognitive impairment. For the cognitively impaired elderly, pain assessment is further complicated by their limited communication abilities. Inaccurate assessments of pain intensity in the cognitively impaired elderly can lead to unnecessary pain and suffering which may compromise their remaining limited abilities. Reliable and clinically feasible methods are desperately needed to assess for pain so that pain can be managed appropriately.

Purpose and Objectives of the Study

The purpose of this study is to examine, within the elderly population, the psychometric properties of three self-report pain assessment tools that have been developed for use within other populations (e.g., children, adults) as well as a behavioral observation tool. The rationale for this approach is: (1) to provide support for the use of pain assessment tools with acceptable psychometric properties that are feasible for use in the clinical setting, and (2) to provide direction for future education of direct care staff about pain assessment in the elderly.

The specific objectives of this measurement study are:

1. To examine the test-retest reliability of four pain assessment scales across four groups of elderly residents: (1) cognitively intact, (2) mildly cognitively impaired, (3) moderately cognitively impaired, and (4) extremely cognitively impaired elderly.
2. To examine the interrater reliability of a behavioral assessment tool for pain across the same four groups of elderly residents.
3. To examine the concurrent validity of three verbal pain intensity scales and a behavioral assessment tool across the same four groups of elderly residents.
4. To examine the completion rates of three verbal pain assessment scales across the same four groups of elderly residents.
5. To evaluate the accuracy of self-report skills of the same four groups of elderly residents.

LITERATURE REVIEW

<u>Measurement Theories</u>

Measurement theories are essential to guide investigators in their pursuit of knowledge. However, this pursuit is complicated when the object of interest is not tangible, but rather, is a subjective state, such as pain. Moreover, the growing interest in research that is conducted in natural settings necessitates unique and creative approaches to measure these subjective states in an accurate and consistent manner.

Classical true-score theory and generalizability theory have been developed to provide frameworks for the measurement of traits, behaviors, or subjective states, such as pain. These measurement theories are described below along with a description of reliability as it relates to each theory. Finally, the concept of validity will be addressed, with particular emphasis on criterion concurrent validity.

Classical True-Score Theory

Classical true-score theory describes how errors of measurement can influence observed scores (Allen & Yen, 1979). The main assumption of this theory is that X = T+E where X is an observed score at any single testing time, T represents the stable true-score, and E is the random error of measurement. The "X" part of the equation is the only observable or measurable entity, whereas the true score and error score are unobservable theoretical constructs (Allen & Yen, 1979). In essence, the best estimate of the true-score is derived from the grand average of an infinite number of measurements; the more measurements the better.

Unfortunately, random error in measurement causes obtained scores to differ from the true scores on a random basis and it is expected that such random errors are normally distributed about the true scores (Nunnally, 1970). The standard error of measurement (s.e.m.) is the standard deviation of a set of measures of the same event or object; the larger the s.e.m., the less accurate the measurement (Cronbach, 1990). To calculate the error variance, the s.e.m. is squared.

The main problem in this formulation is that it is virtually impossible to ascertain the amount of variation of a measurement that is due to error as opposed to the amount of variation that is due to real changes in what is being measured. Moreover, the effects of biases in data collection, such as the influences of the individual observer or the passage of time, cannot be separated, but rather, are clumped together in the error term (E).

Cronbach states that, "only after the universe is defined can we say which sources of variance count as error" (Cronbach, 1990, p. 195).

Reliability

Historically, the classical true-score theory has provided the basis for the calculations of reliability. Reliability is concerned with the precision of measurement regardless of what is measured (Nunnally, 1970). Other possible synonyms of reliability that are found in the literature are reproducibility, dependability, agreement, stability, repeatability, and consistency (Maslany & Weston, 1977; Nunnally, 1970; Streiner & Norman, 1995). There are many factors that can contribute to unreliability such as subjects' states (e.g., mood, fatigue, attention), observer bias, problems with instruments (e.g., poorly worded questions, level of difficulty), and situational conditions (e.g., room temperature, test administration) (Maslany & Weston, 1977).

Various types of reliability have been established. For the purposes of this research study, two different types will be described (i.e., interrater, test-retest).

Interrater reliability. Interrater reliability refers to the degree to which two raters or observers, operating independently, assign the same ratings for an attribute being measured (Nunnally, 1970). The true score would reflect real differences, but the error would reflect differences between the raters in their use of the scale, along with random error (Mitchell, 1979).

Test-retest reliability. Test-retest reliability assesses the stability of an instrument by correlating the scores obtained on repeated administrations (Nunnally, 1970). The true score reflects some stable trait or behavior, while the error includes random fluctuations of subject behavior, and also, real changes in subjects that have occurred between the administrations of the instrument (Mitchell, 1979). One disadvantage of this type of reliability is the possibility of the carry-over effect, which is the effect of memory of responses from the first testing time to the second testing time (Allen & Yen, 1979). A solution to this problem would be to increase the length of time between testing times. Therefore, an interval of time of 48 hours between testing times is recommended since the effects due to changes in resident situations as well as effects due to memory of previous testing times should be minimized.

Reliability Coefficient

The reliability coefficient is based on classical true-score theory and is extended from the assumption that X = True-score + Error, as described earlier. That is,

True-score variance = Observed-score variance - Error Variance

so that,

$$r = \frac{\text{True-score variance}}{\text{Observed-score variance}} \quad \text{or} \quad \frac{\text{True-score variance}}{\text{True-score + Error variance}}$$

There are numerous ways to calculate the reliability coefficient which consequently, has created a great deal of confusion in the literature. These calculations are aimed at determining what proportion of the variability in a measure represents true variance and what proportion represents error variance (Maslany & Weston, 1977). The error variance includes the real error (e.g., testing environment, mental state of resident) plus the error associated with other sources of variation (i.e., within and between observers, changes between two testing times) depending on the method used to obtain the two scores (Mitchell, 1979). The wider the spread of obtained scores about the true scores, the more error is involved in using the instrument (Nunnally, 1970).

It is important to note that, for a given level of error variance, an instrument will have a lower reliability when it is used on a homogenous group of subjects than it will when it is used on a more heterogenous group (Mitchell, 1979). For example, if the error variance is 10 and the true score variance is 10, the reliability of the instrument is 10/20 or .50. But if the error variance is 10 and the true score variance is 40, the reliability of the instrument is 40/50 or .80. Therefore, to obtain a higher reliability coefficient, it is recommended that a heterogenous group of subjects be used.

Generalizability Theory

Generalizability theory provides a framework for assessing the dependability of a measure (Cronbach, Gleser, Nanda & Rajaratnam, 1972). It is an extension of classical true-score theory by recognizing and estimating the magnitude of the multiple sources of measurement error (Shavelson, Webb & Rowley, 1989). It differs from classical true-score theory in that it decomposes the error variance into separate sources of variation (i.e., observer, day, and individual variances). In this way, generalizability theory provides a more useful approach to measure subjective states that are inherently variable, such as pain, because it allows for individual differences among observers or raters, and it also allows for variation of the state or behavior depending on the time or day. More importantly, it can tease out these variations so that the investigator can analyze each source of variation separately, minimizing the error term.

In classical true-score theory, this separation of variances according to each source is not possible, but rather, they are all clumped together to form the error term, which provides essentially little meaning in research that deals with humans. Generalizability theory, however, provides a more meaningful framework to deal with research in the natural settings. For example, an investigator who is trying to measure pain in elderly residents who live in long term care settings would want to generalize broadly - across raters, occasions, and residents. In this manner, the major sources of variation in the measurement of pain can be examined simultaneously and separately along with the individual differences among the residents themselves.

These potential major sources of variation are called facets of generalizability. Each facet is analyzed separately using an analysis of variance, so that each facet's contribution to the overall variation in the set of test scores can be computed, which is called a variance component (Cronbach, 1990). In addition to each facet's variance component, variance components could be computed for each of the possible interactions of these facets (i.e., residents X observers, residents X occasions, observers X occasions). The interaction among all the facets (i.e., resident X observer X occasion) is confounded with the residual error and is called the error term.

Generalizability Coefficient

A generalizability coefficient is an Intraclass Correlation Coefficient (ICC) and it extends the classical definition of reliability (Cronbach, 1990; Mitchell, 1979; Shrout & Fleiss, 1979). The ICC is used as an index of the reliability of ratings (Lahey, Downey & Saal, 1983). The generalizability coefficient is similar to the reliability coefficient in terms of its interpretation, however, the generalizability coefficient is based on a particular measurement design that allows for the evaluation of multiple sources of variation (Streiner & Norman, 1995). For example, interrater reliability is concerned with variance that results from the rater or observer who is measuring the object of interest. Test-retest reliability is concerned with the variance that results from fluctuations in time or day.

To construct a generalizability coefficient, the numerator of the coefficient contains the variance due to residents and all interactions between residents and any factors over which one does not want to generalize (Streiner & Norman, 1995). The denominator contains variance due to residents, interactions between residents and all other factors, and the random error term. For example, in examining interrater reliability, the interaction of occasion is incidental, so therefore, it belongs in the numerator of the generalizability coefficient along with variance due to residents. However, the interaction of observer is important in examining interrater reliability so the variance due to observer would not be included in the numerator. The denominator of the coefficient includes all the variance components, each interaction among these components along with the error term.

Similar to the reliability coefficient, a more heterogenous group will yield a higher generalizability coefficient. Specifically, a sample of subjects with greater variability on the trait being measured will yield a higher generalizability coefficient than will a sample of subjects with lesser variability on the trait (Mitchell, 1979). Therefore, in measuring pain in a group of elderly residents, it is recommended to use subjects with a variable amount of pain, from no pain to a great deal of pain, to yield a higher generalizability coefficient.

Validity

In addition to reliability, validity is equally important in the measurement process. Validity is concerned with the degree to which an instrument measures what it is supposed to be measuring (Nunnally, 1970). Like reliability, it is difficult to assess the validity of an instrument when a hypothetical construct, such as pain, is being measured. However, validity testing of an instrument is usually an ongoing process and it is more difficult to ascertain.

It is important to note that an instrument which is valid is usually reliable as well. However, the converse is not true; an instrument may be highly reliable but not valid (Nunnally, 1970). Another important aspect of validity testing is that an instrument, which has been shown to have high validity in one situation, may not be valid in other kinds of situations. For example, a behavioral observation tool that is a valid measure to assess pain in the healthy adult population may not be a valid measure to assess pain in the cognitively impaired elderly population. This tool will need to undergo further validity testing in each new situation for which it is used.

There are many forms of validity testing, such as content, construct and criterion. For the purposes of this study, criterion validity will be described.

Criterion validity. Criterion validity is the correlation of a scale with some other measure of the trait, ideally a 'gold standard' which has been shown to have strong reliability and validity (Streiner & Norman, 1995). Criterion validity can either be concurrent or predictive. Criterion concurrent validity involves the correlation of a scale with a gold standard when both are measured simultaneously. Predictive criterion validity refers to the correlation of a scale with a gold standard measured at a future date. The proposed study will address criterion concurrent validity.

In summary, measurement theories have guided researchers in their pursuit of knowledge. Historically, classical true-score theory has been widely used in the measurement of traits, characteristics, and behaviors. However, its abstract nature proves troublesome and offers little meaning in the human sciences. Generalizability theory has provided a method that is more conducive to research that involves humans in natural settings and it allows multiple sources of variance to be examined separately. Reliability and validity are essential components in the measurement process, and are particularly important when measuring subjective states such as pain. Finally, a more heterogenous sample will yield a higher generalizability coefficient on the subjective state that is being measured, such as pain.

Pain Theories

Along with these measurement principles, it is also important to have an understanding of pain mechanisms; both will provide some direction in the measurement of pain in the elderly. Major developments in knowledge about pain mechanisms have occurred over the past few decades. Selected theories that have made substantial contributions to the understanding and management of pain include the specificity and gate control theories.

Specificity Theory

The specificity theory of pain reflects one of the first attempts to understand pain. In fact, it originates in the early nineteenth century with Descartes, where the concept of a pain pathway was linked between the periphery of the body and higher centers in the brain (IASP, 1997). According to Livingston (1943), specificity, or what he terms, the "law of specific nerve energies", means that "particular nerves subserve special functions for which they are specifically adapted" (p. 28). He questioned, though, what is meant by the "specific unit", that is, the nerve ending, the neuron, or the "entire conducting mechanism for each kind of sensation" (p. 30).

In this theory it is postulated that, after an injury to body tissue has occurred, peripheral sensory receptors are stimulated, eliciting a pain impulse. This impulse travels via the spinal cord and the thalamus, to sensory areas of the brain. The amount of pain experienced is directly related to the amount of tissue damage incurred. A key aspect of this theory is that pain is represented in the brain as a one-to-one correspondence with specific nerve fibers from certain parts of the body (Saxon, 1991). Although this theory is not considered to be accurate in its representation of pain by most current pain experts, it still guides the thinking of some health care professionals and has been noted as forming the basis of the medical model (Hayes, 1995).

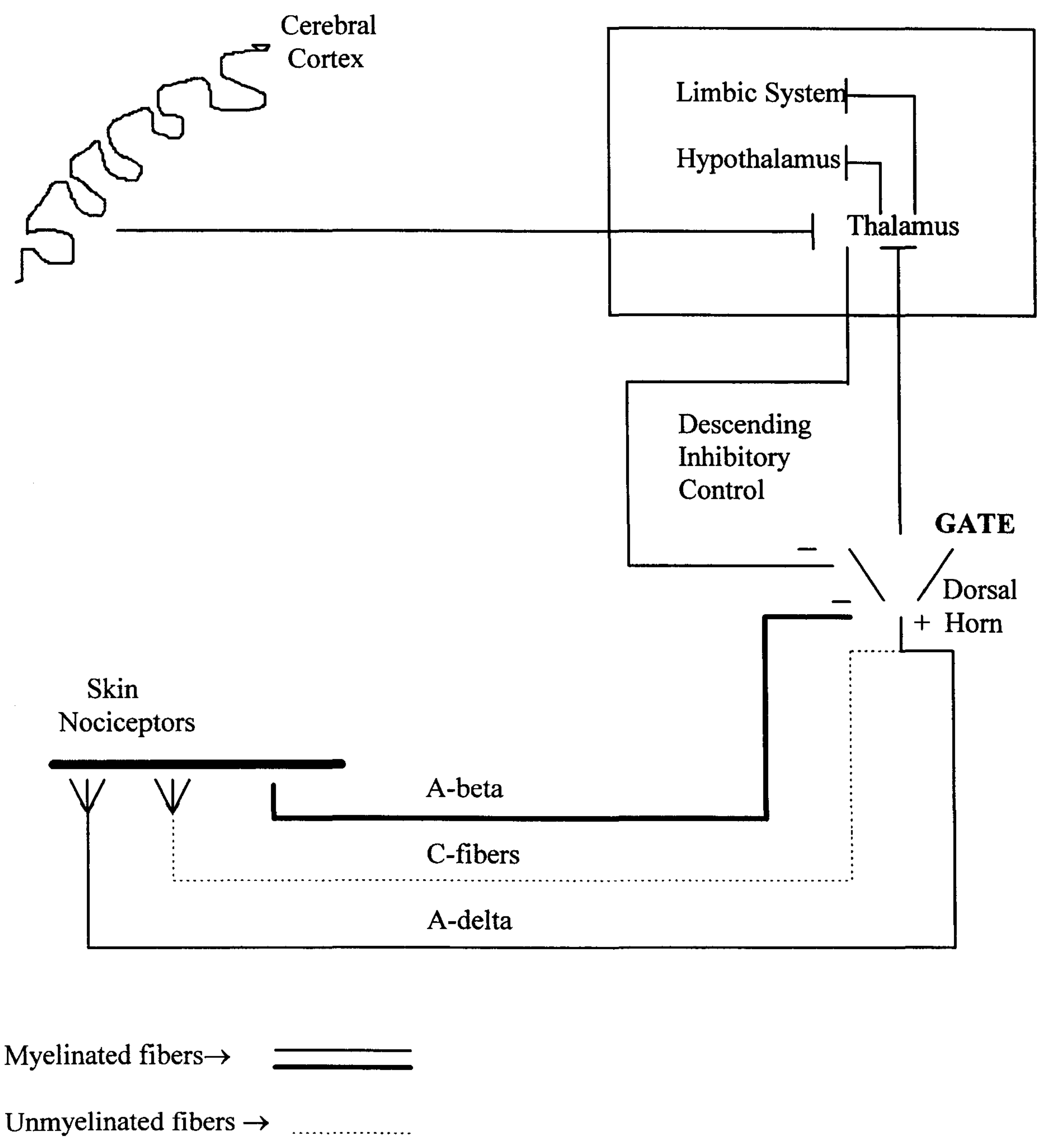
Within this simplistic theory of pain, the management of pain is limited to purely biophysical approaches, using a variety of surgical and pharmacological interventions, in attempts to interrupt the pain impulse. In the management of acute pain, these interventions have proved helpful. However, they have not been as effective in the management of chronic pain. In fact, within this narrow mindset, pain without a discernible physical cause, is not realized, and likely, not treated.

Gate Control Theory

Melzack and Wall's (1965, 1973, 1983) gate control theory, has built upon the specificity theory in attempts to incorporate other factors that influence pain perception and its response, including sensory, motivational, affective, and cognitive aspects. This revolutionary theory offered a complex framework for understanding and managing the multitude of interactions that occur with both acute and chronic pain. For instance, this theory provided some explanation for the influence of various factors on pain perception such as cultural differences, past experience, family attitudes, depression, anxiety, distraction, and placebo effects. The gate control theory has proven useful in providing some rationale for the variability of pain perception among individuals, which could not be explained by the specificity theory.

According to Melzack and Wall (1983), the principal structures of the nervous system that are involved in pain perception are: skin receptors, peripheral nerves, spinal cord neurons and their associated fiber tracts, the thalamus, limbic system, and the cerebral cortex (Escobar, 1985; see Figure 1). There are different kinds of skin receptors; those that respond to pain stimuli are called nociceptors. Nociceptors are terminals of the myelinated A-delta nerve fibers which transmit the immediate, sharp pain sensation, and the smaller unmyelinated C-fibers which transmit the slower, dull pain sensations. The larger, myelinated A-beta nerve fibers transmit other sensory impulses.

Figure 1: **The Gate Control Theory**



Adapted from: Escobar, P. Management of chronic pain. *Nurse Pract 1995;* 10: 24-31.

Melzack, R., and Wall, P. (1983). The Challenge of Pain. New York: Basic Books, Inc., Publishers.

After nociception occurs, an impulse travels via the peripheral nerve tract to the substantia gelatinosa in the dorsal horn area of the spinal cord (Melzack & Wall, 1983). Within this area, there is a gating mechanism, whereby pain impulses can be modulated in various ways. Stimulation of the large A-beta fibers tends to inhibit transmission (closes gate), whereas stimulation of the smaller A-delta and C-fibers tends to facilitate transmission (opens gate). Descending inhibitory control impulses from the brain also affect the gating mechanism. These impulses involve the interaction of multiple brain centers (e.g., reticular formation, thalamus, limbic system, cerebral cortex), and transmit information relating to attention, past experience, emotional states, and behaviors of a painful experience. However, this theory is not able to explain exact details of these interactions. Moreover, certain painful conditions elude explanation by the gate control theory (e.g., phantom limb pain). Nonetheless, this theory continues to provide some explanation of the association among psychological and cognitive variables and the perception and modulation of pain. Furthermore, it has stimulated new areas for research in attempts to understand in more definitive detail the complexities of painful experiences.

The manner in which pain is managed has been greatly influenced by the gate control theory (McCaffery & Pasero, 1999; Melzack & Wall, 1983; Saxon, 1991). In light of the inhibitory effects of the large A-beta fibers on the gating mechanism, many types of cutaneous stimulation techniques (e.g., massage, rubbing, heat and cold therapies) are used as pain control interventions, since these techniques stimulate these nerve fibers. In this manner, the A-beta fibers enable the "pain gate" to close and counteract the pain impulses transmitted by the other, smaller nerve fibers, with the goal of reducing the amount of pain experienced.

Distraction and imagery techniques are methods used to control pain by modulating sensory input. These techniques increase the sensory input for the brainstem, which exerts an inhibitory influence on the spinal gate-control system and on higher brain systems (McCaffery & Pasero, 1999; Melzack & Wall, 1983; Saxon, 1991). The gate control theory offers rationale for these dated pain control techniques, and consequently, they have been widely used and accepted by society at large and health care professionals in particular (Melzack & Wall, 1983).

Other interventions related to increasing a person's sense of control over his/her pain have also been supported by the gate control theory (McCaffery & Pasero, 1999; Melzack & Wall, 1983; Saxon, 1991). Education and strategies designed to address effective coping techniques (e.g., relaxation, use of pain medication) and participation in pain-inducing activities (e.g., debridement of burn tissue) can offer individuals a sense of control over their pain. Although the exact mechanisms are unclear, achieving a sense of control appears to diminish both anxiety and pain by the transmission of inhibitory impulses from the cerebral cortex and thalamus (Melzack & Wall, 1983).

Despite its shortcomings, the gate control theory is useful in understanding the physiological and psychological mechanisms associated with pain perception. In addition, it provides some scientific rationale for the development and implementation of various pain management techniques that have been shown to be effective in reducing pain. However, questions have arisen surrounding the extent to which these pain mechanisms remain intact throughout the aging process. That is, what is the influence of aging on these pain mechanisms? More specifically, is there a change in sensitivity to pain with aging?

Effects of Aging on Pain Sensitivity

It has been suggested that there is an age-related decline in pain sensitivity and perception. In fact, in Critchely's (1931) classic article, he states that older persons appear to tolerate minor surgical procedures and dental extractions with little or no discomfort. Fortunately, these generalizations have been, and continue to be, challenged by researchers using pain-induced laboratory investigations (see Appendix A).

According to Harkins (1988a), reduced pain sensitivity associated with aging would be indicated by increased threshold, decreased tolerance, or perhaps, reduced ability to discriminate among noxious stimuli, using experimental studies. Pain threshold is the most common measurement and is defined as "the lowest stimulus value at which the person reports that the stimulation feels painful", whereas pain tolerance is "the lowest stimulus level at which the subject withdraws or asks to have the stimulation stopped" (Melzack & Wall, 1983, p. 30). These investigations involve a variety of stimuli, for example, electrical, thermal, and mechanical stimulators.

Pain Threshold

Most of the studies that were reviewed measure pain thresholds using thermal methods (e.g., hand-held computer-controlled contact thermode, radiant heat produced by a projection lamp that focuses on skin blackened with ink) on various sites of the body (e.g., hand, forearm, forehead, sole of foot). Although the exact methods varied, the majority of studies showed a general increase in pain thresholds for the elderly, that is, a decrease in pain sensitivity (Chakour, Gibson, Bradbeer & Helme, 1996; Harkins, Price & Martelli, 1986; Procacci et al., 1974; Sherman & Robillard, 1960). However, Procacci (1974) claims that the effects of aging can cause changes in the skin (e.g., thinning), that may result in increased dispersion of thermal energy and/or increased nociceptor thresholds. As a result, the measurement of pain thresholds would show false findings of lower pain sensitivity in the elderly. Therefore, thermal methods may not provide an accurate test to determine pain sensitivity in the elderly.

Other noxious stimuli have been used, in addition to those using thermal methods, in the measurement of pain thresholds of the elderly. However, the results of studies that use these other stimuli (e.g., electrical, mechanical) are inconsistent. In two separate studies Harkins and Chapman (1976, 1977) examined the pain threshold in both the young and elderly using electrical stimulation of healthy, unfilled teeth. Both of their studies revealed no significant differences in threshold between the young and elderly groups. However, the elderly were poorer at discriminating between low and high intensity levels, suggesting a possible age-related deficit in the central nervous system (Harkins & Chapman, 1977).

In contrast to Harkins and Chapman's (1976, 1977) studies, two other studies using electrical stimulation, showed that the pain threshold increased with age, using annular electrodes on the forearm (Neri and Agazzani, 1984; Tucker, Andrew, Ogle and Davison, 1989). Kenshalo (1986) found similar results using two types of mechanical stimulation (i.e., tactile and vibration) on the hand and foot. In this study, the elderly were less sensitive to these noxious stimuli when compared to young individuals.

The elevated pain thresholds in the elderly have been speculated to be due to an age-related slowing in the cognitive processing of noxious information (Helme & Gibson, 1997; Neri and Agazzani, 1984). Specifically, Helme and Gibson (1997) suggest that, with aging, there is reduced cortical activation in response to noxious input. This speculation could also help explain the elderly's poor ability of discriminating varying pain intensities, as noted by Harkins and Chapman (1976, 1977). They also suggest that aging may be associated with a "reaction time slowing" of the cognitive processes used to discriminate pain, where the elderly feel the pain but need more time to report it as compared to younger individuals. Further research is needed to confirm these speculative effects of aging on pain mechanisms, especially those occurring at the cortical level.

Along with proposed changes in the pain mechanisms involving the central nervous system, age-related changes of the peripheral mechanisms have also been postulated. Age-related effects on the functioning of both the C and A-delta nerve fibers have been proposed. The integrity of the C-fibers can be assessed with the axon reflex flare; that is, larger flares are associated with greater pain (Gagliese & Melzack, 1997; Helme & McKernan, 1985). Helme and McKernan (1985), using a chemical stimulant (capsaicin), found a decreased flare response in the elderly compared to younger individuals, suggesting a decrease in (1) the collateral nerve network and/or (2) the distribution of each innervated vessel in the skin. However, the effects of aging (e.g., thinning of skin, variable skin temperature) can also contribute to the flare response. Therefore, these results should be taken with caution.

Recently, the functioning of the A-delta fibers and its relationship to aging, has also been studied. Using a nerve compression block of the A-delta fiber, younger individuals exhibited significant increases in thermal pain threshold (decreased pain sensitivity), while pain threshold remained relatively stable for the elderly (Chakour, Gibson, Bradbeer & Helme, 1996). This finding suggests that there is an age-related decrease in the functioning of the A-delta fiber in pain perception. However, the study used a small, non representative sample of volunteers, that included only healthy subjects; whereas chronic illness in the elderly is estimated to occur in 80% of the elderly (Harkins, 1988a). Moreover, the study design did not incorporate any blinding techniques which may have influenced the participants' responses.

It is possible that aging may have some effects on the C and A-delta nerve fibers in the perception of pain. However, these limited findings need to be confirmed in future study. In the meantime, the significance and experience of pain for older persons should not be underestimated.

Pain Tolerance

In addition to pain threshold, pain tolerance which is, "the lowest stimulus level at which the subject withdraws or asks to have the stimulation stopped", is also used as a means to determine pain sensitivity (Melzack & Wall, 1983, p. 30). Of the studies reviewed, four of them examined the effects of aging on pain tolerance.

The majority of these studies showed a decreased pain tolerance for the elderly, compared to younger individuals, using mechanical pressure on the Achilles tendon to elicit deep pain (Woodrow, Friedman, Siegelaub & Collen, 1972), the cold pressor test (immersing the hand and forearm in cold water and crushed ice with a temperature range of 1-2°C) (Walsh, Schoenfeld, Ramamurthy & Hoffman, 1989), and electrical stimulation of fingers (Collins & Stone, 1966). However, Neri and Agazzani (1984), using similar methods, found no age-related differences on pain tolerance.

The findings of these experimental studies relating to pain tolerance indicate that the elderly are generally more sensitive to painful stimuli than younger individuals. Although these findings are not the focus of this paper, pain tolerance seems to be influenced by other factors, such as gender and culture. It is important to realize the influences of these other variables, in addition to aging itself, when examining the effects of aging on pain tolerance specifically, and pain sensitivity in general.

In summary, although the results from the pain tolerance studies indicate a trend towards greater pain sensitivity in the elderly, this trend is not supported in the pain threshold studies. Overall, the results of the studies relating to pain sensitivity are inconsistent; some indicate a decrease (Chakour et al., 1996; Harkins et al., 1986; Tucker et al., 1989), an increase (Collins & Stone, 1966; Walsh et al., 1989; Woodrow et al., 1972), while others show no age-related differences in pain sensitivity (Harkins & Chapman, 1976; 1977; Kenshalo, 1986; Notermans, 1966). Furthermore, the conclusions drawn from other reviews on this topic, are inconsistent (Ferrell, 1991; Gagliese & Melzack, 1997; Harkins, Kwentus & Price, 1984; Harkins & Price, 1992; Helme &

Gibson, 1997). Therefore, it seems appropriate and prudent that one should assume that pain exists in the elderly population until proven otherwise.

Critical Analysis of Pain Sensitivity Studies

The inconsistencies among the studies reviewed, particularly the ones relating to pain threshold, could be due, in part, to the varied methods (e.g., thermal, electrical, mechanical), the amount and duration of noxious stimulation that was used to induce pain in the laboratory settings, and sampling biases (e.g., paid volunteers, nonrepresentation). Although these studies were conducted in controlled laboratory settings, many possible intervening variables were not controlled for, such as personality type, culture, and sex of the subjects. Moreover, the results of these experimental studies do not lend themselves well to application to the clinical setting. Gagliese and Melzack (1997) state that experimental studies often oversimplify both the acute and chronic pain experience and neglect the important role of psychological and emotional factors. Moreover, the anticipation of an unfamiliar painful experience using strange equipment may influence a subject's response to pain.

In light of the gate control theory, specifically the cognitive-evaluative component, the meaning of the situation can affect the way pain is perceived. In reference to Beecher's (1959) classic wounded soldier example, the meaning of the situation has tremendous impact on the manner that pain is experienced. Beecher found that, civilians whose injuries were less severe than the soldiers incurred, complained of more intense pain and required more morphine to alleviate their pain than the soldiers. The soldiers either denied their pain or had so little that they denied any pain medication.

Pain for the soldier was relief, in that they escaped alive from the battlefield. However, pain for an older person may assume other meanings or fears, such as the need for institutionalization or impending death. In attempts to fight these fears, the elderly may elicit higher pain thresholds or deny mildly- induced pain.

Another issue could be related to an older person's history of accumulated life experiences. Harkins (1988a) states that, old age is characterized by chronic pains which lose their "newness" sometime in the past. For example, an older person who has been plagued with chronic pain for a large part of their life, may perceive the laboratory-induced pain differently than those who are relatively pain-free; chronic pain, could "desensitise" the elderly to additional pain experiences. In contrast, Chapman (1984) suggests that individuals who suffer from chronic pain are more sensitive to pain because of their exaggerated focus on the painful stimulus. This suggestion is consistent with the conclusion drawn from the analysis of the pain tolerance studies in this review; that is, that the elderly are more sensitive to pain than younger individuals.

Moreover, for those who have experienced the pain of labor and/or cancer-related pain, the sensation stimulated by radiant heat using a thermode, may not feel "painful". The elderly constitute a unique group of individuals who may respond differently than their younger counterparts when asked to respond to the exact time when "the stimulation feels painful".

Consequently, Harkins (1996) argues that researchers must consider the effects of response bias when measuring pain in the elderly using experimental studies. In fact, two of his studies (1976, 1977) showed that elderly subjects were significantly biased against reporting their pain thresholds, suggesting the interaction of other attitudinal and judgmental variables. These variables need to be considered when examining age-related differences in pain sensitivity.

Based on this review of the effects of aging on pain sensitivity, Harkins was the first researcher to draw attention to the possible interactive effects of psychological factors in pain perception in these studies. The earlier studies that were reviewed would have been guided by the specificity theory of pain, and therefore, concerned purely with the physiological mechanisms of pain. However, the changes in knowledge about these pain mechanisms that have occurred, stemming from the gate control theory and other physiological findings, are not reflected in the subsequent pain sensitivity studies.

Indeed, future studies are needed to address the psychological and attitudinal variables in the perception of pain in order to accurately measure age-related changes in pain sensitivity. In light of the gate control theory, the motivational, affective, cognitive-evaluative components of pain all need to be systematically examined, specifically among the elderly population to determine their influence on reported pain sensitivity. In this manner, an accurate, and hopefully consistent, representation of the age-related effects on pain sensitivity can be determined.

Effects of Dementia on Pain Mechanisms

The impact of dementia on the mechanisms of pain, traditionally, has been an area avoided by researchers in the area of pain because of its associated complexities. Recently, however, this area has stimulated much speculation and controversy; hopefully, creating momentum for some systematic and thorough research in the near future.

Anecdotal comments about dementia patients pacing the hallways within days following hip surgery has led some nurses to question the validity of pain experienced by these patients. Perhaps, based on the specificity theory of pain, this apparent 'pain-free' state could be explained by a damaged "pain center" in the brain or an interruption in the fixed direct pain pathway, caused by dementia.

However, with increased knowledge of the pain mechanisms that are grounded in the gate control theory, these speculations are somewhat unwarranted. For instance, the idea of a single "pain center" is refuted by Melzack and Wall (1983), as they propose a host of complex and intricate connections of neural synapses that occur in various areas of the brain. Moreover, these pain impulses travel in multiple pathways, rather than a single, direct route. However, the effects of psychological variables on pain perception may be different for a cognitively impaired person, since dementia involves the disturbance of multiple higher cortical functions, including memory, thinking, orientation, comprehension, learning capacity, emotional control, social behavior, and motivation (Farrell, Katz & Helme, 1996).

In light of these changes of higher cortical functions that are associated with dementia, Benedetti et al. (1999) examined pain perception in Alzheimer's disease using phasic (i.e., electrical stimulation) and tonic (i.e., arm ischemia) stimulation, and included both pain threshold and tolerance levels. They found no differences in pain thresholds between Alzheimer's subjects and normal subjects of the same age, whereas an increase in pain tolerance was evident in Alzheimer's subjects. These findings indicate that the sensory-discriminative component of pain is maintained in Alzheimer's patients, while pain tolerance is altered and depends on cognitive and affective factors (Benedetti et al., 1999).

Porter et al. (1996) examined dementia and the response to pain in the elderly. Using a standard venipuncture procedure, they found a blunting of physiologic response (i.e., heart rate) with increasing severity of dementia. In addition, they found an increase in facial expression but it could not be classified by specific emotions. These results indicate that both the experience and reaction to pain are different for the cognitively impaired elderly when compared to the cognitively intact elderly. However, the validity of the proposed painful procedure (i.e., venipuncture) is questioned. That is, this procedure may not produce enough pain to elicit a pain response in the elderly; especially for the cognitively impaired, whose pain experience may not be influenced by typical psychological factors (e.g., anticipation and anxiety).

Nonetheless, these beginning attempts to study pain in the elderly with dementia show some progress towards an understanding of this elusive phenomenon. Critical areas for research in this area are: Does the integrity of the pain mechanisms in the central nervous system diminish with dementia? Do they remain intact but the pain response is altered? What is the role of memory in the experience of pain for dementia patients? Can they discriminate the sensation of pain from the overload of other sensory information?

Melzack and Wall (1973) refer to an experiment that involves the influence of early experience on the perception of pain. In this experiment, dogs who were deprived of normal environmental stimuli throughout their life, failed to respond normally to noxious stimuli (e.g., repeatedly poked noses into a flaming match, endured pinpricks with little evidence of pain). Perhaps, dementia patients respond in a similar manner as a result of severe memory impairment, which decreases their ability to access their accumulated life experiences and appropriate behavioral responses to painful experiences. These questions and speculations merit further thought and investigation to gain a clearer understanding of the unique experience of pain for the elderly with dementia.

Pain Measurement in the Elderly

Defining Pain

The measurement of pain is an arduous task because of its elusive nature. However, important advances in the study of pain, such as the gate control theory, have provided some insight into this phenomenom. The International Association for the Study of Pain (IASP) defined pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (IASP, 1979). This definition has guided the majority of pain research to date. However, it is limiting in scope when dealing with pain conditions that do not produce tissue damage, such as fibromyalgia. Also, it's emphasis appears to be more on the objective rather than the subjective components of pain.

McCaffery (1979) incorporated a more subjective perspective into her definition of pain: " pain is whatever the experiencing person says it is, existing whenever the experiencing person says it does"(p. 8). However, this definition requires a person to have the ability to verbally communicate the experience of pain. How then do we define pain in the nonverbal elderly? On the other hand, there is some speculation about the about the validity of self-reported pain. That is, self-reported pain may be prone to response biases and situational influences (Anand & Craig, 1996). Craig, Prkachin, and Grunau (1992) propose that, nonverbal behavioral information should be used to measure pain, especially when dealing with a nonverbal population, such as the elderly with dementia.

For the purposes of this study, the following operational definition of pain will be used: pain is an unpleasant subjective experience that can be communicated to others through self-report when possible and/or a set of pain behaviors. This definition of pain incorporates the subjective nature of pain and it provides a means for nonverbal populations, such as the elderly with dementia, to express their pain through either self-report or behavioral observation methods.

Pain in the Elderly with Dementia

Marzinski (1991) states that the tragedy of dementia includes the possiblity that the nonverbal elderly will be unable to communicate their pain which may lead to unnecessary suffering. Dementia is characterized by a decline in intellectual function and global cognitive function (e.g., memory impairment, impairment in abstract thinking, judgement, and language use, diminished ability to perform complex physical tasks and to recognize objects or people, personality change) (Office of Technology Assessment Task Force, 1987). The communication of pain often relies on verbal reports. In the case of progressive dementia, such as Alzheimer disease, there are stages of cognitive decline (Reisberg, 1983) with gradual limitation in verbal communication. As dementia progresses, the person will have increasing difficulty with the expression of needs related to painful experiences.

For those elderly with dementia or cognitive impairment, the task of pain measurement can be quite complex. The pain assessment methods described in the literature are varied and often exclude those elderly with dementia. Some methods have focused on verbal or self-reports of pain while others involve the use of nonverbal assessments. If an elderly person is capable of verbally reporting their pain in a reliable and valid fashion, then their voice should be heard. If not, behavioral observation methods should be employed to ensure that their pain is recognized.

Verbal Report

Studies have suggested that patients with mild to moderate cognitive impairment can report their pain using verbal report (Ferrell, Ferrell & Rivera, 1995; Parmelee, Smith & Katz, 1993). For example, Ferrell et al. (1995) found that, in a group of subjects with substantial cognitive impairment, the majority of subjects (83%) could complete at least one of the scales presented. The Present Pain Intensity scale (PPI; Melzack, 1975) had the highest observed completion rate (65%), whereas the visual analogue scale (VAS) had the lowest (44%). Herr and Mobily (1993) also found that the VAS had the highest failure rate (8.2%). In addition, the verbal descriptor scale (VDS), which is similar to the PPI, was ranked as the easiest scale to complete for elderly residents. Next to the VDS, the numerical rating scale (NRS) was ranked as the second easiest tool to use to verbally report pain. Unfortunately, Herr and Mobily (1993) did not include the cognitively impaired elderly in this study.

The results of these studies indicate that the PPI and NRS may be preferred tools to use to assess pain in the elderly. Jensen, Bradley, and Linton (1989) suggest that the elderly have particular difficulty using the VAS because of its demand for abstract thinking and, in consideration of study results, it may not be the best option for pain assessment in this population.

However, the Faces Pain Scale (FPS) may be more promising. Herr, Mobily, Kohout and Wagenaar (1998) evaluated the FPS (Bieri et al., 1990) for use with the elderly. This scale is a series of facial expressions representing different degrees of pain and incorporates components of the four facial actions that have been shown to be associated with pain in adults, including brow lowering, tightening and closing of the eyelids, and nose wrinkling/lip raising (Prkachin, 1992). Although the FPS was not tested with elderly with cognitive impairment, it was shown to have good validity and reliability with those elderly without cognitive impairment. Further testing of the FPS is needed, specifically for use within the cognitively impaired population.

There are limitations to the verbal report of pain. Craig and Prkachin (1983) state that self-reports of pain are carefully monitored, highly obtrusive, and they sensitize people to situational demand and lead to interview bias (Craig & Prkachin, 1983). Craig and Prkachin (1985) further state that self report is subject to voluntary control and hence to underestimating and overestimating. These arguments are well substantiated in the literature that deals with the cognitively intact adult population but they have not been addressed within the elderly population, especially those who live in long term care settings. Still, verbal report remains the most common and useful approach to measure pain for those who are capable.

Although researchers have concluded that verbal report of pain is possible within the cognitively impaired elderly, rigorous testing related to the reliability and validity of these self-reports of pain is lacking. It cannot be assumed that verbal reports are accurate measures of pain simply because they have high completion rates among participants. The ability to understand the questions proposed by the investigator and, in turn, translate a subjective pain experience into an objective verbal report is questionable for the elderly with cognitive impairment. Clearly, more research is needed that addresses the reliability and validity of verbal pain reports within the cognitively impaired elderly along with methods to evaluate the ability to understand the principles underlying these reports.

Self-Report Evaluation

A method to evaluate self-report skills has been developed by Fanurik et al. (1998). In their study, they evaluated the ability of children with mild to extreme cognitive impairment to understand concepts of magnitude and ordinal positions, which are prerequisite skills that are needed in order to complete a verbal report of pain using typical measures. They found that over one third of children with mild cognitive impairment could demonstrate an understanding of magnitude and ordinal position. However, children with a greater level of cognitive impairment did not have this understanding, suggesting that perhaps a simpler scale may be more appropriate for this group of children.

Fanurik's (1998) method of evaluating self-report skills has not been examined within the cognitively impaired elderly population. Future research is needed to examine this method within this elderly group, since they are faced with similar difficulties in understanding concepts of magnitude and ordinal position due to cognitive impairment. This evaluation along with strong research that examines the reliability and validity of verbal report scales will provide some insight when designing approaches to pain assessment in this vulnerable elderly population.

Behavioral Observation Methods

Nonverbal or behavioral observation methods for pain assessment are particularly helpful for individuals who do not have the ability to communicate their pain, such as those elderly with severe dementia. This line of thinking is supported by Anand and Craig (1996) who state that, "pain assessment must be designed to conform to the communication capabilities of the suffering person" (p. 5). Behavior observation methods have been developed in other populations, such as neonates (Grunau & Craig, 1987; Lawrence et al., 1992; Stevens, Johnston, Petryshen & Taddio, 1996), young children (McGrath et al., 1985; McGrath et al., 1998; Merkel et al., 1997), adults (Bonnel & Boureau, 1985; Keefe & Block, 1982; Prkachin & Mercer, 1989; Richards, Nepomuceno, Riles & Suer, 1982; Vlaeyen et al., 1990; Wells, 1990), and animals (Morton & Griffiths, 1985; Soma, 1987).

Changes in facial expression based on anatomical changes of muscles is an accurate measurement of pain (Prkachin, 1992) but feasibility for use in clinical settings still needs to be established. Using the Facial Action Coding System (FACS; Ekman &

Friesen, 1978), Prkachin (1992) found that four facial actions were associated with pain: brow lowering, tightening and closing of the eye lids and nose wrinkling/upper lip raising. LeResche (1982) found similar facial actions for pain using the FACS in the younger adult population. Prkachin, Berzins and Mercer (1994) found that trained individuals' ratings of these four facial actions were highly correlated with self-reports of pain in young adults with pain from a shoulder injury. The authors concluded that untrained observers have a general tendency to underestimate pain when forced to rely purely on expressive behavior to make their judgments.

Solomon, Prkachin and Farewell (1997) developed the FENS (Frown, Eyes close, Nose wrinkle, Squint), which is a shortened clinical version of the FACS behaviors identified by Prkachin (1992) for use with the elderly, excluding those with dementia. The FENS involves a mere 30 minute training session compared to intensive 100 hours of training which is required to use FACS. Solomon (1997) found that, using the FENS, occupational and physical therapy students were significantly more sensitive to subtle facial movements associated with low levels of pain, but not to high levels of pain. Sensitivity could probably be enhanced, through a longer and more complex training procedure, but this approach could limit the clinical utility of the FENS.

Unfortunately, behavioral observations methods in the assessment of pain have not received much attention in the cognitively impaired elderly population. Recently, however, progress has been made within this vulnerable population. Research has identified specific behavioral indicators of pain in the cognitively impaired elderly, such as rapid blinking and other facial expressions, agitation, and aggression, certain body movements, crying, moaning, becoming withdrawn and quiet, guarding of a body part, noisy breathing, negative vocalizations, and fidgeting (Cohen-Mansfield, Billig, Lipson, Rosenthal, & Pawlson, 1990; Hurley et al., 1992; Marzinski, 1991; Mohide, Byles & Chambers, 1983; Parke, 1992).

Behavioral change appears to be the most promising indicator of pain in the nonverbal elderly, but it is very difficult to interpret because change in behavior may be due to pain or to other causes. Unfortunately, the FACS has not been used with the cognitively impaired elderly. With the physical changes that occur with aging in general and dementia in particular, rules for discriminating among particular facial action units may have to be changed. LeResche (1984, p.83) stated that "adaptation of direct facial measurement systems for the elderly is an essential step if research in this area is to progress".

The first attempt to develop a behavioral observation tool for pain assessment in the cognitively impaired elderly was developed by Hurley et al. (1992), which they called the Discomfort Scale for patients with Dementia of the Alzheimer Type (DS-DAT). The nine items that comprise the scale are noisy breathing, negative vocalization, content facial expression, sad facial expression, frightened facial expression, frown, relaxed body language, tense body language, and fidgeting. These items do not appear to be mutually exclusive which may pose some problems in their measurement. In addition, the scoring of the DS-DAT is complicated by using a scoring schema of the frequency, intensity, and duration of each scale item, which may reduce its feasibility for use in clinical settings. Moreover, Hurley et al. (1992) tested the DS-DAT in nonverbal elderly who had discomfort (i.e., fever episodes). However, the concept of discomfort may include pain and/or other internal states related to malaise due to an infection, hunger, depression, or anxiety. Therefore, measurement of discomfort could not be used as the basis for pain interventions such as the administration of an analgesic. Future research is needed to develop an instrument that deals with pain assessment associated with activities of daily living (i.e., transfers, range of motion exercises).

The Pain Assessment in the Communicatively Impaired tool (PACI) has recently been developed for use for those elderly who cannot verbally report their pain, such as the extremely cognitively impaired elderly (Middleton et al., 2001). It incorporates three of the four facial movements used to depict pain as identified by Prkachin (1992) as well as specific body movements (e.g., guarding, rubbing/touching) and sounds (e.g., moan, yell, grunt, cry) that have been associated with pain. There is evidence of strong reliability (Kappa = 0.74 - 0.85) and validity (J. Middleton et al., 2001). This tool is a promising approach for the assessment of pain in the cognitively impaired elderly.

Tools, like the PACI, have many advantages over verbal reports of pain, as described earlier. Specifically, behavioral observation provides a direct sample of behavior which may play a more immediate role in communicating the pain experience (Craig & Prkachin, 1983; Keefe 1989). For staff who lack the skills and time, such as health care aides, behavioral observation may provide a more feasible, less demanding method to assess for pain in the elderly. In fact, nurses reported that nonverbal behaviors were considered to be more salient and easier to use in pain assessment than patient verbalizations about pain (Jacox, 1980). Clearly, future research is needed to address the reliability and validity of behavioral observation methods, especially for use within those populations who lack the communication ability to report their pain, such as the elderly with dementia.

Summary of Literature Review

Generalizability theory provides a useful approach for the measurement of subjective states, such as pain, which is a prevalent problem for the elderly. Advances in pain theories have provided a good understanding of the mechanisms of pain which appear to remain intact throughout the aging process. The elderly with dementia represent a unique group of individuals with whom little pain research has been conducted. However, pain assessment approaches are beginning to be explored with these elderly with dementia in attempts to provide feasible and accurate measurements of their pain levels. Once reliable and valid methods of pain assessment are established, unnecessary suffering for the cognitively impaired elderly can be avoided and their quality of life improved.

Problem Statement

Despite the high rates of pain in the elderly population, the literature review indicates that pain has been understudied, especially for those with dementia. The limited research on pain assessment approaches has often excluded the cognitively impaired elderly. Some studies have suggested that individals with mild to moderate cognitive impairment can report their pain using verbal report (Ferrell, Ferrell & Rivera, 1995; Parmelee, Smith & Katz, 1993). However, none of these studies have addressed the problem of how to assess for the ability to verbally report pain. Without assessing for this ability, it is uncertain whether the pain reports are accurate. The ability to report pain can be assessed using measures of reliability testing, as proposed in this study.

Hypotheses

Test-Retest Reliability

Alternate Hypothesis #1: The test-retest reliability (i.e., two measurement times separated by a 48-hour interval) of the 3 verbal pain assessment scales will be high for the cognitively intact elderly and it will decrease with increasing cognitive impairment.

Alternate Hypothesis #2: The test-retest reliability of the behavioral observation tool (i.e., PACI) will be high and remain relatively constant across all four groups of elderly residents.

Interrater Reliability

Alternate Hypothesis #3: The PACI will be reliable between two raters and the reliability will remain relatively constant across all four groups of elderly residents.

Concurrent Criterion Validity

Alternate Hypothesis #4: The correlations among the four pain assessment scales will be strong for the cognitively intact elderly, but these correlations will decrease with increasing cognitive impairment.

Completion Rates

Alternate Hypothesis #5: The highest completion rates for all the self-report pain assessment scales will be among the cognitively intact elderly, but the completion rates will decrease with increased levels of cognitive impairment.

Self-Report Evaluation

Alternate Hypothesis # 6: The scores on the self-report evaluation will be highest for the cognitively intact elderly and will decrease with increasing cognitive impairment.

CHAPTER 2

METHOD

The proposed measurement study utilized a repeated measures design involving four groups of elderly participants: 1) cognitively intact, 2) mildly cognitively impaired, 3) moderately cognitively impaired, and 4) extremely cognitively impaired. This study examined the reliability (i.e., test-retest, interrater) and validity (i.e.,criterion concurrent) of four different pain assessment scales across all four groups of elderly participants.

Sample

Data were collected at a 240-bed long term care facility. Inclusion criteria for residents in this study were: 65 years and over, male or female, and a resident of a long term care facility for more than three months. Exclusion criteria were: significant visual and/or hearing impairment, and non-English-speaking residents. A nonrandom stratified sample was used in this study.

Sample Size

The sample size needed to answer Hypothesis #1, with an alpha of .05 and 80% power, was 20 for the cognitively intact group (effect size of .6), and 30 for each of the three cognitively impaired groups (effect size of .5), for a total sample of 110 subjects (Donner & Eliasziw, 1987). The sample size needed to address Hypothesis #2, was 20 subjects per group with an alpha of .05 and 80% power, while anticipating a correlation coefficient of .6 or greater, for a total sample size of 80 subjects (Donner & Eliasziw, 1987). The sample size needed to answer Hypothesis #3, while anticipating a reliability of .6 or greater, with an alpha of .05 and 80% power, was 20 observations per group with 2 observers, for a total sample size of 80 subjects (Donner & Eliasziw, 1987). The sample size needed for Hypothesis #4, with an alpha of .05 and 80% power, was 20 subjects for the cognitively intact group (effect size of .6), 30 subjects for the mild cognitively impaired group (effect size of .5), and 40 subjects for each of the moderate and extremely impaired groups (effect size of .4), for a total sample size of 130 subjects (Polit & Hungler, 1997).

Total Sample Size.

Based on these calculations, a total sample size of 130 subjects was required, with 20 subjects in the cognitively intact group, 30 subjects in the mild cognitively impaired group, and 40 subjects in each of the moderate and extremely impaired groups.

Instrumentation

The instruments used for data collection in this study were: a) the Global Deterioration Scale, b) the Pain Assessment for the Communicatively Impaired Elderly, c) the Faces Pain Scale, d) a Numerical Rating Scale, e) the Present Pain Intensity scale, f) a self-report evaluation, and g) a demographic information form. Each of these instruments are described below.

Global Deterioration Scale (GDS). The GDS is an ordinal scale and it was used to group residents according to their stage of dementia. Specifically, residents were screened and classified using the GDS, according to their clinical phase of cognitive decline (Reisberg, Ferris, deLeon & Crook, 1982; Appendix B). The GDS includes seven stages, ranging from no cognitive decline to very severe cognitive decline. Clinical experts (e.g., RN, nurse manager) were asked to stage each resident using the GDS according to each resident's cognitive performance, activities of daily living, personality, and emotions. These seven stages were collapsed into four major clinical phases of cognitive decline (i.e., none, mild, moderate, extreme). These four groups were analyzed separately in the analysis of this study.

Two independent research teams (Dura, Haywood-Niler & Kiecolt-Glaser, 1990; Reisberg et al., 1982) reported high interrater reliability (r=0.92). A strong relationship between the GDS and the Mini-Mental Status Questionnaire (Folstein et al., 1975) (r=0.89), and the Mental Status Questionnaire (Kahn, Goldfard, Pollack & Peck, 1960) (r=0.83) provides evidence of concurrent validity.

Three different verbal pain assessment scales and a behavioral observation measure were used to assess for pain:

Pain Assessment for the Communicatively Impaired (PACI). The PACI is a behavioral observation tool that was developed to assess pain in the nonverbal or cognitively impaired elderly (Middleton et al., 2001; Appendix C). It has 7 items; three of which measure specific facial movements or expression (i.e., brow lower, eyelid tighter, cheek raise), two body movements (i.e., guarding, rubbing/touching), and sounds and words that have been associated with pain. Each item has a dichotomous response (yes/no) with a possible range of scores from 0 (no pain) to 7 (high pain) for each resident.

These items are derived from qualitative data from interviews with registered nurses and resident attendants which were compared with other measures/behaviors described in the pain literature. Convergent validity of the PACI was tested using a set of videotaped segments of elderly residents in potentially painful situations (i.e., walking, transfers). Three pairs of blind raters viewed the videotaped segments and classified them using the PACI as being either a painful episode (PE) or a nonpainful episode (NPE), and the results indicated high interrater agreement (Kappa = 0.74 - 0.85). From the segments with PE/NPE agreement, 60 of these episodes were randomly chosen to be re-edited on a new videotape to examine interrater reliability among nursing aides (n=40) and registered nurses (n=40). The interrater relability ranged from 0.50 for the nonregistered staff and 0.78 for the registered staff. These results support the reliability of the PACI.

Faces Pain Scale (FPS). The FPS is a set of seven schematic faces used by the respondent to measure pain intensity. It was originally developed for use with children (Bieri et al., 1990) but recently has been modified slightly for use with elderly subjects (Herr, Mobily, Kohout & Wagenaar, 1998; Appendix D). The FPS incorporates components of the four facial actions that have been associated with pain in adults, including brow lowering, lid tightening/cheek raising, nose wrinkling/lip raising, and eye closure (LeResche & Dworkin, 1984; Prkachin, 1992; Prkachin, Berzins & Mercer, 1994). Participants in this study were asked to choose one of the faces in the FPS that best depicts their level of pain at that moment. The corresponding number of the chosen face represented their pain score, ranging from 0-6.

Herr et al. (1998) found evidence of strong construct validity and strong test-retest reliability (r=0.94, p=0.01) of the FPS within an elderly population. Although the equality of intervals in the FPS has been supported for children (Bieri et al., 1990), it has not been fully supported in the elderly (Herr et al., 1998).

Numerical Rating Scale (NRS). A simple numerical rating scale was used by the respondent to measure pain intensity, ranging from 0 (no pain) to 10 (worst possible pain) (see Appendix E). This scale was enlarged and bolded for use within the elderly population. Numerical rating scales have been shown to produce reliable responses for different stimulus response functions for pain sensation intensity and provide consistent measures of both experimental and clinical pain intensity (Price, Bush, Long & Harkins, 1994).

Present Pain Intensity scale (PPI). The PPI, which is a subscale of the McGill Pain Questionnaire, is a self-reported six-point word-number scale used to measure pain intensity at the moment and ranges from 0 (no pain) to 5 (excruciating pain) (Appendix F). This scale was also enlarged and bolded for use with the elderly population. Ferrell et al. (1995) found that the PPI had the highest completion rate (65%) among the elderly out of five different pain assessment scales, and also, provided evidence of concurrent validity with these other scales (r=0.54 - 0.72).

Self-Report Evaluation. The ability to use self-report scales (i.e., NRS, FPS) was assessed using a self-report evaluation (see Appendix G). This procedure is based on the work conducted by Fanurik et al. (1998), which has focused on cognitively impaired children aged 4 to 20 years old. An adaptatation of this procedure was used in this study, which is a standardized, multistep procedure consisting of three sections (i.e., Faces assessment, block and numeral assessment). The last two sections consisted of tasks using blocks and numerals to evaluate children's concepts of magnitude and ordinal position. These tasks were performed using five square, wooden blocks, which are numbered and sized accordingly: 1(½ inch), 2 ($^{3}/_{4}$ inch), 3 (1 inch), 4 ($1^{1}/_{4}$ inch), and 5 (1 ½ inch). Numerals used in the last section were printed 1 ½ inches high in black ink on white cards approximately 2 ½ inches square. This type of procedure has been used by many investigators in the area of pain assessment in children but there has been no work of its kind conducted within the elderly population.

Demographic Information Form. A demographic information form was used to collect data on diagnosis, mobility status, history of depression, whether pain medications were prescribed, and whether pain medications had been administered within 24 hours and/or six hours previous to data collection (see Appendix H). These variables have been identified in the literature and are thought to be associated with pain in the elderly. Also, for descriptive purposes, the following information was collected about the residents: age, sex, marital status, educational level, sensory deficits, and ethnic origin. All resident data were collected by chart review.

Procedure

Rater Training

The investigator and research assistant were trained to use the PACI in a correct and consistent manner. This training involved watching a 5 minute video that included a detailed description of each of the pain behaviors that are contained in the PACI. Each description of the pain behavior was followed by a visual representation of the related pain behavior. Karoly (1987) states that providing training to individuals involved in using behavioral observation tools may decrease potential threats to the reliability and validity of the tools.

Screening and Consent

Residents were screened before they were asked to participate in the study. First, a chart review was conducted for the purpose of selecting potential study participants who met the inclusion criteria. Secondly, the investigator met with an expert nurse (e.g., manager, clinical nurse specialist, RN) on each unit and asked the expert nurse to classify the potential study participants using the GDS (Appendix B). Residents were classified in the following manner:

Stage 1 on the GDS = cognitively intact elderly,

Stages 2-3 on the GDS = mild cognitively impaired elderly,

Stages 4-5 on the GDS = moderately cognitively impaired elderly,

Stages 6-7 on the GDS = extremely cognitively impaired elderly.

After the eligible residents were classified into four separate groups, each resident was asked to participate in the study. A brief description of the study was given and written consent obtained (see Appendix I). If the resident was unable to provide verbal/written consent as determined by the investigator and/or expert clinical nurse, then proxy consent was obtained.

Pain Measurement

Once consent had been obtained, then the residents were approached to collect the necessary data for this study. The pain measurement procedure was conducted first to blind the investigator and the research assistant to the results of the other measures used in the study. The investigator offered each resident a brief information session (5-10 minutes) on the correct use and scoring of each verbal report scale to try and reduce the amount of confusion during the actual data collection procedure. Then the investigator and research assistant conducted the following pain measurement procedure twice - at Time 1 and at Time 2 - both in the same fashion but separated by a 48 hour time interval. This time interval was short enough to minimize any changes in resident mood or condition that may have occurred with the passage of time. In addition, this interval was long enough to confuse the raters in terms of previous resident pain ratings, minimizing any potential testing or carry-over effect of the PACI.

Resident interviews took place in the morning since pain is generally worse when residents awaken in the morning (Ferrell et al., 1990). First, the investigator and the research assistant measured the resident's pain during a potential naturally-occurring painful event (e.g., transfer from bed to chair, performing ADL's), over a 2-minute interval using the PACI. The PACI was completed before the verbal reports of pain to blind the investigator and the research assistant to the verbal report scores for pain. Immediately following the behavioural assessment, the residents were asked to rate their pain using the FPS, the NRS, and the PPI scale. Subjects were given at least 30 seconds to reply to each scale and then the next scale was presented. If, at the end of the 30-

second interval, the resident did not provide an answer, the resident was considered unable to respond to that particular scale. These scales were given in random order to each resident to control for the effect of order.

Self Report Evaluation

After the two pain measurements had been completed, the self-report evaluation was done to reduce any bias in the pain measurements. This evaluation was done within 48 hours following the completion of the pain measurements, since residents may have been fatigued from the previous pain measurement procedure and a change in resident status was unlikely to occur within this time frame. The tasks of the self-report evaluation were adminstered in a standardized fashion and adjusted for any resident with physical impairments. For example, any resident who had a disabling upper body motor impairment was able to indicate a choice in the placement of the faces, blocks and numbers by using gesture. All tasks were administered in a nonthreatening manner to eliminate a sense of failure from an incorrect response. The entire interview process took approximately 30-45 minutes for each resident.

Pilot Study

A pilot study was completed using a sample of 25 cognitively intact residents to ensure that the instruments were completed appropriately and that the initial test-retest and interrater reliability results were acceptable. The pilot study included both cognitively intact and impaired residents who had different levels of pain. No modifications to the tools, or their order of administration were needed, and the initial test-retest and interrater reliability were acceptable. Therefore, the study continued.

Data Analysis

The statistical method that was used in the data analysis for this study was the repeated measures Analysis of Variance (ANOVA) and was guided by generalizability theory. The essence of generalizability theory is the recognition that in any measurement situation there are multiple sources of error variance and interactions among these sources of variance (Streiner & Norman, 1995). This theory was used in the analysis of this study because it combines all the sources of variability in one design, thereby increasing the sample size in the analysis and improving precision. For example, two observers contributed to the assessment of test-retest reliability and multiple observation times were summed together in the measurement of inter-rater reliability.

For this study, there were four sources of variance: residents (σ^2_R), observers (σ^2_O), time (σ^2_T), and error (σ^2_{ROT}). The data were organized and analyzed using separate ANOVA tables according to group (i.e., cognitively intact, mildly cognitively impaired, moderately cognitively impaired, extremely cognitively impaired) and instrument (i.e., PACI, FPS, NRS, PPI). For each psychometric test, specific data were used in the analysis, as described in detail below. The formulae for these calculations are as follows:

Test-Retest Reliability:

$$ICC = \frac{\sigma^2_R + \sigma^2_{OR}}{\sigma^2_R + \sigma^2_{OR} + \sigma^2_{TR} + \sigma^2_{TO} + \sigma^2_{RTO}}$$

where Time (T) is the facet of generalization, Observer (O) is the fixed facet, Resident (R) is the differentiated facet, and RTO is the error term.

Interrater Reliability:

$$ICC = \frac{\sigma^2_R + \sigma^2_{TR}}{\sigma^2_R + \sigma^2_{OR} + \sigma^2_{TR} + \sigma^2_{TO} + \sigma^2_{RTO}}$$

where Observer (O) is the facet of generalization, Time (T) is the fixed facet, Resident (R) is the differentiated facet, and RTO is the error term.

Concurrent Criterion Validity: Pearson r correlations were used to examine scores between the behavioral observation tool (i.e., PACI), which was the gold standard, and each of the three verbal pain assessment tools (i.e. FPS, PPI, NRS). High correlations provided some support to the tools' validity in assessing pain in the elderly.

Completion Rate: A pain report was considered incomplete if one of the following occurred: a) tool is left blank, b) responses are inappropriate (e.g., mark placed beyond area of scale), c) more than one score is marked. Descriptive statistics, including percentages and frequency counts, were used to compare the completion rates for each verbal report tool across all four groups.

Ethical Consideration

This was a noninvasive study. All subjects participated voluntarily and confidentiality was maintained. Informed consent was obtained from residents or their proxy (see Appendix I). Ethics approval was obtained from McMaster University and the institution that was involved in this study.

CHAPTER 3

RESULTS

All data were analyzed using SPSS statistical software. For each of the four groups of elderly residents, the results of the data analysis are reported as follows: (a) characteristics of the sample, (b) descriptive analysis of the use of pain medications, (c) descriptive analysis of pain reports, and (d) results according to each research hypothesis.

Characteristics of the Sample

The mean age for each group of elderly residents varied slightly across groups. For the first group, the ages of residents ranged from 68 to 93 years with a mean age of 81.75 (SD = 7.58). The ages of residents in the second group ranged from 71 to 99 with a mean age of 86.20 (SD = 7.24). For the third group, the ages of residents ranged from 65 to 97 with a mean age of 83.30 (SD = 7.11). The ages for residents in the fourth group ranged from 68 to 98 with a mean age of 82.5 (SD = 6.45).

For each of the four groups, the majority of residents were widowed females who had been living at the long term care facility for one to five years and had completed at least a Grade 8 education (see Table 1). The majority of residents had been previously employed in a business and almost one-half (43%) of the subjects in Group 3 had been homemakers. All of the residents in all four groups were Caucasian.

The most common diagnoses in all four groups were dementia, arthritis, and history of a previous fracture. In Groups 3 and 4, all of the residents had a diagnosis of dementia and over two-thirds (69%) of the residents in Group 1 had a diagnosis of arthritis. Over ten percent of residents in all four groups had a history of a previous fracture. The percentage of residents with a history of depression ranged from 15% in Group 1 (n=3) to 28% (n=11) in Group 3.

Table 1

Frequency Counts (n) and Percentages (%) of the Demographic Variables for all Four Groups of Residents

Variable	1 (Intact) (n=20) % (n)	2 (Mild) (n=30) % (n)	3 (Moderate) (n=40) % (n)	4 (Extreme) (n=40) % (n)
Gender				
Male	40 (8)	33 (10)	35 (14)	40 (16)
Female	60 (12)	67 (20)	65 (26)	60 (24)
Marital Status				
Married	20 (4)	17 (5)	20 (8)	38 (15)
Widowed	70 (14)	60 (18)	68 (27)	55 (22)
Single	10 (2)	20 (6)	13 (5)	5 (2)
Length of Stay				
<1 year	40 (8)	33 (10)	20 (8)	18 (7)
1-5 years	55 (11)	40 (12)	65 (26)	63 (25)
6-10 years	5 (1)	10 (3)	10 (4)	20 (8)
>10 years	0 (0)	17 (5)	5 (2)	0 (0)
Education				
<Grade 8	0 (0)	17 (5)	30 (12)	30 (12)
Grade 8-10	40 (8)	50 (15)	50 (20)	28 (11)
Grade 11-13	35 (7)	17 (5)	18 (7)	25 (10)
Post Secondary	25 (5)	17 (5)	3 (1)	18 (7)
Occupation				
Business	35 (7)	40 (12)	18 (7)	23 (9)
Homemaker	5 (1)	27 (8)	43 (17)	20 (8)
Trade	15 (3)	10 (3)	18 (7)	18 (7)
Ethnic Origin				
Caucasian	100 (20)	100 (30)	100 (40)	100 (40)
Mobility				
Dependent	25 (5)	20 (6)	43 (17)	50 (20)
Independent with Assistance	55 (11)	54 (16)	43 (17)	13 (5)
Independent	20 (4)	27 (8)	15 (6)	38 (15)
Diagnoses				
Dementia	0 (0)	63 (19)	100 (40)	100 (40)
Arthritis	69 (13)	30 (9)	30 (12)	25 (10)
Previous fracture	20 (4)	17 (5)	20 (8)	10 (4)
History of Depression	15 (3)	24 (7)	28 (11)	25 (10)

Descriptive Analysis of the Use of Pain Medications

The percentage of residents with scheduled analgesics ranged from 10% for Group 1 to 33% for Group 3 (see Table 2). One-half of the residents in both Groups 1 and 2 had a pro re nata (prn: given as needed) order for analgesics but this proportion decreased for residents in Group 3 (40%) and Group 4 (35%). Similarly, residents in Groups 1 and 2 received proportionately more prn analgesic (50 % and 47% respectively) than those in Group 3 (19%) and Group 4 (21%).

Generally, there were few opioid prescriptions for all residents but more in Group 1 (25%) than the other groups, and no opioids were prescribed for residents in Group 4. All of the residents in Group 1 who had an opioid prn order had received their opioid pain medication in the previous 24 hours.

The percentage of residents with a pain medication order (including analgesics, NSAIDS, and opioids) was high for Group 1 (85%), Group 2 (70%), and Group 3 (80%), but lower for residents in Group 4 (55%). However, the percentage of residents who had received any pain medication was lower; over one-half of residents in Group 1 (55%) and Group 2 (57%) but just over one-quarter for residents in Group 4 (27%).

Table 2

Percentage (%) and Number of Residents (n) in Each Group with Scheduled and Prn Pain Medications

	Level of Cognitive Impairment			
Pain Medication	**Intact (n=20) % (n)**	**Mild (n=30) % (n)**	**Moderate (n=40) % (n)**	**Extreme (n=40) % (n)**
ANALGESICS				
Scheduled	10 (2)	20 (6)	33 (13)	20 (8)
Prn Ordered	50 (10)	50 (15)	40 (16)	35 (14)
Prn Given	50 (5)	47 (7)	19 (3)	21 (3)
NSAIDS				
Scheduled	0 (0)	7 (2)	3 (1)	0 (0)
Prn Ordered	0 (0)	0 (0)	0 (0)	0 (0)
OPIOIDS				
Scheduled	5 (1)	7 (2)	3 (1)	0 (0)
Prn Ordered	20 (4)	7 (2)	15 (6)	0 (0)
Prn Given	100 (4)	0 (0)	17 (1)	----
Ordered Pain Medication	85 (17)	70 (21)	80 (32)	55 (22)
Given Pain Medication	55 (11)	57 (17)	43 (17)	27 (11)

Descriptive Analysis of Pain Reports

For all of the residents in all groups (N=130), the pain reports on average were low (see Table 3). The percentage of residents "in pain" according to their verbal reports (i.e., FPS, PPI, NRS) ranged from 69% to 77%. However, the behavioral reports of residents "in pain" that were scored by two raters were lower (i.e., PACI-1: 67%; PACI-2: 56%).

The first rater's (PACI-1) behavioral reports of residents "in pain" and the mean (M) pain score are consistently higher than the second rater's (PACI-2) reports and mean (M) pain score across all four groups. This finding was examined further, using an Analysis of Variance (ANOVA), which revealed a significant main effect for rater ($F=41.61$, $p<0.001$). Considering the potential effects of unequal sample sizes on this calculation, another ANOVA was conducted with equal sample sizes ($n=20$) for each of the four groups. For Groups 2, 3,and 4, this sample was randomly obtained from the original group sample. The results of the ANOVA using equal sample sizes also showed a main effect of rater and it remained statistically significant ($F=29.12$, $p<0.001$).

For Groups 1, 2 and 3, the behavioral reports of pain did not reach the maximum possible score, whereas the residents' verbal reports of pain did reach the maximum possible score. Finally, both of the raters' behavioral reports of residents "in pain" were highest for Group 4.

Table 3

Maximum (Max), Minimum (Min), Mean, Standard Deviation (SD) of Pain Scores, and Percentage of Residents "In Pain" Using Four Pain Scales for all Groups

	PACI-1 Range: 0-7	PACI-2 0-7	FPS 0-6	PPI 0-5	NRS 0-10
All Groups					
Mean	1.89	1.46	2.18	1.69	3.74
SD	1.88	1.69	1.90	1.47	3.05
"in pain"	67%	56%	73%	69%	77%
Group 1: Intact					
Max	4.00	4.00	6.00	5.00	10.00
Min	0.00	0.00	0.00	0.00	0.00
Mean	1.20	1.00	1.90	1.50	4.00
SD	1.20	1.17	1.89	1.28	3.25
"in pain"	65%	55%	70%	75%	80%
Group 2: Mild					
Max	6.00	5.00	6.00	4.00	10.00
Min	0.00	0.00	0.00	0.00	0.00
Mean	2.00	1.53	2.50	1.70	3.60
SD	1.94	1.80	1.74	1.37	2.87
"in pain"	67%	53%	83%	70%	77%
Group 3: Moderate					
Max	7.00	7.00	6.00	5.00	10.00
Min	0.00	0.00	0.00	0.00	0.00
Mean	1.78	1.43	2.10	1.80	3.75
SD	1.99	1.85	2.13	1.73	3.18
"in pain"	62%	47%	57%	62%	70%
Group 4: Extreme					
Max	7.00	6.00	----	----	----
Min	0.00	0.00	----	----	----
Mean	2.25	1.68	----	----	----
SD	1.94	1.67	----	----	----
"in pain"	72%	67%	----	----	----

Results Related to Research Questions

Test-Retest Reliability.

The intraclass correlations (ICCs) for the PACI were moderate to strong for all groups (0.62 to 0.78) and the error variance (σ^2_{error}) remained relatively constant across all groups (see Table 4). The ICCs for the three verbal report scales were moderate to strong for the cognitively intact group - Group 1 (FPS: ICC = 0.84; PPI: ICC = 0.55; NRS: ICC = 0.87), but they decreased for the remaining groups with increasing cognitive impairment. In addition, the error variances were low for Group 1 (FPS: σ^2_{error} = 0.53; PPI: σ^2_{error} = 0.71; NRS: σ^2_{error} = 1.45) but they increased with increasing cognitive impairment. The error variances for the PPI were lower than the FPS and NRS for Groups 2 (σ^2_{error} = 1.22) and Group 3 (σ^2_{error} = 1.21).

Table 4

Test-Retest Reliability: Source of Variance ($\sigma^2_{subject}$, σ^2_{error}) and Intraclass Correlation Coefficient (ICC) for the Four Pain Assessment Tools for All Groups

Pain Scale	Group (Level of Cognitive Impairment)			
	1 (Intact)	2(Mild)	3(Moderate)	4(Extreme)
PACI				
$\sigma^2_{subject}$	1.39	2.75	2.22	1.71
σ^2_{error}	0.38	0.48	0.28	0.33
ICC	0.78	0.70	0.73	0.62
FPS				
$\sigma^2_{subject}$	2.91	1.36	1.68	----
σ^2_{error}	0.53	1.46	3.49	----
ICC	0.84	0.39	0.32	----
PPI				
$\sigma^2_{subject}$	0.87	0.81	1.29	----
σ^2_{error}	0.71	1.22	1.21	----
ICC	0.55	0.40	0.51	----
NRS				
$\sigma^2_{subject}$	9.31	3.67	5.23	----
σ^2_{error}	1.45	5.89	5.92	----
ICC	0.87	0.38	0.45	----

Interrater Reliability.

The interrater reliability for the PACI was high for all groups (ICC = 0.82-0.88; see Table 5). Group 2 had the highest subject variance ($\sigma^2_{subject} = 2.75$). The error variance for the PACI was low across all groups of residents ($\sigma^2_{error} = 0.28\text{-}0.48$).

Table 5

Interrater Reliability: Source of Variance ($\sigma^2_{subject}$, σ^2_{error}) and Intraclass Correlation Coefficient (ICC) for the PACI for Each Group

	Group (Level of Cognitive Impairment)			
	1 (Intact) PACI	**2(Mild) PACI**	**3(Moderate) PACI**	**4(Extreme) PACI**
$\sigma^2_{subject}$	1.39	2.75	2.22	1.71
σ^2_{error}	0.38	0.48	0.28	0.33
ICC	0.82	0.88	0.88	0.87

Concurrent Criterion Validity.

The Pearson r correlations of the PACI with the three verbal report scales (i.e., FPS, PPI, NRS) were low to moderate (see Table 6). For Group 1 all of these correlations were moderate and significant (FPS: $r = 0.66$, $p<0.001$; PPI: $r = 0.62$, $p<0.01$; NRS: $r = 0.65$, $p<0.01$). For Group 2, none of these correlations were significant at the $p<0.05$ level. For Group 3, the PACI correlated moderately and significantly with the

FPS (r = 0.63, p<0.001) and PPI (r = 0.64, p<0.001). However, the correlation between the PACI and NRS for Group 3 was low and nonsignificant (r = 0.30, p<0.12).

Table 6

Criterion Concurrent Validity: Pearson r Correlations (r) and Level of Significance (p) Between the PACI and Each of the Three Verbal Pain Scales For All Groups

	Group (Level of Cognitive Impairment)			
Pain Scale	**1 (Intact)**	**2(Mild)**	**3(Moderate)**	**4(Extreme)**
FPS				
r =	0.66	0.30	0.63	----
p<	0.001	0.10	0.001	----
PPI				
r =	0.62	0.32	0.64	----
p<	0.01	0.10	0.001	----
NRS				
r =	0.65	0.23	0.30	----
p<	0.01	0.22	0.12	----

Completion Rates.

All of the residents in Groups 1 and 2 completed all of the verbal report scales for pain (see Table 7). However, only 60% of the residents in Group 3 completed the FPS scale; 67 % completed the PPI, and 70 % completed the NRS. None of the residents in Group 4 were able to complete any of the verbal report scales.

Table 7

Completion Rates of Each Verbal Report Scale for Pain for Each Group of Elderly Residents

Verbal Report Pain Scale	Group (Level of Cognitive Impairment) 1 (Intact) (n=20) % (n)	2 (Mild) (n=30) % (n)	3 (Moderate) (n=40) % (n)	4(Extreme) (n=40) % (n)
FPS	100 (20)	100 (30)	60 (24)	0 (0)
PPI	100 (20)	100 (30)	67 (27)	0 (0)
NRS	100 (20)	100 (30)	70 (28)	0 (0)

Self-Report Evaluation.

All of the residents in Group 1 and 97% of the residents in Group 2 participated in the self-report evaluation (see Table 8). In Group 3, 10% refused or were non-responsive when asked to complete the self-report evaluation. Only one resident in Group 4 (3%) participated in the self-report evaluation. The percentage of residents in each group who completed each task correctly was calculated after the number of residents who refused plus those that were non-responsive were subtracted from the total number of residents in the corresponding group.

In Group 1, some of the residents were not able to choose the correct face that depicted the most and least pain and under a third of these residents (30%) could place the FPS in the correct order. The percentage of residents who completed these tasks for the Faces scale correctly decreased for Group 2 and even more so for residents in Group 3. None of the residents in Group 4 were able to complete these tasks for the Faces scale.

Almost all of the residents in Group 1 were able to complete the tasks using blocks and numerals, but again, this proportion decreased for residents in Groups 2 and 3. Only one resident was responsive in Group 4 and this resident completed the magnitude task for both the blocks and numerals correctly.

Table 8

Percentages (%) and Number (n) of Residents Who Completed Tasks Correctly Using Faces, Blocks, and Numerals for the Self-Report Evaluation According to Group

	Task Completed Correctly			
	Group (Level of Cognitive Impairment)			
	1 (Intact) (n=20) % (n)	**2 (Mild)** (n=30) % (n)	**3 (Moderate)** (n=40) % (n)	**4(Extreme)** (n=40) % (n)
Refused	0 (0)	3 (1)	5 (2)	0 (0)
Non-responsive	0 (0)	0 (0)	5 (2)	97 (39)
Faces				
Most pain	70 (14)	45 (13)	22 (8)	0 (0)
Least pain	95 (19)	83 (24)	44 (16)	0 (0)
Order	30 (6)	24 (7)	11 (4)	0 (0)
Blocks				
Magnitude	100 (20)	97 (28)	75 (27)	100 (1)
Order	95 (19)	93 (27)	56 (20)	0 (0)
Numerals				
Magnitude	100 (20)	93 (27)	81 (29)	100 (1)
Order	100 (20)	100 (29)	58 (21)	0 (0)

Summary of the Results

The pain reports on average were low but over two-thirds of all residents reported some degree of pain. Generally, the residents in Group 4 (extremely cognitively impaired) were prescribed proportionately less pain medication and were given proportionately less pain medication than those in Groups 1, 2, or 3.

The test-retest reliability of the PACI was moderate to strong for all groups and the error variance remained consistently low across all groups. The test-retest reliability for the three verbal report scales was moderate to strong for Group 1 but it decreased with increasing levels of cognitive impairment. The interrater reliability of the PACI was high for all groups and the error variance remained consistently low across all four groups of elderly residents.

With respect to the criterion concurrent validity, there were moderate and significant correlations between the PACI and all of the verbal report scales for Group 1. In addition, there were moderate and significant correlations between the PACI and both the FPS and PPI for Group 3. However, none of the verbal report scales were significantly correlated to the PACI for Group 2.

The completion rates for Groups 1 and 2 were high but decreased in Group 3. None of the residents in Group 4 were able to complete any of the verbal report scales. The majority of residents in Group 1 were able to complete the tasks using blocks and numerals but fewer residents were able to complete the tasks related to the Faces scale.

The percentage of residents who were able to complete these tasks in the other groups decreased with increasing cognitive impairment.

CHAPTER 4

DISCUSSION

In this chapter, the study results are discussed. First, the characteristics of the sample, the use of pain medications for all groups, the pain reports, and the results according to each research hypothesis, are reviewed. These findings are discussed in light of existing research and relevant theory. Finally, the study limitations, implications for nursing research and practice are discussed, followed by the conclusions of the study.

Characteristics of the Sample

The mean age for each group of elderly residents varied slightly across groups, ranging from 81.75 to 86.20 years. This range is similar to the range of ages in other studies that have examined pain in the elderly who live in long term care settings (Feldt et al., 1998; Ferrell et al., 1995; Krulewitch et al., 2000; Parmelee, 1996). As well, the high proportion of females to males in this study is consistent with the majority of studies reviewed that have been conducted in long term care facilities (Chibnall & Tait, 2001; Ferrell et al., 1995; Feldt et al., 1998; Krulewitch et al., 2000; Middleton et al., 1997; Parmelee, 1996).

However, the generalizability of these results to other ethnic groups may be hindered by the fact that all of the residents in all four groups were Caucasian. Similarly, other studies that assessed pain in the elderly used samples that were comprised mostly of

Caucasian subjects (Herr et al., 1998; Ferrell et al., 1995) while other studies included mostly African-Americans (Chibnall & Tait, 2001; Weiner et al., 1999). Further study is needed to examine the psychometric properties of these scales with residents from different ethnic backgrounds.

<u>The Use of Pain Medications</u>

Similarly to other studies reviewed (Feltd et al., 1998; Horgas & Tsai, 1998; Kaasalainen et al., 1998; Scherder & Bouma, 1997; Sengstaken & King, 1993), the findings of this study reveal that residents who were cognitively impaired were prescribed and administered less pain medication than those elderly with no cognitive impairment. These results are concerning and clearly indicate that pain is undertreated within the cognitively impaired elderly population.

For example, Horgas and Tsai (1998) used a correlational study to examine the use of analgesics within a sample of 339 residents from four nursing homes. They found that the cognitively impaired resident were prescribed significantly less and administered significantly less analgesic medication compared with the cognitively intact elderly. In addition, Scherder and Bouma (1997) found that the residents with dementia used fewer NSAIDS.

Weissman and Matson (1999) state that there is a widespread fear of treating pain without understanding the exact cause of pain, along with concern about over-medication and drug toxicity, especially for those elderly with cognitive impairment. Clearly, there is a need for more education and training of health care professionals relating to pain management strategies, such as the use of pain medications, within the cognitively impaired elderly.

Pain Reports

The rates of residents "in pain" in this study ranged from 56% to 77% depending on the tool used. These rates of pain in the elderly are high and they are similar to the findings of other studies (Desbiens et al., 1997; Ferrell, Ferrell, & Osterweil, 1990; Simons & Malabar, 1995). These findings indicate that pain is prevalent and a serious problem for residents who live in long term care facilities.

Moreover, the high rates of pain in the elderly support the contention that pain perception in the elderly remains intact, despite the inconsistencies of pain sensitivity studies that have been conducted in the elderly population (Kaasalainen & Molloy, 2001). The findings of this study support the criticism that laboratory studies may not be an accurate means to examine pain perception in the elderly as these studies oversimplify both the acute and chronic pain experience and neglect the important role of psychological and emotional factors (Gagliese & Melzack, 1997). Thus, generalizations related to diminished pain experiences in the elderly are unwarranted based on the results of this study.

It is interesting to note that the residents who had the highest level of cognitive impairment (Group 4), also had both the highest average pain score and the highest percentage of residents "in pain" using the PACI. Other studies have found similar results (Buffum et al., 2001; Feldt et al., 1998). Buffum et al. (2001) found that discomfort was significantly related to severity of dementia ($r=0.44$, $p=0.01$); that is, the level of discomfort in the elderly increased with the level of cognitive impairment. Using a behavioural observation tool, Feldt et al. (1998) found that the cognitively impaired subjects scored significantly higher ($p<0.05$) on the Checklist of Nonverbal Pain Indicators during movement than did the cognitively intact subjects.

These findings offer support to the belief that dementia does not alter the perception of pain in the elderly as proposed by other researchers (Benedetti et al., 1999; Farrell et al., 1996). Rather, this vulnerable group of elderly may be at great risk for suffering with unrelieved pain due to the higher rates of pain coupled with the complexities of pain assessment associated with high levels of dementia. Therefore, much attention needs to be given to staff education and training related to suitable pain assessment methods, such as the PACI, for the extremely cognitively impaired elderly.

In contrast, studies that have examined verbal reports of pain in the elderly have found that pain reports are higher in the intact group compared to the impaired group (Parmelee et al., 1993; Scherder & Bouma, 2000). These findings are contrary to the findings using behavioral observation and are consistent with the belief that the cognitively impaired elderly underreport their pain, not due to the absence of pain, but rather, due to a diminished capacity to report pain (Farrell et al., 1996; Heye, 1997). Thus, it emphasizes the critical need for behavioural observation methods, such as the PACI, to be used to assess for pain in the cognitively impaired elderly.

The finding of low levels of pain intensity using both the verbal and behavioural measures indicates that the residents on average had some pain but they did not appear to be experiencing intense pain at the time of testing. This finding could be due to several factors.

According to the gate control theory of pain, pain perception is a subjective state and can be influenced by cognitive factors such as past experience and the meaning of the situation (Melzack & Wall, 1983). The majority of elderly have been exposed to many painful situations in their lifetime (e.g., labour, cancer, surgery) and the amount of pain induced by range of motion exercises may be relatively low compared to other previously-experienced pains. In addition, range of motion exercises are considered therapeutic in nature, and therefore, may be considered less painful than other kinds of situations which may have different meanings (e.g., fractured hip, surgery). Furthermore, chronic pain may have become part of their everyday life and it may have lost its "newness" a long time ago. For example, Sheffield et al. (1997) found that patients with stable angina perceived pain as less intense and unpleasant than controls.

Other researchers have also found low levels of pain in the elderly (Chibnall & Tait, 2001; Hadjistavropoulos et al., 1998; Krulewitch et al., 2000; Parmelee, 1996). Chibnall and Tait (2001) found similar mean scores of pain in the elderly, which fell in the lower third of each scale using a verbal rating scale (mean: 1.5, range 1-5) and FPS (mean: 2.7, range 1-7). Krulewitch et al. (2000) found similar results using verbal reports of pain when they asked elderly subjects to recall the worst pain experienced in the preceding week (e.g., FPS: 2.1, range: 0-6; VAS: 27.3, range: 0-100; Pain Intensity Scale: 9.2, range: 5-22). Unfortunately, a recall of pain over a week relies on intact memory and it is questionable how accurate the pain ratings were since many of the subjects that were included in the study had cognitive impairment. In their study, a behavioral observation tool was also used to measure pain intensity and it produced similar results (i.e., mean: 8.3, range: 0-27) to the behavioral observation results of the present study using the PACI.

It is important to recognize, however, that these pain ratings may not be representative of the amount of pain that the elderly experience "on average" over a longer period of time. The type of physical activity that was used to induce pain (e.g., walking, range of motion exercises) may not be as painful as other types of activity that occur during their day, week, or month. The activity that was performed for this study was executed in a controlled fashion by a physiotherapist whereas the majority of activity that residents are subjected to are performed by nurses (e.g., dressing, bathing) which may be more painful as nurses may be more concerned with getting the task done rather than trying to minimize the amount of pain experienced.

In addition, other kinds of pains, such as angina or wound care, may not have been captured during these two testing times. Therefore, one must be cautious in generalizing these low pain reports. Instead, more research is needed to examine the amount or intensity of pain that the elderly experience "on average" by using more appropriate and informative designs with multiple measurement times, such as longitudinal or times series designs.

The behavioral reports of residents "in pain" that were scored by the two raters were lower than the verbal reports of pain. This finding indicates that the behavioral observation tool (i.e., PACI) did not identify some residents who actually reported that they were experiencing pain. This finding is concerning and it is supported in the literature (Hadjistavropoulos et al., 2000; Weiner et al., 1999). One explanation for this finding may be that the elderly consciously inhibit painful behaviours, such as facial expressions of pain, for reasons related to social desirability or stoicism (Hadjistavropoulos et al., 2000; Heye, 1997). Thus, it may be judicious to use verbal reports of pain for those elderly who are capable, such as those elderly with no or mild cognitive impairment.

The consistent and significantly higher PACI ratings for the first rater compared to the second rater for Groups 2 to 4 leads one to think that there is something different between the two raters that influenced their pain ratings. One notable difference between the raters is the amount of clinical experience or training of each rater. For example, the first rater had been employed as a registered nurse for over 10 years and most of that time had been spent working with the elderly. In contrast, the second rater was a third year nursing student who had minimal clinical experience and even less time working with the elderly. Prkachin et al. (1994) found that untrained observers were sensitive to gross variations in pain states but there was a tendency to underestimate the patient's pain on a systematic basis from 50% to 80%.

Hadjistravopoulos et al. (1998) found contrasting results to this study. They found that university students rated elderly pain significantly higher than nurses ($t=2.89$, $p<0.006$), suggesting that routine exposure to patient pain might affect sensitivity to pain-related cues. However, pain was assessed using a visual analogue scale, rather than a behavioral observation method; the VAS tends to be more subjective in nature, allowing for more observer bias compared to the structured format of the PACI.

The significant differences between raters using the PACI supports the need for training programs to improve pain assessment using behavioral methods. Solomon, Prkachin and Farewell (1997) found that the amount of training affected behavioral pain assessments in the elderly. In their study, the trained group, who was exposed to a 30-minute training session, was significantly ($F=12.92$, $p=0.006$) more sensitive to subtle facial movements associated with low levels of pain. Although, both raters in the present study were trained to use the PACI with a 5-minute video, perhaps a longer, more intensive training session would benefit those raters with limited clinical experience. Further study is needed to confirm this speculation.

For Groups 1, 2 and 3, the behavioral reports of pain using the PACI did not reach the maximum possible score, whereas the residents' verbal reports of pain did reach the maximum possible score. It appears that the PACI may not be a good measure of pain intensity. One explanation may be that some elderly are not capable of expressing their pain using certain behaviours due to physical limitations, such as paralysis, contractures, and even the immobilizing effects of pain itself. As well, LeResche (1984) postulates that facial expressions of pain may be blunted due to the physical changes in faces that occur with age.

Although the PACI may not provide a good measure of pain intensity for all elderly, it appears to be able to detect the majority of residents who are in pain. For the extremely cognitively impaired elderly, the PACI can detect pain in those residents who are incapable of providing verbal reports of pain. Without the measurement of pain using behavioural indices, the majority of pain in this vulnerable population would go unnoticed. Thus, it seems prudent to use the PACI, despite its limitations, to provide a measure of pain for those elderly with extreme cognitive impairment so that attempts can be made to manage their pain therapeutically.

Results Related to Research Questions

Test-Retest Reliability.

The intraclass correlations (ICCs) for the behavioural observation tool (i.e., PACI) were moderate to strong for all groups and the error variance remained relatively constant across all groups. These correlations support the reliability of the PACI considering the variability of pain over time. The time interval between the test and retest in this study was 48 hours to reduce the effect of memory on the retest scores. However, there is evidence that pain ratings obtained using shorter intervals early after initial testing have slightly higher reliability coefficients than those gathered later (Gift, 1989). Thus, the reliabilities of the PACI across all levels of cognitive impairment are acceptable for use in clinical settings.

As expected, the test-retest reliability for the three verbal report scales were moderate to strong for Group 1, but they decreased for the remaining groups with increasing cognitive impairment. Similarly, the error variances were low for Group 1 but they increased with increasing cognitive impairment. These findings indicate that the level of cognitive impairment decreases the reliability of verbal reports of pain.

For those elderly without dementia, the NRS appears to have the highest reliability compared to the other verbal report scales (i.e., FPS, PPI) used in this study. However, the test-retest reliability of the NRS drops considerably for those elderly with mild and moderate cognitive impairment, suggesting that this tool may not be as good a choice for these elderly.

Perhaps, the ability to conceptualize pain using numbers diminishes with the onset of dementia. Residents need to be able to understand concepts of magnitude and ordinal position to accurately report their pain using a numerical scale. The findings from the self-report evaluation that was used in this study support this speculation. That is, almost all of the cognitively intact residents (Group 1) were able to choose the highest and lowest number correctly and place the numerals in the correct order; however, the residents with cognitive impairment had considerably more difficulty completing these tasks. Therefore, the NRS appears to be a clinically useful and reliable method to assess for pain in those elderly without cognitive impairment, but, it may not be an accurate method for pain assessment for those with cognitive impairment.

Similarly, the test-retest reliability of the FPS was strong for the residents without cognitive impairment but it also declined substantially for the residents with cognitive impairment. Herr et al. (1998) also found strong test-retest reliability for a group of cognitively intact elderly using the FPS (r=0.94, p=0.01) by asking cognitively intact elderly subjects to rate a vividly remembered painful experience about the degree of pain perceived using the FPS, separated by a 2-week interval. This method for test-retest reliability is questionable, however, as it relies on memory over a longer period of time.

Chibnall and Tait (2001) found similar results using ICCs to assess test-retest reliability of the FPS for the cognitively intact elderly (ICC=0.57) and cognitively impaired elderly (ICC=0.32). Unfortunately, error variances were not reported in their study.

Error variances provide important information when assessing the reliability of an instrument, especially in the measurement of a variable, such as pain, over several groups of subjects with varying abilities. Generalizability theory, which was used in the present study, offers a comprehensive and practical approach to assess reliability by providing both an ICC and an error variance for each reliability result (Cronbach et al., 1972). In this case, the error variances were separated from the subject variances which allowed for them to be examined independent of one another. Thus, future study using generalizability theory is recommended to examine the reliability of pain report measures over groups of residents with varying level of impairment.

Nonetheless, the reliability results reported in these studies indicate that elderly residents can accurately represent their pain experiences using the FPS. These results offer support for the use of the FPS to assess for pain in the elderly, particularly for the cognitively intact.

The test-retest reliability of the PPI appears to be slightly better compared to the NRS and FPS for those residents with mild to moderate levels of cognitive impairment. This finding indicates that the PPI may be a better choice of tool and simpler to use for these residents. This finding is congruent with most of the other studies reviewed that have compared a verbal descriptor scale with other types of tools that have been used within an elderly population (Herr & Mobily, 1993; Feldt et al., 1998; Ferrell et al., 1995; Parmelee et al., 1993).

It may be that the PPI is a more reliable measurement of pain for residents with mild to moderate cognitive impairment because their ability to use words to describe their pain may be retained longer than their ability to use numbers or abstract tools like the FPS. Perhaps, using a scale that has different terms to describe pain, such as the PPI, may be useful as older persons may use more words to describe their pain and may not use the word "pain" to describe their discomfort; they may reserve the word pain to describe severe discomfort (Heye, 1997). Although there are language skills lost with the onset of dementia, perhaps, by using a simple tool with few words, such as the PPI, it may allow elderly residents a way to express their pain accurately and in a more personal and meaningful way.

Interrater Reliability.

The high interrater reliabilities for the behavioral observation tool (i.e., PACI) and low error variances across all groups of elderly residents offer support for the use of the PACI to assess for pain in clinical settings. These reliabilities are slightly higher than those found in a previous study using the PACI (Middleton et al., 2001). In their study, the interrater relabilities ranged from 0.50 for the nonregistered staff and 0.78 for the registered staff, indicating a higher reliability with the more experienced and educated staff.

Two other studies examined interrater reliability using a behavioral observation tool to assess for pain in the elderly (Feldt et al., 1998; Hurley et al., 1992). Feldt et al. (1998) found 93% agreement on the behaviors observed on the dichotomous checklist items of the Checklist of Nonverbal Pain Indicators (CNPI) between two master's prepared nurse practitioners (kappa = 0.63-0.82, p = .02 - .006). However, only 12 subjects were included in this study which poses methodological concerns over the generalizability of the findings.

Similarly, the interrater reliability of the DS-DAT was high at four separate testing times using two master's prepared nurses to assess for pain in a group of cognitively impaired elderly (r=0.86-0.98). However, the feasiblity of the DS-DAT for clinical use is questionable because of its complexity and the amount of time required to complete it. Nonetheless, these studies indicate that behavioural observation is a reliable method to assess for pain in the elderly with dementia. The PACI is unique in that it offers a reliable method to assess for pain and it is also feasible for use in clinical settings.

Concurrent Criterion Validity.

The correlations of the behavioural observation tool (i.e., PACI) with the three verbal report scales (i.e., FPS, PPI, NRS) were low to moderate. These correlations were lower than expected and indicate that, perhaps, the PACI was measuring a slightly different dimension of pain compared to the verbal report scales.

Similar to the findings of this study, Krulewitch et al. (2000) found that behavioural obervation scores of pain did not correlate well with verbal report scores of pain. Unfortunately, they did not report the strength or significance levels of these correlations. As well, the verbal reports of pain measured the worst pain in the preceding week were compared with behavioral observation scores taken at that moment.

Hadjistavropoulos et al. (2000) also found that self-reports of pain using a coloured visual analogue scale did not correlate with a behavioural observation measure (i.e., FACS). They suggest that each measure taps very different parameters of the pain experience when used in the elderly, implying that a comprehensive assessment of pain should include both self-report and behavioural indices.

Feldt et al. (1998) found moderate concurrent validity between a behavioral observation tool and a VDS for both the cognitively impaired (r_s=0.46, p=0.009) and cognitively intact residents (r_s=0.39, p=0.032). Interestingly, the correlations are stronger for the impaired group than for the intact group of elderly. This finding is similar to the findings in the present study for Group 2. That is, the concurrent validity between behavioural observation scores and verbal report scores of pain were lower than for the residents in Group 3 who had more cognitive impairment.

It is worth noting the nonsignificant correlations between the PACI and all three verbal report scales for the residents with mild cognitive impairment (Group 2). These nonsignificant correlations may be due to the low "true variance", or rather, variance due to subjects. As shown in Table 4, Group 2 had the lowest amount of subject variance (σ^2subject) compared to the other three groups of residents, indicating that Group 2 was more homogenous in their pain ratings. This homogeneity of the sample for Group 2 could account for the poor and nonsignificant correlations between the PACI and each of the verbal report scales, since an instrument will have a lower reliability when it is used on a homogenous group of subjects than it will when it is used on a more heterogenous group (Mitchell, 1979). Therefore, future study is needed to address the reliability and validity of these pain assessment tools on a more heterogenous group of residents with mild cognitive impairment.

Although, it is interesting that Farrell et al. (1996) found increased pain reporting in subjects with mild dementia. They suggested that patients with mild dementia may report increased pain to mask failing abilities associated with cognitive decline (Farrell, Katz, & Helme, 1996; Fordyce, 1978; Taylor et al., 1988).

Perhaps, this group of residents were plagued with more chronic pain, since they reported the highest levels of pain, compared to the other groups. Teske et al. (1983) found that there was a tendency for nurses to underestimate pain in both acute and chronic pain sufferers but the discrepancy between patient and nurse ratings was greater for the chronic pain patients. Thus, the elderly with chronic pain pose a challenge for health care professionals for pain assessment using behavioural methods.

In addition, there is some evidence that observer ratings of facial expression of pain are not particularly sensitive to subject's own ratings of pain (Parmelee, 1996; Prkachin et al., 1994; Solomon et al., 1997). Solomon et al. (1997) found that the underestimation of pain using a method based solely on facial expression of pain (FACS) was most evident for the expressive patients particularly for the passive movements where 75% of the ratings were less than those of the patient.

Despite these discrepancies, behavioral observation has many advantages over verbal report methods of pain assessment. For example, behavioural observation provides a direct sample of behaviour whereas self-reports of behaviour provide only an indirect indication of behaviour with questionable correlation with the actual behaviour (Hayes, 1995). Moreover, Hadjistavropoulos et al. (2000) found evidence of distress and pain in the cognitively impaired residents using a behavioural observation method but this pain and distress was not evident in their self-reports. Thus, it appears that behavioural observation remains an important tool to assess for pain in those elderly who may have difficulty with the verbal expression of pain.

Completion Rates.

As expected, the cognitively intact elderly and those with mild impairment were able to complete all of the verbal report scales for pain, with over two-thirds of the residents with moderate impairment being able to complete either the PPI or the NRS. These findings indicate that a large proportion of the residents with moderate impairment could complete a verbal report of pain which is consistent with the majority of other studies (Feldt et al., 1998; Ferrell et al., 1995; Herr & Mobily, 1993; Krulewitch et al., 2000; Parmelee et al., 1993).

Krulewitch et al. (2000) found similar completion rates for the elderly with mild (FPS: 76%; VAS: 76%; VDS: 84%), and moderate (FPS: 55%; VAS: 52%; VDS: 64%) cognitive impairment using a sample of 156 community-dwelling elderly. However, Krulewitch et al. (2000) found a much higher percentage of residents with extreme cognitive impairment who were able to complete the verbal reports of pain (FPS - 41%; VAS - 41%; VDS - 50%), compared to the present study. This discrepancy may be due to the fact that the residents included in the severe group in Krulewitch et al.'s (2000) study were less impaired than those elderly included in the 'extreme' group (Group 4) in the present study; only 2% of their sample had Mini-Mental Status Examination (MMSE) scores at or below 5. As well, their sample of cognitively impaired residents could be a higher functioning group since they all still lived in the community, rather than in an institution.

Nonetheless, these high completion rates provide some indication of the suitability of these verbal report scales for use within an elderly population in the assessment of pain. However, the reliability of these scales must also be assessed to determine their accuracy for use in clinical settings.

Self-Report Evaluation.

As expected, the percentage of residents who were able to complete the tasks required in the self-report evaluation declined with increasing levels of cognitive impairment. These findings are similar to the findings of Fanurik et al.'s (1998) study. In her study, she examined the ability of children with cognitive impairment to complete similar tasks. She also found that the number of tasks completed declined with increasing levels of impairment.

Surprisingly, the findings from the self-report evaluation relating to the FPS suggest that even the cognitively intact residents had some difficulty choosing the correct face that depicted the most and least pain and under a third of these residents could place the faces in the correct order. These findings are concerning considering their implications to the validity of the tool.

In contrast to the findings of this study, Scherder and Bouma (2000) found that all of the cognitively intact residents in their study comprehended the FPS. They asked residents to choose the face that depicted the most pain and the face that depicted the least pain. However, they did not ask residents to place these faces in order. Moreover, it is likely that the residents were asked to choose these two faces while they appeared in the correct order, rather than each face being placed in an unordered fashion, as they were in the present study. Subsequently, this task would have been much easier in their study, and not an accurate representation of resident's understanding of the scale.

Yet, Scherder and Bouma (2000) did find a similar decline in comprehension of the FPS with increasing cognitive impairment. That is, they found that 60% of those elderly with mild cognitive impairment and only 30% of those with moderate cognitive impairment were able to choose the correct face that depicted the most and least pain.

Similar to Scherder and Bouma's (2000) findings, Herr and Mobily (1998) also found that cognitively intact elderly were able to comprehend the FPS. They found that rank ordering tasks for the individual faces demonstrated near-perfect agreement between the actual expected ranking and the ranking produced by a group of cognitively intact elderly subjects (Kendall's $W=0.97$, $p=.00$).

Thus, the results of these studies that assessed comprehension of the FPS, even with the cognitively intact elderly, are inconsistent. More study is needed to determine the suitability of the FPS for use within an elderly population.

Limitations of the Study

There are limitations to this study. First, all of the residents included in the study were Caucasian, which limits the generalizability of the findings to elderly residents from a different ethnic background. Future study needs to be conducted relating to the measurement of pain using both verbal and behavioral methods in the elderly from different ethnic groups.

Secondly, there was a lack of heterogeneity in the group of residents with mild cognitive impairment which may have affected the reliability and validity results of the pain assessment tools. Future study is needed to further examine the reliability and validity of these pain assessment tools using a more heterogeneous sample.

Finally, the type of activities that were performed in this study (i.e., ROM, walking) appear to have induced low amounts of pain in general, which resulted in relatively low subject variances. The reliability of the tools used could be improved by increasing the magnitude of the variance between subjects (Streiner & Norman, 1995). Thus, future study is needed to test the reliability of these pain assessment scales, especially the PACI, using situations that elicit more variation in pain responses in the elderly, such as hip fractures and surgical procedures, along with ROM and walking activities.

Implications for Research

Based on the findings of this study, there are implications for research. Despite the high rates of pain in the elderly, the undertreatment of pain using pain medications was evident in this study. To date, minimal research has been conducted that deals with effective treatments to alleviate pain and suffering within the elderly population. With reliable methods of assessing for pain emerging in research, the next step in the management of pain in the elderly is to develop effective ways to treat pain.

Pasero , Reed and McCaffery (1999) state that often, simple analgesics such as acetaminophen will effectively treat mild to moderate pain for the elderly. However, intervention studies are needed to assess the effectiveness of certain drugs for pain associated with different conditions in the elderly. In addition, the effectiveness of adjuvant analgesics, such as antidepressants and anticonvulsants, needs to be evaluated in their effectiveness to reduce pain in the elderly.

Future study is also needed to further examine the validity of both verbal and behavioral observation methods to assess for pain in the elderly. In this study, the criterion concurrent validity between the behavioral observation tool (i.e., PACI) and the other three verbal report scales (i.e., FPS, PPI, NRS) was assessed. However, the correlations were lower than expected, especially for the residents with mild cognitive impairment, indicating that the verbal reports of pain were tapping into a dimension of pain that was different than that of the PACI. Perhaps, a qualitative study could retrieve some important information that could explain the discrepancies of pain measurements between these two methods of pain assessment.

Moreover, further validity studies need to be conducted to assess the accuracy of these methods to measure pain. For example, construct validity could be evaluated by assessing pain before and after the administration of pain medication, or before, during, and after a known painful procedure. These studies may allow a closer examination of the validity of these scales.

Finally, a more comprehensive examination of the average pain intensity within the elderly needs to be conducted. In this study, pain was measured at two different moments separated by a 48-hour interval. However, these two measurements are probably not indicative of the amount of pain that the elderly experience on average. Therefore, future study is needed to examine pain intensity over multiple testing times for a longer period of time, to be able to generalize the average pain intensity findings to an elderly population.

Implications for Practice

There are implications for practice as a result of this study. First, it appears from the study findings that training and experience may affect the assessment of pain using behavioral observation methods; that is, training may improve the reliability and accuracy of pain assessments. More attention needs to be given to the development of a standardized training procedure that specifically relates to the use of the PACI in long term care. This training procedure needs to be relatively short and simple so that it can be implemented with minimal cost to employers and understood by all levels of staff. Perhaps, with increased training, staff will be able to use the PACI to provide more accurate pain assessments for those elderly who are not able to complete verbal reports of their pain.

In addition, efforts need to focus on effective ways of disseminating the findings of this study to practice. For example, the use of Registered Practical Nurses (RPNs) as knowledge brokers is suggested. They work closely with residents and health care aides and they are the staff responsible for administering pain medications in long term care. Thus, they are instrumental in making a change in pain management practices. Further study is needed to evaluate the effectiveness of RPNs in the role of knowledge brokers as a strategy to implement evidence-based practice in long term care settings.

Conclusions

The findings of this study support the use of a behavioural observation tool (i.e., PACI) for use in clinical settings. This tool is particularly useful to detect pain in residents with extreme cognitive impairment. For those elderly with no or mild cognitive impairment, the use of verbal reports of pain appear reliable and accurate. However, it is recommended that residents with moderate cognitive impairment should be assessed with both behavioral and verbal report methods, since the reliability of verbal reports of pain decreases for this group of elderly. For this group, the PPI seems to be the most appropriate and reliable way to assess for pain using verbal report scales, compared to the FPS and the NRS.

Despite the high rates of pain, pain is undertreated within the elderly population. Thus, future research is needed to examine effective ways to treat pain, such as the use of pain medications along with increased training for health care professionals. In turn, pain management will be improved in this vulnerable population, especially for the cognitively impaired, and unnecessary suffering can be alleviated.

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Appendix A

Effects of Aging on Pain Sensitivity

Reference	Noxious Stimulus	Sample	Pain Threshold	Pain Tolerance	Other Relevant Findings
Chakour et al., 1996	Thermal	n = 15 young (20-40 yrs) n = 15 elderly (65 - ? yrs) mean:74.1 yr	♦increase with age	---	♦age-related change in A-delta fiber-mediated epicritic pain perception
Collins & Stone, 1966	Electrical	N = 56 20 - 54 yrs	♦decrease with age	♦decrease with age	
Hardy et al., 1943	Thermal	N = 200 10 - 80 yrs	♦no differences	---	
Harkins & Chapman, 1976	Electrical → tooth	N = 20 healthy men	♦no differences	---	♦age-related increase in response bias ♦ elderly less accurate in discriminating pain intensity → anxiety scores higher also
Harkins & Chapman, 1977	Electrical → toothe	N = 20 healthy women 20-81 years	♦no differences ♦decrease threshold for intense pain	---	♦age-related increase in response bias for mild noxious stimuli

Reference	Noxious Stimulus	Sample	Pain Threshold	Pain Tolerance	Other Relevant Findings
Harkins et al., 1986	Thermal	N = 44 volunteers 20-80 years	♦ slightly elevated for elderly	---	
Helme & McKernan, 1985	Chemical	N = 220 17 - 84 yrs (estimated using scatter diagram but not made explicit in article)	---	---	♦ **flare response** increases with age → may be associated with skin thickness
Kenshalo, 1986	Mechanical → tactile & vibration Thermal	n=27 young n=21 elderly 19-84 yrs	♦ increase to mechanical ♦ no difference for thermal	---	
Neri & Agazzani, 1984	Electrical	N = 100 20 - 82 yrs	♦ increases with age	♦ no differences	
Notermans, 1966	Electrical	N = 30 10-65 yrs	♦ no differences		♦ representation of older population not known
Procacci et al., 1974	Thermal	no data available	♦ increase with aging	----	♦ changes in physical qualities of older person's skin (e.g., thinning) can increase pain threshold

Reference	Noxious Stimulus	Sample	Pain Threshold	Pain Tolerance	Other Relevant Findings
Sherman & Robillard, 1960	Thermal	N = 200 20 - 97 yrs	♦ increases with age	---	
Tucker et al., 1989	Electrical	N = 520 5-105 yrs	♦ increases with age	---	
Walsh et al., 1989	Cold Pressor Test	n = 500 healthy volunteers n = 113 patients with chronic pain 18-87 years		♦ decrease with age	
Woodrow et al., 1972	Mechanical → pressure on Achilles tendon "deep pain"	N = 41,119 <20- 70+ yrs *only 4% of sample 70+		♦ decrease with age	

Appendix B

Global Deterioration Scale

→ **Choose the most appropriate global stage based upon cognition and function.**

☐ 1. **No subjective complaints of memory deficit.** No memory deficit evident on clinical interview.

☐ 2. **Subjective complaints of memory deficit**, most frequently in following areas:
a) forgetting where one has placed familiar objects and
b) forgetting names one formerly knew well.

No objective evidence of memory deficit in clinical interview.
No objective deficits in employment or social situations.
Appropriate concern with respect to symptomatology.

☐ 3. **Earliest clear-cut deficits.**

Manifestations in more than one of the following areas:
a) patient may get lost when traveling to an unfamiliar location,
b) coworkers become aware of patient's relatively poor performance,
c) work-finding and/or name-finding deficits become evident to intimates,
d) patient may read a passage of a book and retain relatively little material,
e) patient may demonstrate decreased facility in remembering names on introduction to new people,
f) patient lose or misplace an object of value, and
g) concentration deficit may be evident on clinical testing.
Objective evidence of memory deficit is obtained **only with an intensive interview.**
Decreased performance is apparent in demanding employment and social settings.
Denial begins to become manifest in the patient.
Mild to moderate anxiety accompanies symptoms.

☐ 4. **Clear-cut deficit on careful clinical interview.**

Deficit manifest in the following areas:
a) decreased knowledge of current and recent events.
b) difficulty remembering one's personal history.
c) concentration deficit elicited on serial subtractions.
d) decreased ability to travel, **handle finances**, etc.
Frequently, no deficit is apparent in the following areas:
a) orientation to time and place.
b) recognition of familiar persons and faces.
c) ability to travel to familiar locations.
Inability to perform complex tasks.
Denial is the dominant defense mechanism.
Flattening of affect and withdrawal from challenging situations.

☐ **5.** **Patient can no longer survive without some assistance.**

Patient is unable during interview to recall a major relevant aspect of their current life, e.g.:

a) their address or telephone number of many years.
b) the names of close members of their family (such as grandchildren).
c) the name of the high scholl or college from which they graduated.

Frequently some disorientation to time (date, day of the week, season, etc.) or to place.
An educated person may have difficulty counting back from 40 by 4s or from 20 by 2s.
Persons at this stage retain knowledge of many major facts regarding themselves and others.
They invariably know their own names and generally know their spouse's and children's names.

☐ **6.** May occasionally forget the name of the spouse upon whom they are entirely dependent for survival.
Will be **largely unaware of all recent events and experiences in their lives.**
Retain some knowledge of their surroundings; the year, the season, etc.
May have difficulty counting by 1s from 10, both backward and sometimes forward.
Will require some assistance with activities of daily living:

a) may become incontinent.
b) will require travel assistance but occasionally will be able to travel to familiar locations.

Diurnal rhythm frequently disturbed.
Almost always recall their own name.
Frequently continue to be able to distinguish familiar from unfamiliar persons in their environment.
Personality and emotional changes occur. These are quite variable and include:

a) delusional behavior, e.g., patients may accuse their spouse of being an imposter; may talk to imaginary figures in the environment, or to their own reflection in the mirror.
b) obsessive symptoms, e.g., person may continually repeat simple cleaning activities.
c) anxiety symptoms, agitation, and even previously non-existent violent behavior may occur.
d) cognitive abulia, e.g., loss of willpower because an individual cannot carry a thought long enough to determine a purposeful course of action.

☐ **7.** **All verbal abilities are lost over the course of this stage.**
Early in this stage words and pharases are spoken but speech is very circumscribed.
Later there is no speech at all - only grunting.
Incontinent; requires assistance toileting and feeding.
Basic psychomotor skills (e.g. ability to walk) **are lost with the progression of this stage.**
The brain appears to no longer be able to tell the body what to do.
Generalized and cortical neurologic signs and symptoms are frequently present.

Appendix C

Pain Assessment in the Communicatively Impaired Elderly (PACI)

Behaviour	Present
Facial:	
Brow Lower	
Eyelid Tighten	
Cheek Raise	
Sounds	
Words (unsolicited)	
Guarding	
Rubbing/Touching	
TOTAL	/7

Definitions:

Brow lower: eyebrow is lowered, eyebrows closer together, eyes may narrow, deep vertical wrinkles between the eyebrows
Eyelid Tighten: eyelids tighten, eye opening narrows, lower eyelid is raised, eyes may squint

Cheek Raise and Eyelid Compress: cheeks lift upwards, eye opening narrows, wrinkling of skin beneath the eye, may cause crow's feet or wrinkles at outer corners of eyes

Sounds: crying, moaning, groaning, not words

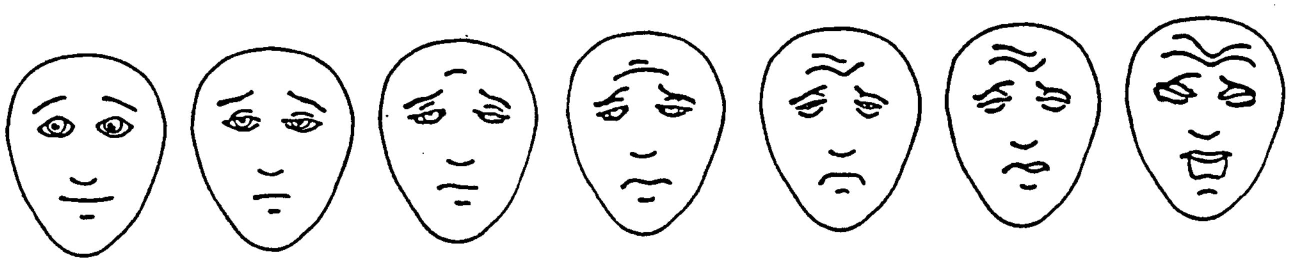
Words (unsolicited): words indicating pain: "ouch", "that hurts", do not include if in response to question "does this hurt?"

Guarding: to protect, pull away, cover up, draw back

Rub/Touch: rub or hold or press a body area or forehead

Appendix D

The Faces Pain Scale (FPS)

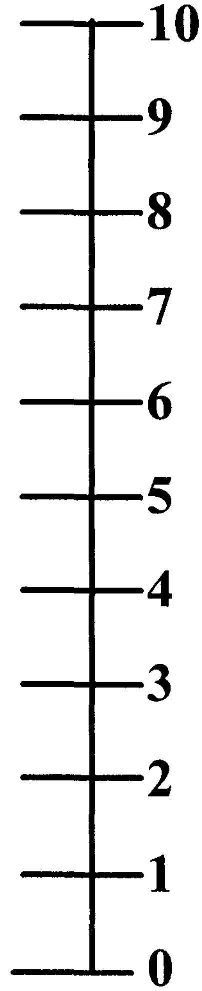


Bieri, D., Reeve, R., Champion, D., Addicoat, L., & Ziegler, J. (1990). The Faces Pain Scale for the self-assessment of the severity of pain experienced by children: development, initial validation, and preliminary investigation for ratio scale properties. Pain, 41, 139-150.

Appendix E

<u>Numerical Rating Scale</u>

Pain As Bad As It Could Be



No Pain

Appendix F

Present Pain Intensity Scale

5 - Excruciating

4 - Horrible

3 - Distressing

2 - Discomforting

1 - Mild

0 - No Pain

Appendix G

Self-Report Evaluation

Tasks	Pass	Fail
1. **Faces Scale Assessment** → Which face shows the most pain? → Which face shows the least pain? → Put these faces in order from no pain to the most possible pain.		
2. **Block Assessment** ***Magnitude:*** (Present blocks in 3, 5, 1 order) → Which block is bigger? → Which block is smaller? (Present blocks in 5, 1, 3 order) → Which block is bigger? → Which block is smaller?		
Ordinal Position: **Three Blocks (Place in order: 3, 5, 1)** → Put these blocks in order from smallest to biggest. **Five Blocks (Place in order: 4, 1, 3, 5, 2)** → Put these blocks in order from smallest to biggest.		
3. **Numeral Assessment** ***Magnitude:*** (Present numbers in 3, 5, 1 order) → Which number is bigger? → Which number is smaller? (Present numbers in 5, 1, 3 order) → Which number is bigger? → Which number is smaller?		
Ordinal Position: **Three Numerals (Place in order: 3, 5, 1)** → Put these numbers in order from smallest to biggest. **Five Numerals (Place in order: 4, 1, 3, 5, 2)** → Put these numbers in order from smallest to biggest.		

Appendix H

Demographic Data Form

Code #: ________

Name: ____

Age: __________ Gender: Male/Female (circle)

Marital Status: Married Widowed Divorced Single (circle)

Admission Date: ___________________________________

Education: ____

Occupation: ____

Ethnic Origin: ____

Diagnoses: ____

____

Mobility Status: ____

Sensory Deficits: ____

History of Depression: Yes or No

Pain Medication Use: **Analgesics*** **NSAIDS**** **Opioid Analgesics*****

Prescribed:

Administered:

Within Last 24 hours:

Within Last 6 hours:

***Analgesics:** acetaminophen, aspirin

****NSAIDS:** ASA if > 1/day, ibuprofen, naproxen

*****Opioid Analgesics:** acetaminophen with codeine, morphine, hydromorphine, meperidine

Appendix I

Consent Form

**PAIN ASSESSMENT IN THE ELDERLY:
AN EVALUATION OF METHODS AND SELF-REPORT SKILLS**

Dear Resident/Proxy:

We are concerned about pain experienced by residents over 65 years who live in long term care. People in this age group often suffer from pain which affects their ability to enjoy life. The purpose of this study is to try to evaluate different methods of assessing pain in the elderly, especially in those elderly with dementia. These elderly are particularly difficult to assess for pain because of communication problems and often their pain goes unnoticed. Improved methods of pain assessment can lead to more adequate management of pain.

This study will involve each resident meeting with the investigator for three sessions that each last approximately 10-15 minutes. The first two sessions will occur within 30 minutes of each other and will involve the same procedure. These sessions will include the investigator asking the resident about the amount of pain felt at that moment. The third session will involve the resident performing some tasks using numbers and blocks. The purpose of these tasks is to assess the resident's ability to place numbers and different size blocks in ascending order. Information will also be taken from the chart record.

This study does not involve risk of any kind and will not affect the care given. Participation in the study is voluntary and all information will be confidential. If any study results are published, participants will in no way be identified. If, at any time, the resident wishes to withdraw from the study, he/she may do so without any consequences. Each participant will receive a copy of this consent form once it is signed. We hope that you will join us in our efforts to improve care for residents, especially those with dementia.

Sharon Kaasalainen, R.N. Phone #: (905) 332-2472

I hereby agree to participate, or have my relative,________________________

participate in this study.

(Signature)	Date	Name Printed
(Witness)	Date	Name Printed