

HEALTHCARE WORKER FACTORS INFLUENCING REPORTS OF PAIN JUDGMENTS
ABOUT OLDER PATIENTS WITH CANCER AND DELIRIUM

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ABSTRACT

Healthcare workers (HCWs) rely on behavioural cues to judge pain in older adults with cancer and delirium. This study identified HCW factors associated with pain judgments about older patients with advanced cancer who are cognitively intact or have delirium, including the hypoactive, hyperactive, and mixed subtypes. Fifty-three HCWs with experience in pain-related specialties were interviewed on their experiences regarding pain judgments about this patient population. The Cancer Pain and Delirium Scale (CPDS) was used to score each interview transcript for reported pain cues for each patient group. Backward regression models found that age, discipline, specialty, years of experience in palliative oncology or geriatrics, percentage of older patients cared for per month, and pain catastrophizing each contributed to at least one of the models for CPDS INT, DEL, HYPO, and HYPER. These results support the biopsychosocial model of pain and aging and highlight the influence HCW factors have on pain assessments.

TABLE OF CONTENTS

ABSTRACT.....	ii
TABLE OF CONTENTS.....	iii
LIST OF TABLES	v
LIST OF FIGURES	v
INTRODUCTION	1
Overview.....	1
Pain: Definition and Theories	2
Cancer Pain and Aging	4
Cancer Pain and Delirium.....	6
Biopsychosocial Model of Pain and Aging	8
A Framework for HCWs' Pain Judgments about People with Delirium.....	11
Assessment of Pain in Non-Verbal Populations	14
Pain in Non-Verbal Populations	14
Pain Assessment in Non-Verbal Populations	16
Pain Assessment in Patients with Delirium.....	17
Development of The Cancer Pain and Delirium Scale (CPDS)	23
HCWs' Pain Judgments about Older Adults with Advanced Cancer and Delirium.....	26
Observer Factors Influencing Pain Judgments	30
Age.....	30
Gender	31
Clinical Experience.....	32
Pain Catastrophizing.....	38
Empathy	40
Knowledge and Beliefs about Cancer Pain and Aging.....	41
RELEVANCE AND IMPORTANCE	43
OBJECTIVE	44
METHODS	44
Study Design and Setting.....	44
Study Population.....	45
Data Collection and Procedures.....	45
Measures	46
Data Analysis	48

Missing Data.....	48
Descriptive Statistics	48
Qualitative-Quantitative Content Analysis.....	49
Multivariable Linear Regression Model Building.....	50
Backward Selection Multivariable Linear Regression Models	52
RESULTS	53
Participant Characteristics	54
Qualitative-Quantitative Content Analysis.....	56
Bivariate Analyses: Identifying Candidate Correlates.....	56
Multivariable Linear Regression Models.....	63
DISCUSSION	65
Biopsychosocial Model of Pain and Aging	66
Correlates Across Models	71
Correlates of the Number of Reported Pain Cues.....	78
Demographic Correlates	78
Clinical Experience Correlates	83
Psychological Correlates	93
Gender and Cultural Competence.....	96
Limitations, Strengths, and Future Directions	102
CONCLUSION.....	106
REFERENCES	108
APPENDIX A: QUESTIONNAIRES	144
Demographic and Professional Data Collection Sheet	144
HCW Interview Sample Questions.....	145
Pain Catastrophizing Scale	146
Davis Empathic Concern Scale.....	147
Cancer Pain and Delirium Scale	148
APPENDIX B: MODEL ASSUMPTION TESTING.....	149

LIST OF TABLES

Table 1. Demographic and Clinical Characteristics of HCWs	55
Table 2. Descriptive Characteristics of CPDS Scores	56
Table 3. Continuous Candidate Correlates of CPDS Scores for each Patient Group	59
Table 4. Categorical Candidate Correlates of CPDS Scores for each Patient Group	59
Table 5. Multivariable Backwards Linear Regression Correlates of CPDS Scores	65

LIST OF FIGURES

Figure 1. The Biopsychosocial Model of Pain and Aging ⁸²	10
Figure 2. Lower half of the Biopsychosocial Model of Pain and Aging ⁸²	10
Figure 3. A-B-C model of observer pain judgments for the detection of pain in older cancer patients with delirium	13
Figure 4. Consort diagram of HCWs	53
Figure 5. Lower half of the revised Biopsychosocial Model of Pain and Aging.....	71

INTRODUCTION

Overview

In the advanced stages of cancer, up to 88% of older adults experience moderate-to-severe pain¹, and up to 88% of these patients also develop delirium^{2,3}. Unfortunately, research into cancer pain and delirium is limited, and health care workers (HCWs) continue to experience difficulties in the assessment, treatment, and management of pain in this vulnerable patient population⁴⁻⁷. Patients with delirium are unable to provide reliable self-report of pain^{4,8,9}, and a standardized pain assessment tool for HCWs to use with these patients is not yet available. As a result, HCWs must rely on behavioural cues to judge pain⁴. However, the behavioural manifestations of pain and delirium may present similarly to one another^{4,9}, thus complicating pain assessment and management. These pain judgments may be influenced by a range of HCW biopsychosocial factors, such as age, gender, clinical experience, pain catastrophizing, empathy, and beliefs about pain^{10,11}. Given the increasing prevalence of cancer and delirium among older adults^{2,3,12}, research to better understand how HCWs judge pain in this population is crucial. The aim of the current study was to identify HCW biopsychosocial factors that are associated with pain judgments about older patients with advanced cancer who are cognitively intact or who have delirium, including the hypoactive, hyperactive, and mixed subtypes. Physicians and nurses with experience in pain assessment in geriatrics, oncology, palliative care, and other related specialties were recruited to participate in the study. Participants attended a data collection meeting, where demographic and professional information was collected. They were then interviewed regarding their experiences and beliefs about pain in cognitively intact and cognitively impaired, older cancer patients. Each interview was then transcribed verbatim. To analyze the data, an approach referred to as qualitative-quantitative content analysis¹³ was used.

Specifically, this involved first using conceptual content analysis¹⁴ to quantify the number of pain cues reported in each interview, and then performing quantitative analysis on these data. The Cancer Pain and Delirium Scale (CPDS)¹³ was used to score each interview transcript for reported pain cues used to judge pain in patients who are cognitively intact, have delirium, as well as those with hypoactive, hyperactive, and mixed subtypes. For each HCW, five CPDS scores were calculated by totaling the number of reported pain cues used to judge pain in each patient group (i.e.: CPDS INT, CPDS DEL, CPDS HYPO, CPDS HYPER, CPDS MIX). Backward regression was used to build models of the HCW biopsychosocial correlates of CPDS scores for each patient group.

Pain: Definition and Theories

Pain is defined as “an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage.”¹⁵ Several theories regarding pain processing and experience have emerged and evolved over time. Among the first was Specificity theory, which proposed that specific pain receptors in the tissue directly project to a pain center in the brain¹⁶. The theory also stated that there was a one-to-one relationship between pain perception and the intensity of the stimulus¹⁶, where a more intense stimulus would lead to higher levels of pain. However, this theory did not account for contributions to pain made by the central nervous system^{16–18}.

In 1965, Melzack and Wall¹⁷ proposed the Gate Control theory, which states that incoming peripheral nerve impulses are modulated by a “gate” at the spinal cord^{17,18}. The balance between nociceptive signals and non-nociceptive signals determines whether the gate will be “open” or “closed”^{17,18}. For example, if nociceptive signals outweigh non-nociceptive

signals, the gate will be “open”, thus allowing the signal to be transmitted to the brain. In addition, nerve impulses descending from the brain can also influence the spinal cord gate^{17,18}; central nervous system activities responsible for emotion, attention, and memories of prior painful experiences can influence sensory input¹⁷. This theory allowed for the possibility that psychological factors, such as attention and previous experiences, can influence pain perception and response by acting on the gate control system¹⁷.

Melzack and Casey¹⁹ extended the Gate Control theory¹⁷ by examining the effects of the propagated signal at the brain level. They proposed the Multidimensional Model of Pain, which describes pain as multifaceted and complex, with sensory, motivational, and cognitive components¹⁹. The interactions and relationships among these three systems influence the motor mechanisms that characterize pain¹⁹.

To further understand the role of the brain in pain, Melzack proposed the Neuromatrix theory^{20,21}. The Neuromatrix theory states that pain is a multidimensional experience produced by an inherent neural network in the brain^{20,21}, known as the body-self neuromatrix, which has a wide range of components that act on it^{20,21}. These include sensory, visual, auditory, cognitive, emotional, and neural inputs, as well as stress-regulation systems^{20,21}. This theory moves us away from the idea that pain is a sensation solely caused by tissue damage, and towards the concept of pain as a multidimensional experience produced by various influences²¹.

The understanding that pain is influenced by a number of intrapersonal and environmental factors led to the biopsychosocial model of pain²². The biopsychosocial model of pain proposes that pain is subjective and is influenced by the dynamic interaction of biological (e.g.: age), psychological (e.g.: emotional distress), and social factors (e.g.: social environments)²². This model suggests that these factors interact with one another as opposed to

working independently to produce the experience of pain, creating individual variability in pain experience, expression, and report^{22,23}. The biopsychosocial model of pain is now widely accepted; however, the factors that influence pain experience, expression, and report have yet to be fully established.

Cancer Pain and Aging

Older adults (≥ 65 years old) make up the largest proportion of cancer patients²⁴. By 2030, 70% of all cancer diagnoses will occur in persons 65 years or older¹². Pain is one of the most common symptoms of advanced cancer²⁵, with almost 70% of advanced cancer patients experiencing pain^{25,26}. Cancer pain may be due to the nature of the disease and/or treatment^{27–30}. As the disease progresses, the prevalence and intensity of cancer pain increases^{25,31}, with up to 83% of palliative care patients reporting moderate-to-severe pain^{25,26,32,33}. In older adults, over 66% of advanced cancer patients receiving palliative care experience pain³⁴ with almost 88% of these patients reporting moderate-to-severe-pain¹.

Research examining the relationship between age and pain prevalence in advanced cancer patients presents mixed results^{26,35–38}, with studies reporting increases³⁵, decreases^{26,36,37}, and no changes³⁸ in pain prevalence with age. Similar to pain prevalence, research into the relationship between age and pain intensity in advanced cancer patients presents mixed results^{26,27,31,39–43}. Some studies report a decrease in cancer pain intensity with increasing age^{26,31,39,40}, while others report no change^{27,41–43}. These inconsistent findings may be due to methodological differences across studies, such as sample size variations and differences in scales used to measure pain, making it difficult to draw conclusions about the relationship between age and cancer pain intensity.

Unfortunately, it has been found that there is a risk for inadequate cancer pain assessment and management in older adults^{12,29,44–50}. Studies have shown that HCWs underestimate both pain prevalence and pain intensity in older patients with advanced cancer^{29,50}. Consistent with this, older patients with advanced cancer were less likely than younger patients to receive opioid analgesics^{47–49}.

Inadequate cancer pain assessment and management in older adults may be due to numerous patient, HCW, and health-care system barriers^{41,44,51–53} as many patients and HCWs have misconceptions regarding pain and aging⁵⁴. Some misconceptions include the belief that pain is a normal part of aging⁵¹, and that older adults perceive less pain than younger adults⁴⁶. However, there is evidence to suggest that older adults may be more sensitive than younger adults to pain⁵⁵, thus challenging this misconception. Another misconception is that older patients maintain a sense of stoicism when in pain⁵¹. Mah and colleagues⁵⁶ have challenged this concept, as they found that younger patients with advanced cancer scored higher than older patients on measures of stoicism.

These knowledge gaps, misconceptions, and barriers to adequate pain assessment may influence HCWs' decisions regarding pain management and treatment in older adults^{44,57}. HCWs may have biases and concerns about use of opioid analgesics in this demographic^{44,57–59}. Spitz and colleagues⁵⁸ conducted a qualitative study examining HCWs' perspectives on prescribing opioids to older adults with chronic non-malignant pain. They found that most HCWs would proceed with caution when prescribing opioids to older adults due to a fear of causing harm, and concerns regarding opioid abuse, misuse, and addiction⁵⁸. Similarly, another qualitative study examining HCWs' beliefs about pain in older advanced cancer patients found that most HCWs believed an age-tailored approach should be taken when prescribing opioids to

this demographic⁵⁹. They believed opioids should be used less frequently and at lower doses in older than younger patients, and that there is a greater risk for opioid-related side effects in older than younger patients⁵⁹. However, this belief is supported by previous research examining the efficacy and tolerability of opioids in older adults^{60–62}. Older patients require lower doses of opioids^{60–62}, due to the differences in metabolization and absorption between younger and older patients^{60,61}. This patient population is at greater risk of adverse effects of opioids due to comorbidities and interactions with other medications⁶⁰. Taken together, HCWs may be more hesitant to prescribe and administer opioids to older adults in pain, as they are concerned about the use of this medication in this demographic.

As a result, inadequate pain assessment and management in older adults may lead to other physical, psychological, and social issues for both the patient and their loved ones. For instance, unrelieved pain is associated with impairments in physical functioning, as well as cognitive decline and depression in older advanced cancer patients^{45,63}. Family members also report difficulty coping with the patients' illness and symptoms, and feelings of helplessness and frustration in trying to manage the unrelieved pain⁶⁴. More research is needed to understand the management and impact of pain in older adults with advanced cancer.

Cancer Pain and Delirium

Delirium is an acute neurocognitive disorder characterized by disturbances in attention, awareness, and cognition⁶⁵, which can lead to difficulties with memory, orientation, language, and other areas⁶⁶. Delirium can be classified into three subtypes: hypoactive, which presents with sedation, lethargy, and confusion; hyperactive, which presents with agitation, restlessness, and disorientation, and is often accompanied with delusions and hallucinations; and a mixed

form which features characteristics of both hypoactive and hyperactive subtypes^{65,67,68}. It typically develops over a short period of time, and the course tends to fluctuate⁶⁶. Hypoactive delirium is most common, followed by hyperactive and mixed subtypes^{3,67,69,70}.

Delirium is the most common neuropsychiatric complication experienced by older advanced cancer patients⁶⁹, as up to 88% will develop delirium at the end of life^{2,3}. In a recent study, HCWs determined that pain was present in over 60% of older advanced cancer patients with delirium; this did not differ by delirium subtype^{4,5}. Thus, many older patients with advanced cancer will experience cancer pain and delirium together at the end of life.

Older adults with advanced cancer and delirium may have difficulty reporting their pain to HCWs^{71,72}, thus complicating pain assessment and management. As delirium diminishes the ability to provide reliable self-report of pain^{4,8,9}, HCWs must rely on behavioural cues to assess and manage cancer pain⁴. This can create significant challenges to the assessment and management of pain, as behavioural manifestations of pain and delirium may be nonspecific and present similarly to one another^{4,9}. For example, grimacing, agitation, and yelling may be indicative of pain, delirium, both or neither.

This overlap in behavioural manifestations of pain and delirium may lead to both undertreatment and overtreatment of pain^{6,73–77}. If behavioural cues indicating pain are mistaken for symptoms of delirium, it may lead to the underestimation and undertreatment of pain. Consequently, pain undertreatment has been associated with anxiety, suffering, cognitive impairment, and poorer quality of dying and death^{78,79}. Undertreatment of pain can also exacerbate delirium^{73,75,76}, thus worsening behavioural symptoms and its consequences.

Conversely, if these behavioural cues are misattributed to pain rather than delirium, this could inflate pain judgments, which may lead to the overtreatment of pain^{6,74}. Unwarranted

opioid escalation may contribute to opioid-induced neurotoxicity, which in turn may worsen delirium and exacerbate pain-like behaviours^{6,74,77}.

Taken together, the cognitive and behavioural symptoms which accompany delirium can hinder the ability of older patients with advanced cancer to provide a reliable self-report of pain, as well as hinder HCWs' ability to accurately interpret these behavioural cues and make reliable pain assessments and treatment decisions⁴⁻⁷. The literature on HCWs' judgments about pain in older people with advanced cancer and delirium is limited; more research is needed to better understand this relationship.

Biopsychosocial Model of Pain and Aging

There is increasing evidence to suggest that cancer pain is biopsychosocial, with clinical differences between older and younger adults^{27,80,81}. Biological factors, such as comorbidities, are associated with cancer pain qualities in older adults⁸⁰. There are also age-related differences in psychosocial factors, such as adaptation to cancer pain^{27,81}. Therefore, it is important that a life-span developmental approach be taken to understand the relationship between pain, aging, and biopsychosocial factors.

In order to further understanding of the relationships between aging, pain, and biopsychosocial factors, Gagliese et al.⁸² proposed the Biopsychosocial Model of Pain and Aging (Figure 1). Adapted from previous biopsychosocial models of pain^{18,22}, the upper half of the model proposes a dynamic relationship between pain and various biological (e.g.: gender), psychological (e.g.: depression), cognitive (e.g.: cognitive status), and social (e.g.: socioeconomic status) factors, where these factors may influence pain and vice versa. For

instance, depression may be a biopsychosocial factor that perpetuates and worsens pain; however, unrelieved pain can also perpetuate and worsen depression⁸².

Adapted from The Pain Communication Process Model by Prkachin and colleagues¹⁰, the lower half of the model (Figure 2) considers the communication of pain and its interpretation by others. Specifically, how HCW and caregiver factors (e.g.: age, clinical experience, empathy, pain beliefs) influence their decoding, judgments, and management of pain in others⁸². Further, patient factors, such as delirium, may also alter pain expression and hinder self-report, which can influence HCWs' judgments of pain⁸².

This study will test the lower half of the model by examining the HCW factors influencing their judgments about pain in older people with advanced cancer and delirium (Figure 2). The factors included in the model (i.e.: age, empathy, clinical experience) as well as other important observer factors found in the literature (i.e.: gender, pain catastrophizing) have yet to be examined extensively or in a multivariate way. In doing so, we will refine the model and further our understanding as to how pain judgments are made in this population, and which HCW factors are influencing these judgments.

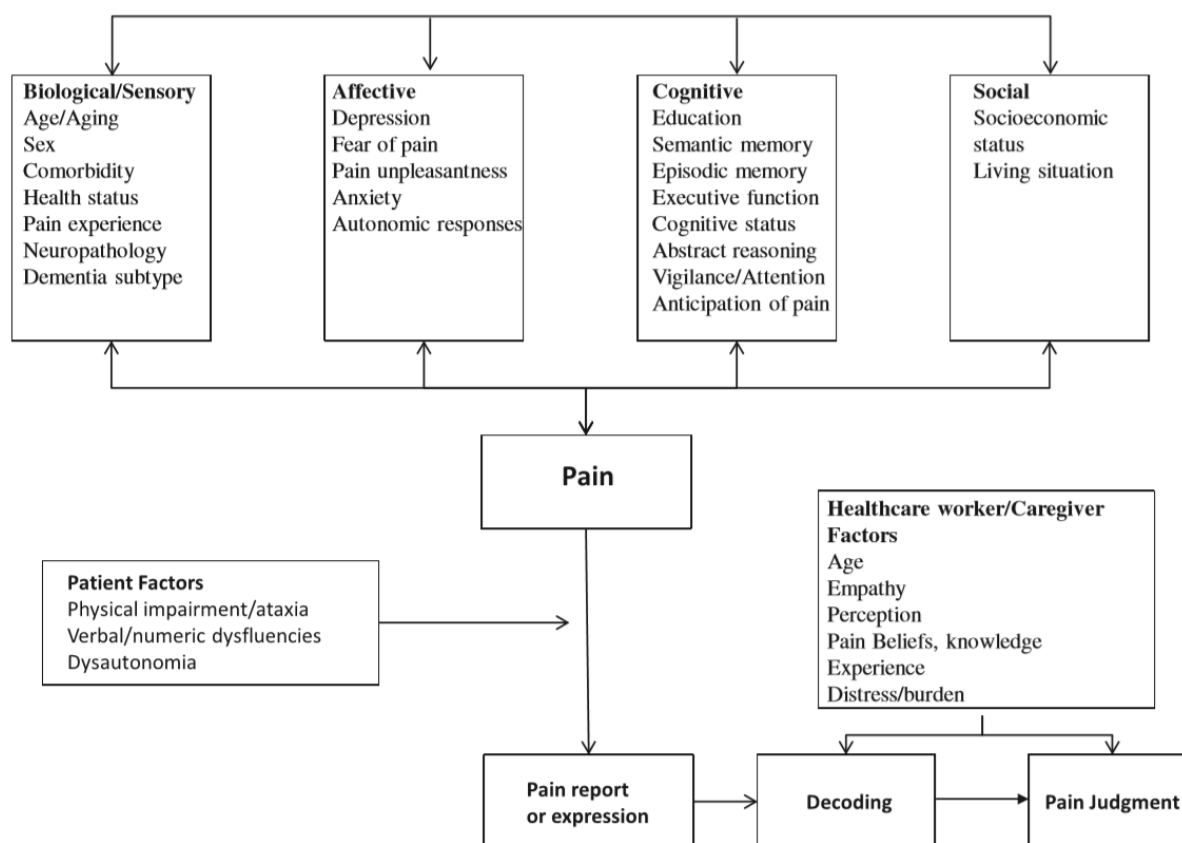


Figure 1. The Biopsychosocial Model of Pain and Aging⁸²

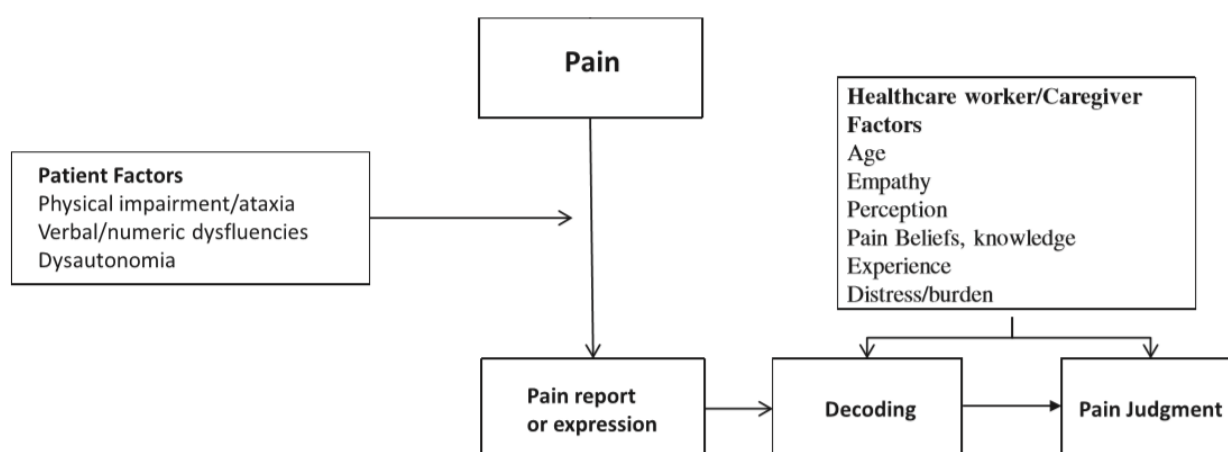


Figure 2. Lower half of the Biopsychosocial Model of Pain and Aging⁸²

A Framework for HCWs' Pain Judgments about People with Delirium

Patient self-report is considered the “gold-standard” for pain assessment in older adults^{83,84}. However, this may not be reliable or valid in various populations⁸⁵, including people with delirium^{4,8,9}, due to their limited capacity to verbally communicate. As a result, observers must use behavioural cues to determine if these patients are in pain^{4,9,86}.

Rosenthal has developed a basic A-B-C model of observer judgments of nonverbal behaviour, known as The Judgment Study Model⁸⁷, where “A” represents the encoder’s state; “B” represents the encoder’s nonverbal behaviour; and “C” represents the decoder’s judgment. This model⁸⁷ is not specific to pain. Prkachin and colleagues¹⁰ extended Prkachin and Craig’s general model of pain expression⁸⁸ by incorporating The Judgment Study Model⁸⁷ to create a comprehensive framework known as The Pain Communication Process Model¹⁰. This model¹⁰ highlights the fundamental processes and variables involved in the pain-communication process, which is the communication of a painful experience between two members of a dyad: the individual experiencing pain and the individual to whom they are communicating this experience. In the Pain Communication Process Model¹⁰, “A” represents the individual’s internal pain experience, “B” represents the encoding of the painful experience into a socially recognizable signal (i.e., pain behaviours), and “C” represents the decoding of the pain behaviours by an observer.

These preceding models^{10,87,88} were adapted into a framework for HCWs’ pain judgments about older people with delirium that incorporates the unique factors which may impact the pain-communication process in this population (Figure 3). “A” denotes the individual’s internal experience, which is described as “nociception”. The use of the term “nociception” (rather than “pain”) in this framework is important to note. The subjective experience of pain is difficult to

determine in nonverbal populations, such as in older adults with delirium, due to the lack of verbal self-report and overlap of behavioural manifestations^{4,8,9}. Nociception, defined as the neural and physiological process of encoding noxious stimuli⁸⁹, was used in this framework as it considers the possibility that the individual's internal experience is something other than pain but may be presenting itself as such⁹⁰.

“B” denotes the individual's verbal and nonverbal behaviours/cues used to communicate “A”, which may be impacted by cognitive status (i.e., delirium and its subtypes) and other health factors (e.g., disease factors, comorbidities, and performance status).

“C” denotes the decoding of “B” by HCWs to judge if the individual is experiencing pain. This may be influenced by various patient (e.g.: age, gender) and HCW factors (e.g.: age, gender, clinical experience, knowledge and beliefs about pain, symptom certainty, empathy, and pain catastrophizing). Although Prkachin and colleagues¹⁰ incorporated various HCW factors into their model, the current framework expanded this list to account for HCW factors that may be important when specifically judging pain in older adults with cancer and delirium (e.g.: age, gender, clinical experience, knowledge and beliefs about pain, symptom certainty, empathy, and pain catastrophizing). Moreover, they did not include patient factors, which are also important influences on HCWs' pain judgments. The HCWs' pain judgments that follow the decoding of pain behaviours play a fundamental role in determining course of treatment, as well as initial and subsequent assessments of their patients. The current framework displays this as a cycle, where the evaluations made based on treatment decisions can influence future pain judgments. This is different from the Pain Communication Process model¹⁰ as it does not include this cyclic process.

In the present study, we are investigating the latter half of this framework, namely how HCW factors (i.e.: age, gender, clinical experience, empathy, and pain catastrophizing) impact “C” (the decoding of pain cues) when “B” (verbal or nonverbal expression of pain cues) is expressed by older people with delirium.

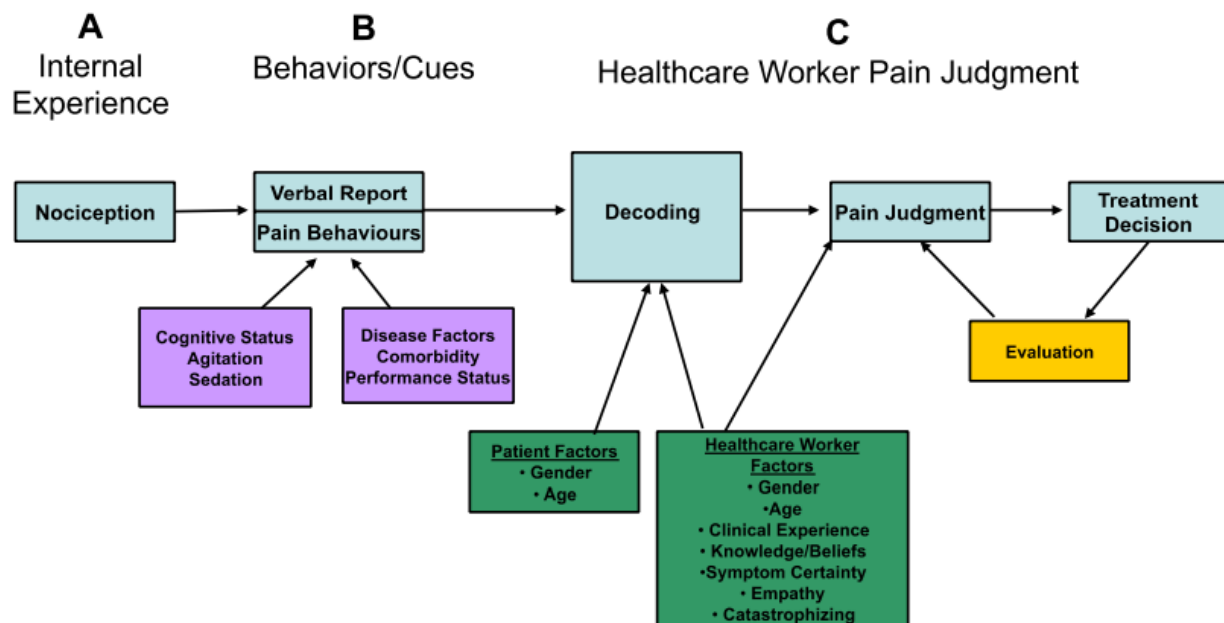


Figure 3. A-B-C model of observer pain judgments for the detection of pain in older cancer patients with delirium (Adapted by L. Gagliese from Rosenthal, 2008; Prkachin & Craig, 1994; Prkachin et al., 2007)

Assessment of Pain in Non-Verbal Populations

Pain in Non-Verbal Populations

Pain is a common symptom experienced by many non-verbal populations, such as persons with dementia, with prevalence rates of up to 56%^{91,92}; critically ill or unconscious persons, where more than 58% of ICU patients experience pain during their stay^{93,94}; and patients at the end of life, where pain was reported to be present in over 60% of older patients with advanced cancer and delirium^{4,5}. Research comparing pain prevalence between cognitively intact and cognitively impaired individuals report mixed results⁹⁵⁻⁹⁹, with most studies reporting a decrease in pain prevalence in patients who are cognitively impaired^{95-97,99}, while one study found comparable rates between the two groups⁹⁸. Burfield and colleagues⁹⁵ found that 47.7% of cognitively intact nursing home residents experienced daily pain, while only 39.6% of those with mild cognitive impairment, 29.4% with moderate cognitive impairment, and 18.2% of older adults with severe cognitive impairment reported pain, despite similar painful diagnoses. In contrast, Shega and colleagues⁹⁸ found no significant difference between pain prevalence in cognitively intact (35.9%) and mild-to-moderately cognitively impaired (37.6%) individuals. However, Shega and colleagues⁹⁸ did not include individuals with severe cognitive impairment in their study, which may explain the differences in results^{95,98}. Taken together, these results suggest that pain is less likely to be detected in persons with cognitive impairment than in those who are cognitively intact, particularly in individuals with more severe cognitive impairment.

This decrease in reported pain prevalence in non-verbal populations may be due to difficulties or an inability to verbally communicate¹⁰⁰. Cognitive impairment has been associated with changes in speech, language, memory, and consciousness¹⁰⁰, which may make recall and communication of pain difficult or impossible, especially as cognitive impairment

worsens^{101,102}. Kunz and colleagues¹⁰¹ examined the impact of cognitive impairment on various aspects of pain processing, such as self-report, in patients with dementia following noxious electrical stimulation. They found that almost half of the patients with cognitive impairment were unable to continuously provide verbal self-report pain ratings, despite the pain rating scale being non-cognitively demanding¹⁰¹. Furthermore, they found that a decrease in cognitive functioning was strongly associated with a decrease in the percentage of scorable pain ratings¹⁰¹. Interestingly, they also found that patients with cognitive impairment reported similar levels of pain intensity as those who are cognitively intact¹⁰¹. These results suggest that the inability to verbally communicate does not negate the fact that an individual is experiencing pain^{15,103}. In fact, the International Association for the Study of Pain (IASP) recently added this note to their definition of pain to better reflect the differences in pain expression and report among different groups of individuals^{15,103}. More research is needed to better understand the relationship between pain experience and pain report in non-verbal populations.

Unfortunately, it has been found that non-verbal populations are at risk for inadequate pain management^{94,97,104}. McDermott and colleagues¹⁰⁴ examined inconsistencies in pain management between cognitively intact and cognitively impaired individuals following fractured neck of femur. They found that patients with cognitive impairment received a weaker level of analgesia and would wait, on average, an hour longer to receive pain relief, as compared to cognitively intact patients¹⁰⁴. In addition, they found that in the ambulance, 45% of patients with cognitive impairment did not receive any pain relief, compared with just 8% of cognitively intact patients¹⁰⁴. Consequently, unrelieved pain has been associated with depression, anxiety, worsening of cognitive impairment, sleep disturbances, and lower quality of life¹⁰⁵. More

research aimed at understanding and improving pain management and treatment in non-verbal populations is needed.

Pain Assessment in Non-Verbal Populations

Patient self-report is considered to be the “gold standard” for pain assessment^{83,84} and is generally attempted first^{85,105}. However, it may not be reliable or possible in non-verbal populations⁸⁵. As a result, HCWs must use other methods to determine the status of pain in non-verbal patients; clinical practice recommendations for pain assessment in patients unable to self-report have been developed⁸⁵.

Observation of pain cues is an alternative approach to the assessment and judgement of pain in non-verbal populations⁸⁵. Pain cues are behaviours that a patient may express to communicate the status of their pain to others^{10,106}. These behaviours may include: paralinguistic vocalizations (e.g.: moaning, crying), facial expressions (e.g.: grimacing), body movements (e.g.: protective behaviours, body postures), changes in interpersonal interactions (e.g.: aggression), changes in activity patterns or routines (e.g.: appetite changes), and mental status changes (e.g.: distress)^{10,84,106,107}.

Observational pain scales use the assessment of pain cues and have been developed and validated specifically for use in various non-verbal populations^{108–117}. For example, Payen and colleagues¹¹⁷ developed the Behavioural Pain Scale (BPS) to assess pain intensity in sedated, mechanically ventilated patients. The behavioural items included on this scale were selected based on a survey of ICU nurses, as well as a literature review of pain scales for infants and children, and of pain-related behaviours¹¹⁷. Patients were then assessed with the BPS by pairs of evaluators (nurse and nurse’s aide) before and during a painful procedure, as well as a non-

painful procedure¹¹⁷. To ensure reliability of the data, another pair of evaluators (physician and physical therapist) assessed the patients during another painful procedure¹¹⁷. Although this scale development approach created a tool commonly used for assessing pain in the ICU^{118,119}, the partial use of pain behaviours elicited by other non-verbal populations (i.e.: infants and children) may not be reflective of those elicited by the target patient population (i.e.: adult ICU patients).

Using a different approach than Payen and colleagues¹¹⁷, McGrath and colleagues¹⁰⁸ created a checklist of behaviours that caregivers can use to assess pain in non-verbal children with cerebral palsy. Primary caregivers participated in a qualitative, semi-structured interview where they were asked to recall situations where their child may have been in pain and describe their behaviour¹⁰⁸. The interviews were then transcribed and a checklist of pain cues was generated¹⁰⁸. All interview transcripts were then coded using the checklist, and some were double-coded by another coder to ensure reliability of the data¹⁰⁸.

The use of qualitative interviews to explore caregivers' judgments of pain informed the development of the CPDS¹³ by Graham and colleagues, which served as a data collection tool in the present study. In addition, the present study tests the interrater reliability of the CPDS data in a similar procedure to the one used in McGrath and colleagues'¹⁰⁸ study. We chose this approach to develop the CPDS¹³ as HCWs with extensive experience in assessing pain in older adults with advanced cancer and delirium would have the most knowledge of pain cues elicited by this population.

Pain Assessment in Patients with Delirium

Herr and colleagues⁸⁵ developed clinical practice recommendations for the assessment of pain in patients with delirium at the end of life. These recommendations are: identifying

potential causes of pain, attempting self-report, observing patient behaviours, soliciting proxy reports of pain, and attempting analgesic trial⁸⁵.

Identify Potential Causes of Pain. First, HCWs should be aware of the potential causes of pain in this population⁸⁵. Advanced cancer pain is often complex and may be due to the disease itself and/or its treatment²⁷⁻³⁰. In addition, other biopsychosocial factors should be considered as potential causes and influences of pain, particularly in older adults^{27,80,81}. Herr and colleagues⁸⁵ recommend clinicians assume pain is present whenever a potentially painful stimulus is identified, regardless of whether the patient's behaviour indicates pain, and provide treatment. While this assumption of pain presence may minimize patient suffering, improper opioid administration may worsen delirium^{6,74,77}. Therefore, while it is important to be aware of the potential causes of pain, caution is in order when judging pain and making treatment decisions in this population.

Attempt Self-Report. Second, they suggest that an attempt of self-report should be made if the patient is able to verbally communicate⁸⁵. Gagliese and colleagues⁴ recently conducted a retrospective chart review examining the patient-based cues HCWs use to assess pain in older patients with advanced cancer and delirium. They found that pain assessments were primarily based on patient self-report when patients could verbally communicate⁴. However, a study examining symptom communication in critically ill patients found that patients with delirium were significantly less likely than cognitively intact patients to report their pain, thus challenging the dependence on self-report for pain assessments in this population⁷. Although this study⁷ looked at patients in the intensive care unit (ICU), these results may be generalized to palliative care patients, as delirium may impact symptom communication similarly in this population. The

validity and reliability of self-report of pain older palliative care patients with delirium have yet to be established⁴ and may be a topic for future research to examine.

Observe Patient Behaviours. Third, Herr and colleagues⁸⁵ suggest the observation of clinical signs of pain and/or the use of behavioural assessment tools. Although observation of pain cues is an alternative method of pain assessment in this population⁸⁵, it should be done with caution. Behavioural manifestations of pain (e.g.: agitation, yelling, grimacing), may be indicative of pain, delirium, both or neither⁴. Hadjistavropoulos and colleagues⁹ examined the extent to which each of the individual items on the Doloplus-II¹²⁰, a pain assessment tool used for older adults with dementia, were indicative of delirium, depression, and dementia severity. They found that several items used to assess pain were confounded with delirium, depression, and dementia severity⁹. For example, higher delirium severity was significantly associated with the pain cues “problems with behaviour” and “washing and dressing”⁹. These results further illustrate that individual clinical signs indicating pain may also indicate other causes of discomfort. Due to the poor specificity of these clinical signs, their sole use in the assessment of pain in patients with delirium at the end of life may lead to improper treatment of pain^{6,73–77}. Therefore, a more standardized approach to pain assessment is needed for this population.

While psychometric tools are comprised of these clinical signs, they have been carefully designed and validated specifically for use in various non-verbal populations^{108–117}. For example, Fuchs-Lacelle and Hadjistavropoulos¹⁰⁹ developed and validated the Pain Assessment Checklist for Seniors with Limited Ability to Communicate (PACSLAC), a pain assessment tool used for older adults with severe dementia. They found that the PACSLAC was able to differentiate between pain and non-pain-related distress, demonstrating specificity¹⁰⁹. Although this study focused on pain assessment in patients with dementia, these results suggest that the use

of a psychometric tool to assess pain in non-verbal patients may be a better strategy than the observation of clinical signs, as they are able to distinguish between pain and other causes of discomfort. Furthermore, these results highlight the importance and need of a validated pain assessment tool used for patients with advanced cancer and delirium, where there is the potential for behavioural overlap^{4,5,13}. The use of a standardized pain assessment tool for this population may help clinicians decipher between pain cues and delirium symptoms.

Although limited, there are some behavioural pain assessment tools developed and validated for people with delirium, specifically in intensive care^{121,122}. Chanques and colleagues¹²¹ validated an adaptation of the Behavioural Pain Scale for non-intubated intensive care patients (BPS-NI). To develop this scale, the authors modified the Behavioural Pain Scale (BPS) by replacing the “compliance with ventilation” domain with a “vocalization” domain¹²¹. A physician and bedside nurses then used the BPS-NI to rate pain intensity in non-intubated, non-verbal patients before and during a painful procedure, as well as a non-painful procedure¹²¹. The BPS-NI demonstrated discriminant validity between painful and non-painful stimuli, as well as good internal consistency and interrater reliability¹²¹. However, some patients with other reasons for their inability to self-report their pain were included in the analysis, therefore making it difficult to draw clear conclusions about patients with delirium. Kanji and colleagues¹²² investigated the validity of the Critical Care Pain Observation Tool (CPOT) in patients with delirium. This scale demonstrated discriminant validity between baseline and painful stimuli, as well as excellent interrater reliability and good internal consistency¹²². However, it is unclear whether the CPOT scores were inflated due to agitation from delirium, as opposed to pain. In addition, other observational pain scales designed for patients in other clinical settings, such as mechanically ventilated patients¹²³, patients with other cognitive impairments⁷⁶, and hospice

patients¹¹⁵, have been used or recommended for patients with delirium, despite no evidence of validity or reliability for this patient population.

Although there are already existing pain assessment tools that have been developed or recommended for use in non-verbal populations, these tools should not be used to assess pain in older adults with advanced cancer and delirium. Generalizing pain behaviours or using pain assessment tools developed for other cognitively impaired or non-verbal populations may not be appropriate, as clinical differences between these groups may uniquely impact behaviour⁸⁵. For example, high symptom burden, impending death, acute cognitive dysfunction, and polypharmacy may be unique to older advanced cancer patients receiving palliative care^{1,34} and may impact on pain behaviours in ways that are different from other patient populations. In addition, scales developed for other non-verbal populations may not include distinctive pain behaviours elicited by patients with delirium. Pain assessment tools developed and validated for people with delirium in other settings, such as intensive care¹²², should also not be used to assess pain in older adults with advanced cancer and delirium. These scales may be limited in generalizability due to differences in symptom presentation and pathophysiology¹²⁴. Therefore, a standardized method of pain assessment specific to older adults with advanced cancer and delirium is needed.

Solicit Proxy Reporting of Pain. Herr and colleagues⁸⁵ also recommended the use of proxy reports of pain by family members and caregivers. However, mixed results have been reported with regards to the accuracy of proxy assessments of pain in oncology and palliative care settings^{125–128}; some have found that proxies rate pain similarly to the observed patients^{125,126}, while others have found that proxies either overestimated¹²⁷ or underestimated¹²⁸ patients' pain. Dawber and colleagues¹²⁵ had older palliative care patients and their informal

caregivers complete their respective versions of a palliative care symptom assessment tool. After comparing the patients' assessments with those of the caregivers, they found high agreement for physical symptoms, with the best agreement for pain ratings¹²⁵. However, in a systematic review of studies comparing patient and proxy reports of symptoms at the end of life, it was found that agreement was poorest for subjective symptoms, such as pain¹²⁷. Specifically, most studies included in the review found that proxies reported patients' pain as more severe and frequent than what the patients reported¹²⁷. In contrast, Fine and colleagues¹²⁸ found that caregivers tended to underestimate hospice patients' self-reports of duration, intensity, and number of breakthrough pain episodes, as well as the amount of time to pain relief. Taken together, these results challenge the dependence on proxy reports of pain in patients at the end of life, as the accuracy of this assessment method is not guaranteed.

The use of proxy reports of pain in patients with delirium at the end of life has been reported in the literature^{4,129–131}; however, there is currently no evidence to support its validity or reliability in this population. Bruera and colleagues¹³¹ explored pain assessment in patients with cancer before, during, and after hyperactive delirium. Patients provided self-report before and after, and HCW proxies rated pain during delirium¹³¹. They found that pain intensity ratings were similar before and after the delirium episode, but were significantly higher during it¹³¹, suggesting that proxies overestimated pain intensity. Without the use of a standardized pain assessment tool for this population, proxies may misattribute behavioural cues to pain rather than delirium or vice versa, thus leading to the overtreatment or undertreatment of pain^{6,73–77}. In addition, Gagliese and colleagues⁴ found that a limited number of pain assessments in older patients with advanced cancer and delirium were based on proxy reports by family members. However, the chart notations were silent on how family members arrived at their conclusions, or

how HCWs verified these judgments⁴. This lack of information in the chart notations may be due to the absence of a standardized and validated protocol to obtain proxy reports in this population.

Attempt Analgesic Trial. Herr and colleagues⁸⁵ also suggest an attempt of analgesic trial⁸⁵. However, they caution that this can be very challenging in this population⁸⁵ as improper opioid use can further exacerbate delirium^{4,76,85,132}. Despite this, Graham and colleagues¹³ found that HCWs frequently reported *improvement with analgesic trial* as a cue they use to assess pain in older adults with advanced cancer and delirium. The use of analgesic trial to assess pain in this population may be due to the absence of a valid and reliable pain assessment tool.

In summary, clinical practice recommendations for the assessment of pain in patients with delirium at the end of life have been developed⁸⁵. Despite the lack of evidence to support each of these pain assessment strategies, HCWs continue to employ them. Unfortunately, the use of these strategies may lead to the provision of inadequate pain management to this vulnerable patient population. Therefore, a standardized pain assessment tool specific to patients with advanced cancer and delirium is urgently needed.

Development of The Cancer Pain and Delirium Scale (CPDS)

Despite the high prevalence of cancer pain and delirium occurring together at the end of life^{4,5}, pain assessment in this population has not been examined extensively and remains difficult for HCWs¹³¹. Gagliese and colleagues⁴ conducted a retrospective chart review to understand how HCWs judge pain in older adults with advanced cancer and delirium. Consistent with the clinical practice recommendations for pain assessment in patients at the end of life⁸⁵, pain judgments were primarily based on self-report when patients could communicate verbally.

However, the validity and reliability of self-report in this population have yet to be established⁴. As verbal reporting of pain significantly decreases during delirium⁷, reliance on self-report may lead to inadequate pain treatment in this population. Also consistent with clinical guidelines⁸⁵, pain judgments were based on behavioural cues (i.e.: facial expressions, body behaviours, vocalizations) in patients who were unable to verbally self-report⁴. However, almost half of the observational assessments did not specify which behavioural cues were used to determine pain presence⁴; the complete repertoire of pain cues used to judge pain in this population remained a gap in the research. Moreover, none of the chart notations explained how HCWs distinguished pain behaviours from delirium symptoms⁴. Reliance on clinical signs may lead to the misattribution of behavioural cues to pain rather than delirium or vice versa, which in turn may lead to the overtreatment or undertreatment of pain^{6,73–77}. These results⁴ illustrate the lack of evidence-based strategies for pain assessment in older adults with advanced cancer and delirium, which prompted the development of a specific pain assessment tool for this patient population.

As part of a larger program of research dedicated to pain assessment in older patients with cancer and delirium at the end of life, Graham and colleagues¹³ addressed the gap found in the chart review⁴ through a qualitative-quantitative content analysis. HCWs with experience in pain-related specialties were interviewed on their experiences and beliefs about pain assessment and management in this patient population¹³. They identified specific pain cues that HCWs report using to assess pain in older adults with advanced cancer and delirium¹³. Through this, Graham and colleagues¹³ developed the Cancer Pain and Delirium Scale (CPDS), a preliminary 20-item observational pain tool that lists cues HCWs use to identify pain in this patient population. Qualitative interviews have previously been used to successfully develop

observational pain scales for other non-verbal populations, such as children with cerebral palsy^{108,110}, babies¹¹⁶, and older adults with dementia¹⁰⁹.

Building on Graham and colleagues' study¹³ as part of this larger program of research, the present study seeks to establish construct validity and interrater reliability of the CPDS¹³. Construct validity aims to determine the relationship between a measure and other variables with which it should, theoretically, be associated¹³³. In the current study, we examined the relationships between CPDS scores and various HCW factors that have been theoretically associated with pain judgments (i.e.: age, discipline, specialty, years of experience, percentage of older patients cared for per month, pain catastrophizing, and empathy). To establish construct validity, we first collected demographic and professional information from HCWs with experience in pain-related specialties. We then interviewed them about their experiences and beliefs about pain in cognitively intact and cognitively impaired, older patients with cancer. We then used the CPDS to score each interview transcript for reported pain cues used to judge pain in patients who are cognitively intact, have delirium, as well as those with hypoactive, hyperactive, and mixed subtypes. Two independent coders performed this to ensure interrater reliability of the data. For each HCW, five CPDS scores were calculated by totaling the number of reported pain cues used to judge pain in each patient group (i.e.: CPDS INT, CPDS DEL, CPDS HYPO, CPDS HYPER, CPDS MIX). Backward regression was then used to identify relationships between HCW biopsychosocial factors and CPDS scores. Establishing construct validity and interrater reliability of the CPDS are important steps in the development of this standardized pain assessment tool for older adults with advanced cancer and delirium.

HCWs' Pain Judgments about Older Adults with Advanced Cancer and Delirium

Clinical decision making involves the careful weighing of known best practices, research evidence, clinical experience, and the needs of the patient in order to select a choice of action regarding clinical care^{134–136}. Clinical decision making skills are required for many areas of care, including pain assessment and management¹³⁷.

Croskerry¹³⁸ theorizes that clinical decision making is carried out through two systems: system one, where decisions are made based on intuition and pattern recognition; and system two, where decisions are made based on systematic analysis of evidence. System one relies on HCW experience and is influenced by a variety of factors, such as patient and illness characteristics; it is usually employed when a HCW recognizes symptom patterns from previous experiences¹³⁸. For example, Ruben and Hall¹³⁹ found that having a family history of pain, as well as previous experiences of observing others in pain, were significantly associated with more accurate pain detection. It is possible that these participants were able to identify pain more accurately because they recognized verbal and non-verbal pain behaviours from previous exposure to pain in others. In addition, Rababa and Al-Rawashdeh¹⁴⁰ found that nurses with more clinical experience reported significantly better intuitive decision-making skills than less experienced nurses. Taken together, it can be suggested that more experienced HCWs' clinical decisions are more intuitive than less experienced HCWs, and these decisions regarding pain assessment and management may be based on their previous clinical experiences.

In contrast, system two is engaged when a patient's signs and symptoms are not easily recognized as belonging to a specific illness¹³⁸. In this case, a HCW may adopt a more systematic approach to narrow down the diagnosis and course of treatment¹³⁸. For example, pain assessment in patients with dementia may be complicated the lack of verbal self-report, therefore

making it unclear as to whether observed behaviours are due to pain or another source of agitation¹⁴¹. However, Fuchs-Lacelle and Hadjistavropoulos¹⁰⁹ developed and validated the Pain Assessment Checklist for Seniors with Limited Ability to Communicate (PACSLAC), a pain assessment tool used for older adults with severe dementia. This pain assessment tool can differentiate between pain and non-pain-related distress¹⁰⁹. This is an example of a systematic approach to pain assessment where it may not be easily recognized and is difficult to assess.

When caring for older patients with advanced cancer, HCWs must make decisions regarding multiple areas of care, including symptom assessment and management¹⁴². As pain is one of the most common symptoms of cancer at the end of life²⁵, it is crucial that clinical decisions regarding pain assessment and management are carefully considered in order to optimize the care provided to this population. Clinical decisions made by HCWs regarding pain assessment in patients with advanced cancer are informed by both verbal and nonverbal behaviours, as well as pain assessment tools¹³⁷. Patient self-report is considered to be the “gold standard” for pain assessment^{83,84} and is generally attempted first^{85,105}. However, it may not be reliable or possible in older adults with advanced cancer and delirium. Since verbal self-report may be diminished in this population^{4,8,9}, self-report pain tools are no longer applicable, and HCWs must rely on observed pain behaviours, or pain cues, to assess and judge pain^{4,9,86}. The clinical decision making process for pain assessment in older adults with advanced cancer and delirium is complicated due to the overlap of pain behaviours and delirium symptoms^{4,9}. According to Croskerry¹³⁸, HCWs would adopt a more systematic approach to narrow down the diagnosis and course of treatment in this clinical situation. However, there is lack of evidence to support the systematic clinical practice recommendations developed for the assessment of pain in patients with delirium at the end of life⁸⁵. Unfortunately, the use of these strategies may lead to

inadequate pain management in this patient population. Therefore, a standard method of pain assessment specific to older adults with advanced cancer and delirium is needed.

Gagliese and colleagues⁴ recently conducted a retrospective chart review examining the patient-based cues HCWs use to make pain judgments about older palliative care patients with delirium. They determined that HCWs judged pain to be present in over 60% of this sample. These pain judgments, consistent with clinical practice recommendations regarding pain assessment in other non-verbal populations⁸⁵, were primarily based on self-report when patients could verbally communicate and behavioural cues (i.e.: vocalizations, facial expressions, and body behaviours) when patients were unable to verbally self-report⁴. However, the validity and reliability of self-report of pain in this population have yet to be established⁴. Moreover, almost half of the observational assessments did not specify which behavioural cues were used to determine the presence of pain⁴. Rather, the HCWs wrote general behavioural impressions, such as “looks comfortable”, “no obvious sign of pain”, “reacts to painful stimuli, or “pain with repositioning” in their charts⁴. In addition, none of the chart notations explained how HCWs distinguished between pain and delirium⁴. The full repertoire of pain cues used and how they differ between cognitive status and delirium subtypes remained a gap in the research.

Extending the chart review study⁴, Mah and colleagues⁵ concluded that HCWs judged pain as more poorly controlled in patients with delirium than patients without delirium. They found that HCWs documented significantly fewer days with good pain control in patients with delirium, despite the frequent administration of opioids⁵. They hypothesize that this may be due to misinterpretation of delirium symptoms as pain cues, thus inflating pain judgments⁵.

Graham et al.¹³ addressed the gap found in the chart review study⁴ through a qualitative-quantitative content analysis study, where specific behavioural cues HCWs use to judge pain in

this population were further explored. HCWs were interviewed on their practices and beliefs regarding pain assessment and management in older adults with advanced cancer and delirium¹³. They found that HCWs used different behavioural cues in cognitively intact individuals than in patients with delirium; these also differed by delirium subtype¹³. HCWs most frequently mentioned the pain cue *self-report* for patients who are cognitively intact, and the pain cues *agitation, moaning, yelling, restlessness, analgesic trial, and evoked cues* for patients with delirium. Interestingly, the behavioural cues identified for the different subtypes overlapped with the symptoms of that subtype of delirium¹³. For example, the behavioural cue *aggression* was used for hyperactive patients, whereas the behavioural cue *withdrawn* was used for hypoactive patients. Through their study, Graham and colleagues¹³ developed The Cancer Pain and Delirium Scale (CPDS), a 20-item observational pain tool that lists cues HCWs use to identify pain in older patients with advanced cancer and delirium. The CPDS was used as a data collection tool in the current study.

In summary, HCWs' pain assessments in older advanced cancer patients with delirium are complicated by a lack of reliable self-report, and difficulties in differentiating pain and delirium symptoms due to the potential for behavioural overlap^{4,5,13}. Although pain cues are considered a valid alternative to self-report of pain, they are not specific to pain and may be indicating another source of emotional or psychological distress, such as delirium⁸⁵. Without a valid and reliable tool to assess pain in this patient population, HCWs conducting observation-based assessments must rely on their professional judgment⁵. However, HCWs' professional judgments may be influenced by their own characteristics. The present study further investigates HCWs' pain assessments in this patient population by examining the influence their own characteristics have on their pain judgments.

Observer Factors Influencing Pain Judgments

Age, gender, clinical experience, pain catastrophizing, empathy, and knowledge and beliefs about pain are observer factors that may influence pain judgments¹⁰. This section outlines these components of the biopsychosocial model of pain and aging⁸².

Age

Observers' age may influence recognition of facial pain cues in the observed individual^{143–146}. Age-related changes in the recognition of facial pain expressions may be due to the “own-age bias”^{143,144}. Ebner and colleagues¹⁴³ had younger and older adults view photographs of younger and older faces displaying various facial expressions. The participants were asked to identify the facial expressions from a provided list. They determined that younger and older adults recognize facial expressions better in people of their own age than in people of other ages¹⁴³. This suggests that age-matched comparisons are better than when there is an age difference. However, Denkinger and colleagues¹⁴⁴ only found a significant own-age bias in younger adults, which they attribute to accumulated life experience. Compared to older adults, younger adults have had a shorter amount of time to observe and interact with a wide variety of different age-group facial expressions¹⁴⁴. Methodological differences, such as the smaller sample size of older adults in the Denkinger et al. study¹⁴⁴ as compared to the Ebner et al. study¹⁴³, may explain the discrepancies in their results. Also, neither of these studies examined recognition of facial pain expressions, which may limit the generalizability of these findings.

Age-related declines in accuracy of facial expression recognition have also been reported^{145,146}. Lautenbacher and colleagues¹⁴⁵ had younger and older participants view video clips of individuals in pain, and asked them to rate the pain intensity observed in the clips. The

ratings were then compared to ratings made by the observed individuals¹⁴⁵. They determined that younger observers were more accurate at judging pain than older observers, especially when observing older individuals¹⁴⁵. These findings conflict with those that support an own-age bias^{143,144}. Possible reasons for the discrepant results include differences in facial expression observed (i.e.: general vs. pain facial expression recognition), and differences in stimulus material for decoding (i.e.: photographs, video clips)^{143–145}.

In the present study, our sample was limited to HCWs who are working-age adults. We acknowledge that a small age range has statistical implications, such as a reduction in the stability of the correlations among variables^{147–151}. It can also threaten external validity by limiting the generalizability of results to individuals within the age range. However, as HCWs are typically of working-age, the results may be generalized to other HCWs. Given the conflicting evidence of an association between younger age and recognizing facial pain cues in older adults, inclusion of this variable in our analysis is warranted and clarification of this relationship is needed.

Gender

Research examining how the gender of the observer affects their pain judgments reports mixed findings^{152–155}, with some reporting differences in pain judgments between male and female observers^{152,153}, while others report no differences^{154,155}. Robinson and colleagues¹⁵² had undergraduate men and women view video clips of individuals undergoing an experimentally-induced pain procedure and asked them to rate the pain observed in the clips. The ratings were then compared to ratings made by the observed individuals¹⁵². They found that while both men and women tended to underestimate pain in others, men underestimated more than women¹⁵².

However, in a study looking at parents' judgments of pain in their own children, it was found that fathers tended to be more accurate judges of their children's pain than mothers, as the mothers tended to underestimate their children's pain¹⁵³. The conflicting results of these studies may be due to differences in the subject population and the relationships between the observer and the observed. Also, both studies used experimentally induced pain^{152,153}, which may not be generalizable to real clinical scenarios with HCWs judging pain in their patients.

There may also be gender-related differences in the decoding of non-verbal cues, with women being better than men at decoding negative facial expressions^{156,157}. Prkachin and colleagues¹⁵⁶ had undergraduate men and women view video clips of shoulder pain patients undergoing passive range-of-motion tests and asked them to judge the presence of pain based on their facial expressions. They found women were better than men at detecting facial pain cues¹⁵⁶. Hampson and colleagues¹⁵⁷ reported similar results, with women being able to identify various facial expressions faster than men. However, this study did not examine facial expressions of pain. Although one study looked at accuracy and the other looked at speed, both concluded there may be a female advantage in decoding non-verbal pain cues. Clarification of the relationship between gender and pain judgments is needed, which justifies its inclusion as a variable in our analysis.

Clinical Experience

Years of clinical experience. Several studies suggest that greater clinical experience is associated with greater underestimation of patients' pain^{10,156,158,159}. These findings follow a similar trend to the age of observer findings reported by Lautenbacher et al.¹⁴⁵. HCWs with more clinical experience may also be older, suggesting that the age of the observer may be a

confounding variable. However, more research is needed on the interaction between, and independent contribution of, these two variables.

Prkachin and colleagues¹⁵⁶ tested the effects of exposure on perception of pain expression. Undergraduate students were asked to view video clips of multiple shoulder pain patients undergoing a painful treatment and to determine pain presence and intensity (i.e.: none, moderate, severe); the video clips varied in the frequency of facial expressions indicating severe pain¹⁵⁶. It was found that participants who had greater exposure to severe pain expressions were less likely than those who had less exposure to judge moderately painful expressions as painful¹⁵⁶. Although this study provides insight into how exposure to pain may impact pain judgments, it did not specifically look at years of experience. Moreover, it did not include HCWs. Choinière and colleagues¹⁵⁸ compared nurses' and burn patients' pain ratings and found that nurses with more years of experience working with burn patients were more likely than those with fewer years of experience to underestimate their patients' pain¹⁵⁸. Although this study included HCWs in a clinical setting, it only included burn care unit nurses, which may limit the generalizability of these findings to HCWs in specialties related to advanced cancer, such as palliative care, and oncology.

The literature suggests that clinical experience leads to an adaptation effect, which may explain the underestimations of patients' pain^{10,156,158–161}. Adaptations occur when the basis of an observer's judgment may depend on previous experiences they have had with similar stimuli¹⁵⁶. In the context of pain judgments, HCWs with more years of practice may use their memory of extreme clinical experiences as a calibration standard and make pain judgments according to that¹⁵⁶. Due to adaptation effects, HCWs may experience emotional distancing towards a patient's pain as a defense mechanism against continued exposure^{158–161}, which is

essential to work efficiency and individual psychosocial health¹⁵⁹. This is especially prevalent in high stress and emotionally demanding environments^{159,162}. Consequently, this process may translate into a tendency for HCWs to unintentionally overlook some pain cues and underestimate pain in their patients. This emotional distancing from others' pain can be problematic, especially when judging pain in palliative care patients with delirium. As HCWs must rely on pain cues to assess and judge pain in these patients due to diminished verbal communication, overlooking pain cues can lead to inadequate pain management.

Another explanation for underestimations of patients' pain among HCWs with more clinical experience is the demanding nature of the profession¹⁶¹. Ruben and colleagues¹⁶¹ suggest HCWs with more years of experience have larger patient loads and time constraints which may cause them to miss some of the more subtle pain cues. This is also problematic, especially in a palliative care setting, as the clinical decisions that follow will impact quality of care.

To our knowledge, the association between greater experience and greater underestimations of patients' pain has not been examined in the context of HCWs judging pain in older advanced cancer patients at the end of life. Therefore, the inclusion of this variable in the present study is justified.

Specialty. Although limited, there is some evidence to suggest that HCW specialty is associated with pain judgments¹⁶³. Tait and colleagues¹⁶³ compared neurosurgeons' and internists' pain ratings for hypothetical low back pain patients described in vignettes. It was found that, compared to internists, neurosurgeons rated patients' pain severity as significantly lower¹⁶³. They hypothesized that physicians specializing in treating populations with severe pain, such as neurosurgeons, are subject to adaptation effects¹⁶³. Although this study provides

insight into how pain judgments may differ by specialty, it used vignettes of patients with chronic low back pain, which may not be generalizable to a clinical palliative care or oncology setting. Moreover, this study did not include nurses, which may also limit generalizability.

HCWs working in various oncology-related specialties (i.e.: palliative care, pain and anesthesia, geriatrics) may be subject to adaptation effects as pain is also highly prevalent in these settings^{164,165}. In a qualitative study looking at hospice nurses' experiences of working in palliative care, a theme that emerged from the interviews related to developing resilience by maintaining professional boundaries¹⁶⁵. The authors explain that these boundaries have a protective function against the emotional distress of working in this specialty¹⁶⁵. Although this study did not look at how pain judgments were affected by this distancing, it is possible that distancing in oncology-related specialties may be associated with underestimations of patients' pain. However, more research is needed on pain underestimations in these specialties.

To our knowledge, the association between HCW specialty and pain assessments has not yet been studied in palliative care or oncology. Our study was the first to examine pain judgments by HCW specialty in this clinical setting.

Discipline. Previous literature suggests that nurses and physicians differ in their pain assessments and judgments^{166,167}. Wandner and colleagues¹⁶⁷ had nurses and physicians observe virtual human patient profiles consisting of vignettes and videos. The participants were then asked to rate each virtual human patient's pain intensity and to indicate their willingness to administer opioids¹⁶⁷. They found that nurses' pain intensity ratings and willingness to administer opioids were higher than physicians'¹⁶⁷.

Mixed results have been reported with regards to the accuracy of pain judgments between nurses and physicians; some have found that nurses and physicians display similar levels of

accuracy¹⁶⁸, while others have found that either nurses are more accurate than physicians¹⁶⁹, or that physicians are more accurate than nurses¹⁷⁰. Heuss and colleagues¹⁶⁸ found similar levels of accuracy among physicians and nurses when judging pain in patients undergoing endoscopies. However, this study looked at pain resulting from a non-surgical procedure, which may not be generalizable to cancer pain and delirium. Sjöström and colleagues¹⁷⁰ found that, although both physicians and nurses underestimated the pain of their patients, physicians were slightly more accurate than nurses¹⁷⁰. These differences were no longer significant between nurses and physicians with more years of experience¹⁷⁰, suggesting the effects were due to experience. However, this study looked at postoperative pain, which may not be generalizable to cancer pain and delirium. Conversely, Laugsand and colleagues¹⁶⁹ determined that nurses are more accurate judges of pain in patients with cancer; both underestimation and overestimation of pain was more common when assessed by physicians as compared to nurses. Clarification on the relationship between HCW discipline and accuracy of pain judgments is needed.

Latimer and colleagues¹⁷¹ had nurses and allied health professionals (HCWs who are not part of the medical, dental, or nursing professions¹⁷²) view video clips of infants undergoing a painful procedure and asked them to rate the observed pain. It was found that nurses' scores for facial pain cues were higher than those of allied health professionals¹⁷¹. Although this study did not compare nurses and physicians, it suggests that nurses may be less likely than other health professionals to underestimate pain¹⁷¹, especially when caring for patients who are unable to provide verbal self-report. Further, a recent qualitative study examining HCW beliefs about pain in older adults with cancer and delirium suggests that nurses and physicians differ in the tools and pain characteristics used to assess pain in this population⁵⁹. Although this study did not

examine how these differences impact pain judgments, it suggests that they may differ between nurses and physicians.

To our knowledge, the association between HCW discipline and pain judgments about older advanced cancer patients at the end of life has yet to be examined. Therefore, it is important that this variable be included in the present study.

Specialized Training in Pain Management. Previous literature suggests that specialized training in pain management may lead to increased knowledge and attitudes regarding pain assessment^{173–175}. Alnajar and colleagues¹⁷³ had oncology nurses complete a survey on knowledge and attitudes toward cancer pain management. They found that nurses who had previously completed a pain education program scored higher on the survey than those who did not receive such education¹⁷³. Although this study did not examine how specialized training impacts pain judgments, the results support the hypothesis that a greater knowledge of pain due to specialized training may contribute to better pain assessments and judgments. However, more research is needed on the relationship between specialized pain education, knowledge about pain, and pain judgments.

Specialized training in pain management may increase HCWs' sensitivity to patient discomfort by improving the recognition of pain cues^{11,176}. Solomon and colleagues¹⁷⁶ compared pain ratings made by physiotherapy and occupational therapy students who either did or did not receive specialized training in the recognition of facial pain cues. They determined that those who received training were more sensitive to these cues¹⁷⁶. However, as the participants in this study were physiotherapy and occupational therapy students, the results may not be generalizable to other healthcare professional groups, such as nurses and physicians. Nonetheless, this increase in sensitivity to patient discomfort may ultimately lead to better identification of pain

cues. This may be especially beneficial in populations with limited ability to self-report, such as older adults with advanced cancer and delirium, due to the increased reliance on observed pain cues for assessment. However, effects of training on pain judgments made by HCWs in this population have yet to be examined.

Pain Catastrophizing

Pain catastrophizing is defined as an amplified and negative response to actual or anticipated painful experiences¹⁷⁷. It includes elements of rumination, which consists of thoughts reflecting worry and fear, as well as the inability to direct attention away from the pain; magnification, which consists of exaggerating the threat value or seriousness of the painful stimuli; and feelings of helplessness, which consist of pessimism in relation to the ability to deal with the pain¹⁷⁷.

Pain catastrophizing is an important predictor of pain experience^{178–182}. Several studies suggest that higher levels of pain catastrophizing are associated with higher pain intensity^{179–182} and pain interference¹⁸¹. Pain catastrophizing is also associated with poorer physical function^{178–180,182} and overall quality of life¹⁷⁸.

Pain catastrophizing may also influence pain judgments, as higher levels of catastrophizing have been associated with a heightened perception of pain in others^{183–185}. Sullivan and colleagues¹⁸³ found that undergraduate students who scored higher on pain catastrophizing measures judged pain as more intense than those with lower scores in individuals participating in a cold pressor procedure (an experimental technique where the arm is placed in cold water, inducing a slowly mounting pain and is terminated upon withdrawal of the

arm^{183,186}). Similar results have been found in studies of undergraduate students judging pain in patients with chronic back pain¹⁸⁴, and parents judging their children's pain^{185,187}.

Mixed results have been reported with regards to pain catastrophizing and the accuracy of pain judgments; some have shown that it may be associated with more accurate judgments of pain^{184,187}, while others did not find this relationship¹⁸³. Goubert and colleagues¹⁸⁷ found greater parent-child congruence in pain ratings when parents scored higher on pain catastrophizing measures. However, in the Sullivan et al. study¹⁸³, observers who scored higher on measures of pain catastrophizing were not more accurate than those who scored lower on these measures in their pain judgments.

The discrepancies in these findings may be due to the relationship between the observer and the observed individual. Parent-child dyads have an existing relationship, which may contribute to greater accuracy in their pain judgments. As the observers and observed individuals in the Sullivan et al study¹⁸³ were undergraduate students, it is likely that they did not have previous or existing relationships with one another, which may have contributed to less accurate judgments. The relationship between HCWs and their patients is different than the dyads observed in these studies. Moreover, the pain observed in the previous studies^{183,187} was experimentally-induced, which may not be generalizable to clinical pain. Clarification on the relationship between catastrophizing and pain judgments in HCW-patient dyads is needed.

Sullivan et al.¹⁸³ determined that individuals who scored higher on pain catastrophizing measures may rely more heavily than individuals who scored lower on these measures on pain behaviour, or pain cues, as a basis for their pain judgments¹⁸³. Individuals with lower pain catastrophizing scores may deem pain cues as more unreliable indicators of others' pain compared to those with higher pain catastrophizing scores¹⁸³. Discounting pain behaviours may

be an important factor contributing to the underestimation of pain in others¹⁸³. Taken together with their other findings mentioned above, increased reliance on pain behaviours may not necessarily contribute to more accurate assessments. However, as this study only included undergraduate students, these findings may not be generalizable to HCWs judging pain in advanced cancer patients with delirium, where there may be an increased reliance on pain behaviours to assess pain. The association between pain catastrophizing and HCWs' judgments about patients' pain has yet to be examined, which justifies the inclusion of this variable in the present study.

Empathy

Empathy is the ability to infer, share, and respond to the feelings and emotional experiences of others; it contains both cognitive and affective aspects¹⁸⁸. Cognitively, empathy involves perspective taking, which is the ability to take on another's point of view while maintaining a certain level of emotional detachment¹⁸⁹. The affective aspect involves sharing an emotional experience with someone by imagining the individual's internal emotional state¹⁹⁰. Research has also focused on the behavioural aspect of empathy, which refers to mimicking others' facial and body behaviours, as well as their verbal characteristics^{191,192}. Verbal behaviours (e.g., asking questions about thoughts and feelings) and non-verbal behaviours (e.g.: head nodding) are examples of empathic communication, which is the intentional behaviour that demonstrates empathy to others¹⁹³.

Higher levels of empathy have been associated with a more profound response to observed pain^{171,194,195}. Green and colleagues¹⁹⁴ had undergraduate students complete a measure of empathy and rate video clips of individuals undergoing a cold pressor test. They found that

observers with higher levels of empathy had an increased perception of pain in others¹⁹⁴. However, there was no correlation between empathy and accuracy of pain judgments¹⁹⁴. Despite methodological differences, including subject populations, empathy measures, and experimental versus clinical pain, Latimer and colleagues¹⁷¹ found the same relationship in nurses judging pain in video clips of infants undergoing a painful medical procedure. It was impossible to calculate the accuracy of these pain judgments¹⁷¹, due to the infants' inability to self-report. These findings may be especially relevant to the current study; the role of empathy in nurses judging infant pain may be similar to that in nurses judging pain in older advanced cancer patients with delirium, as both patient populations have limited ability to self-report. Taken together, HCWs with greater empathy may judge greater pain in their patients; however, it is not clear whether they are more accurate in estimating pain. In patient populations with limited ability to self-report, this is impossible to determine.

To our knowledge, the association between HCW empathy and their pain judgments about older advanced cancer patients at the end of life has yet to be examined, which justifies this variable's inclusion in the present study.

Knowledge and Beliefs about Cancer Pain and Aging

Despite the increase in pain prevalence among older adults¹⁹⁶, it has been consistently reported that HCWs exhibit knowledge gaps regarding pain in older people with and without cognitive impairments^{57,59,197–199}. Zwakhalen and colleagues¹⁹⁹ examined nurses' knowledge and beliefs regarding various aspects of pain in older patients with dementia by having them fill out a questionnaire. Knowledge deficits regarding pain treatment and medication in this patient population were found¹⁹⁹. For example, there was a lack of consensus among the participants

about whether medication should be administered when necessary, rather than according to a fixed schedule¹⁹⁹. Similarly, Gagliese and colleagues⁵⁷ assessed older adults' and HCWs' knowledge regarding pain and aging before and after a brief educational intervention. Prior to the educational session, knowledge gaps regarding analgesic use in older adults, as well as the relationship between pain and aging, were evident among HCWs⁵⁷. For example, some HCWs believed that older adults often become addicted to opioids when using them to treat their pain. HCWs demonstrated significant knowledge gains following the session⁵⁷. Taken together, these results demonstrate a lack of knowledge among HCWs about pain in older people of varying cognitive status and suggest the need for more education.

Knowledge gaps regarding cancer pain and pain during palliative care are also evident among HCWs^{59,173,200–202}. Alnajjar and colleagues¹⁷³ examined the knowledge and attitudes towards cancer pain management among oncology nurses. They found that nurses' knowledge regarding cancer pain management was less than optimal despite working in a specialty where pain is highly prevalent¹⁷³. Further, Omran and colleagues²⁰² compared oncology and non-oncology nurses' knowledge and attitudes about pain management. They found that both groups of nurses displayed knowledge gaps and inconsistent beliefs regarding pain management, specifically regarding pain medication administration and side effects²⁰². However, these studies^{173,202} did not specifically focus on knowledge and beliefs about pain in older adults. Sloman and colleagues¹⁹⁷ investigated nurses' knowledge of pain and pain management with respect to older adults. Contrary to the aforementioned findings^{173,202}, they found that nurses with experience in palliative care scored the highest for knowledge of pain in older adults¹⁹⁷. Nonetheless, the findings still indicated a significant knowledge deficit regarding pain in this patient population¹⁹⁷. Taken together, these results demonstrate that, despite specializing in

areas where pain is highly prevalent, knowledge gaps regarding pain and its management are common among HCWs specializing in oncology and palliative care.

It has also been found that knowledge gaps and inconsistent beliefs about pain management are common among HCWs caring for older adults with advanced cancer and delirium⁵⁹. A recent qualitative study conducted by Ghandeharian and colleagues⁵⁹ explored HCWs' knowledge and beliefs about pain in older patients with advanced cancer. It was found that HCWs provided inconsistent beliefs about opioid use, as well as the priority of pain management during delirium⁵⁹. For example, while some HCWs believed that pain management should be prioritized over delirium, other HCWs believed that symptoms of delirium should be managed first⁵⁹. These inconsistent beliefs demonstrate knowledge gaps regarding pain management. Consequently, these misconceptions and knowledge gaps could lead to either improper opioid use or unrelieved pain, both outcomes that can exacerbate delirium^{4,76,85,132}.

RELEVANCE AND IMPORTANCE

Despite cancer pain and delirium frequently occurring together at the end of life, HCWs continue to face many challenges in the provision of adequate pain management to this vulnerable patient population. As delirium diminishes the ability to provide reliable self-report of pain, HCWs must rely on pain behaviours to assess and manage pain; this is challenging due to the behavioural overlap of cancer pain and delirium. HCWs' pain judgments may be influenced by their own biopsychosocial characteristics, such as their age, gender, clinical experience, pain catastrophizing, and empathy. While multiple studies have examined how various HCW factors impact pain judgments, this is the first study, to our knowledge, that

considered these factors simultaneously, and in the context of judging pain in older adults with advanced cancer and delirium.

OBJECTIVE

The objective of this study was to identify HCW biopsychosocial factors that are associated with pain judgments about older patients with advanced cancer who are cognitively intact or who have delirium, including the hypoactive, hyperactive, and mixed subtypes. We expected that each outcome (i.e.: CPDS scores for INT, DEL, HYPO, HYPER, AND MIX patient groups) would be associated with various HCW biopsychosocial factors, with some overlap in the variables that contribute to each model. In addition, we expected there to be differences in the correlates of CPDS scores for patients who are cognitively intact and those who have delirium, those with the hypoactive, hyperactive, and mixed subtypes. This is a preliminary hypothesis-generating study. Thus, it is premature to formulate specific hypotheses. Nonetheless, it is expected that the relationships and patterns found in this study will inform the development of subsequent studies regarding the association between HCW factors and their pain judgments about older adults with advanced cancer and delirium.

METHODS

Study Design and Setting

This study is part of a larger, CIHR-funded study of delirium and cancer pain at the end of life. This larger study was carried out at the University Health Network (UHN), which consists of four locations in Toronto, Ontario. These locations include Toronto General Hospital, Toronto Western Hospital, Toronto Rehabilitation Institute, and the Princess Margaret

Cancer Center. Ethics approval was obtained from the Research Ethics Boards of the UHN and York University (#11-0698-CE).

Study Population

HCWs (i.e.: nurses and physicians), with varying experience in pain and anesthesia, palliative care, oncology, cardiology, and other related specialties were recruited. HCWs within these specialties are primarily responsible for pain assessment. The inclusion criteria were ≥ 18 years of age, English fluency sufficient to provide informed consent, be interviewed, and complete accompanying questionnaires, and experience in the specialties stated above.

Data Collection and Procedures

Recruitment was achieved using flyers posted on-site, electronic postings, and presentations. Contact information (telephone number and email), as well as sign-up sheets, were provided. HCWs interested in the study met with a research assistant (RA) individually at a mutually convenient time. Following informed consent to partake in the study and be audio recorded, HCWs provided demographic and professional information regarding position, training, and experience. The Pain Catastrophizing Scale (PCS) and the Davis Empathic Concern Scale (DECS) were also completed at this time. HCWs then participated in an individual, one-hour, audio-recorded, semi-structured interview conducted by an RA. The interview focused on their experiences and beliefs about pain in older cancer patients who are either cognitively intact or have delirium. They were asked to describe the cues or signs they use to identify pain and assess pain control in patients who are cognitively intact, have delirium, and with each subtype of delirium separately. The diagnostic criteria for each subtype of delirium

(i.e.: hypoactive, hyperactive, and mixed) were available, if needed. The HCWs were compensated \$75 for their time to partake in the study. The interviews were professionally transcribed verbatim by a third-party dictation company, Wordmap, and subsequently checked by research staff. The demographic and professional data collection sheet, questionnaires, and interview protocol can be found in Appendix A.

Measures

Demographic and clinical information collected from each HCW includes age, gender, education (i.e.: institute of study, year of graduation), professional discipline (i.e.: nurse or physician), specialty (and sub-specialty, if applicable), years of professional clinical experience, years of experience with palliative care, oncology, geriatrics, and cognitively impaired patients, percentage of younger (<65) and older (≥ 65) patients typically treated per month, number of advanced cancer patients cared for per month, and history of specialized training in pain management.

The **Pain Catastrophizing Scale (PCS)** is a 13-item measure of pain ideation consisting of 3 subscales: Rumination, Magnification, and Helplessness^{203,204}. The frequency with which individuals experience thoughts of ruminative, magnifying, or helpless natures when they are in pain is evaluated on a 5-point Likert scale¹⁸³. The five responses which are used to rate each item are: (0) *Not at all*, (1) *To a slight degree*, (2) *To a moderate degree*, (3) *To a great degree*, and (4) *All the time*. The scores range from 0 to 52, with higher scores reflecting greater pain catastrophizing. The PCS has good internal consistency reliability, as well as criterion-related, concurrent, and discriminant validity for adult populations not currently in pain^{205,206}. It has been

used in studies involving HCWs²⁰⁷ and pain judgments^{183,208}, but none specifically looking at how HCWs judge pain in others.

The **Davis Empathic Concern Scale (DECS)** is a 7-item subscale of the Davis Interpersonal Reactivity Index (IRI) which measures empathic concern²⁰⁹. It evaluates the tendency to take another's perspective and show compassion and concern for the mistreatment of others on a 5-point Likert scale²⁰⁹. The five responses which are used to rate each item range from: (1) *Does not describe me well*, to (5) *Describes me very well*. The scores range from 7 to 35, with higher scores reflecting greater empathic concern. It has good internal consistency reliability, as well as convergent and concurrent validity for adult populations²⁰⁹. It has been used in pain judgment studies involving HCWs²¹⁰ and other adult populations¹⁹⁴.

The **Cancer Pain and Delirium Scale (CPDS)** is a 20-item observational pain tool that lists cues HCWs use to identify pain in older cancer patients with delirium¹³. These cues include vocalizations (i.e.: self report of pain, asking for help, moaning or groaning, yell/scream/shout/call out, crying); facial expressions (i.e.: grimace, furrowed brow); body (i.e.: guarding, favouring a body part, holding a body part, tense/rigid/stiff, unusual posture in bed, difficulty moving/restricted range of motion, gripping/clenching fists); general behaviour (i.e.: aggression, agitation, restlessness, withdrawal, not interested in interaction); and other (i.e.: change in respiration). The tool assesses whether these cues were seen spontaneously or evoked during an activity; the intensity (i.e.: mild, moderate, severe) and duration (i.e.: brief, periodic, constant) of behaviour; and asks whether they were due to pain or delirium. There is also a comment section to note anything else the user attributes to pain in the observed patient. The

pain cues included on this scale were carefully selected from cues reported in interviews. To construct the scale, the reported pain cues were categorized into larger categories, and any overlapping cues were discussed and collapsed¹³.

Data Analysis

Missing Data

All data were screened for missing values prior to analyses. Missing data were assessed using Little's Missing Completely at Random (MCAR) test²¹¹, which revealed that the data were "missing completely at random" ($p = 0.713$). Two participants had 1 item missing in the DECS (1/7 missing, 14.3%); the mean item response was imputed for these values as each participant had less than 20% of their questionnaire items missing²¹². Since the amount of missing data for the full sample was small (<5%), the mean item response was also imputed for number of advanced cancer patients per month ($n = 11$ missing), and percentage of older patients ($n = 1$ missing)²¹³.

Descriptive Statistics

Means and standard deviations were reported for continuous variables; and frequencies and valid percent were reported for categorical variables. The data were examined for skewness and kurtosis. Z-scores for skewness and kurtosis were calculated by dividing by their corresponding standard errors. A cut-off of 3.29 for either of these values was used to determine normality²¹⁴. Scores for the following were not normally distributed: years practicing; years in specialty; years of experience in pain assessment; years of experience in palliative oncology; years of experience in geriatrics; years of experience with cognitively impaired patients; and

number of advanced cancer patients treated per month. Square root transformations were applied to these variables as their distributions were moderately positively skewed from normal^{215,216}. These distributions became normal after these transformations. Categorical variables were dummy coded so that further analyses were possible.

Qualitative-Quantitative Content Analysis

This study used qualitative-quantitative content analysis¹³ to analyze the data. This involved first quantifying the number of pain cues reported in each transcript, and then performing quantitative analysis on these data.

Each interview transcript was read and the pain cues stated were scored on the Cancer Pain and Delirium Scale (CPDS)¹³. For each participant, a total CPDS score was calculated by totaling the number of reported pain cues. For example, if a HCW stated that “self-report” and “grimacing” were cues for pain in cognitively intact patients, those two pain cues would be scored on the CPDS, and the total score of reported pain cues for this patient group would be two. This was repeated for HCWs’ description of cues used with cognitively intact patients, those with delirium, and then those with each subtype of delirium (i.e.: hypoactive, hyperactive, and mixed), for a total of five CPDS scores for each HCW (i.e.: CPDS INT, CPDS DEL, CPDS HYPO, CPDS HYPER, CPDS MIX). Pain cues reported in the interviews that were not on the CPDS were not scored and were therefore not included in the analysis. The CPDS¹³ was carefully constructed from pain cues reported in interviews. These pain cues were categorized into larger categories, and any overlapping cues were discussed and collapsed¹³. The use of the CPDS ensured that important pain cues were not missed.

The coder (V. C.) was blind to all other HCW data to avoid any potential bias. A second coder (P. H.), also blind to HCW data, also scored all the transcripts to ensure reliability of the coding^{217,218}. Once all transcripts were read and coded by V.C. and P.H., Cohen's kappa²¹⁹ was calculated to assess interrater reliability on each of the pain cues scored for each transcript²²⁰. Following this, V. C. and P. H. discussed any scoring discrepancies (i.e.: one coder identified a particular pain cue, but the other coder did not) and resolved them. A third coder (G. C.), also blind to HCW data, served as a tiebreaker for any discrepancies that could not be resolved through discussion between V. C. and P. H.

Multivariable Linear Regression Model Building

For our study objective, models to identify HCW biopsychosocial factors associated with total CPDS scores for cognitively intact (INT), delirium (DEL), hypoactive (HYPO), hyperactive (HYPER), and mixed (MIX) patient groups were developed using multivariable linear regression, for a total of five models. This regression method was the most appropriate for our analyses, as it is used for identifying associations between multiple candidate correlate variables and one continuous outcome variable^{221,222}.

Potential Candidate Correlates: Potential candidate correlates were demographic variables (age, gender); professional variables (discipline, specialty, number of years practicing, number of years in specialty, number of years of experience in pain assessment, number of years of experience in palliative oncology, number of years of experience in geriatrics, number of years of experience with cognitively impaired patients, number of advanced cancer patients cared for per month, percentage of older and younger patients cared for, specialized training in pain management); and psychological variables (PCS, DECS).

Identifying Candidate Correlates for Inclusion: Several steps were taken to identify candidate correlates for inclusion in the multivariable linear regression analyses. Pearson's correlations were performed between continuous variables and outcomes²¹⁶. Independent t-tests with a Bonferroni correction ($p = 0.25/3 = 0.083$) were performed between categorical variables and outcomes. A one-way ANOVA was performed between specialty and the outcome variables, as four group means (i.e.: pain and anesthesia, palliative care and oncology, cardiology, and other related specialties) were compared for this variable. To determine if the assumption of homogeneity of variances was met for the independent t-tests and one-way ANOVA, Levene's test for Equality of Variances was performed; this test was non-significant for each categorical variable and outcome variable ($p > .05$).

All candidate correlates that were associated with any of the outcomes at a significance level of $p < 0.25$ (for Pearson's correlations and one-way ANOVA tests; $p < 0.083$ for the independent t-tests) were considered for inclusion in all of the multivariable linear regression analyses; this significance level was used to ensure that important candidate correlates were being included in the models²²³.

Multicollinearity among Candidate Correlates: To test for multicollinearity among the candidate correlates, a series of association tests were performed. Among continuous variables, Pearson's correlation was examined, while point-biserial correlation was used between binary categorical and continuous variables. A cut-off of $r > 0.7$ ²²⁴ was used to determine multicollinearity. Chi-square tests were conducted between categorical variables. A significant ($p < 0.05$) phi coefficient (Φ) or Cramer's V, where appropriate, was used to determine a strong association between the variables^{224,225}. A one-way ANOVA was performed to assess the association between specialty and continuous variables. In cases where variables were highly

correlated or associated with one another, those with the least missing data, or those that would allow for a wider variety of HCW characteristics to be tested, were considered for inclusion in the multivariable models^{215,221}.

Backward Selection Multivariable Linear Regression Models

All identified candidate correlates for each outcome variable were entered into each multiple linear regression model. Backward selection was used for an exploratory approach^{215,216}. Pairwise deletion maximized usage of the data²¹⁶. Criteria for entry and removal were set at $p < 0.10$ and $p > 0.15$, respectively; these significance levels for entry and removal were used to ensure that important variables were included and retained in the models²²³.

Multivariable linear regression assumptions were investigated. Linearity was assessed by visual inspection of partial regression plots of each correlate with each outcome variable²¹⁶. Visual inspection of a histogram, as well as standardized residuals were used to assess multivariate normality. A normally distributed histogram satisfies this assumption²¹⁶. Standardized residuals $> \pm 3.3$ were considered to indicate outliers²¹⁵. Multicollinearity within each model was assessed using Variance Inflation Factor (VIF) statistics. VIF averages that are ≥ 10 indicate multicollinearity²¹⁶. Durbin-Watson's test was used to test for autocorrelation. Visual inspection of the residuals scatterplot tested for homoscedasticity. A funnel-shaped plot indicates heteroscedasticity, thus violating this assumption²¹⁶. IBM Statistical Package for Social Sciences 27 (SPSS 27) software was used for quantitative analyses.

RESULTS

A CONSORT diagram of HCWs' recruitment is presented in Figure 4. Of the 82 HCWs who inquired about participation, 10 failed to respond to further contact attempts from the research staff, and 12 were considered ineligible following screening due to insufficient English fluency. Of the 60 interviews scheduled, 2 HCWs did not attend their scheduled interviews, and 5 cancelled their interviews and did not wish to reschedule. In total, 53 HCWs were recruited and participated in the study.

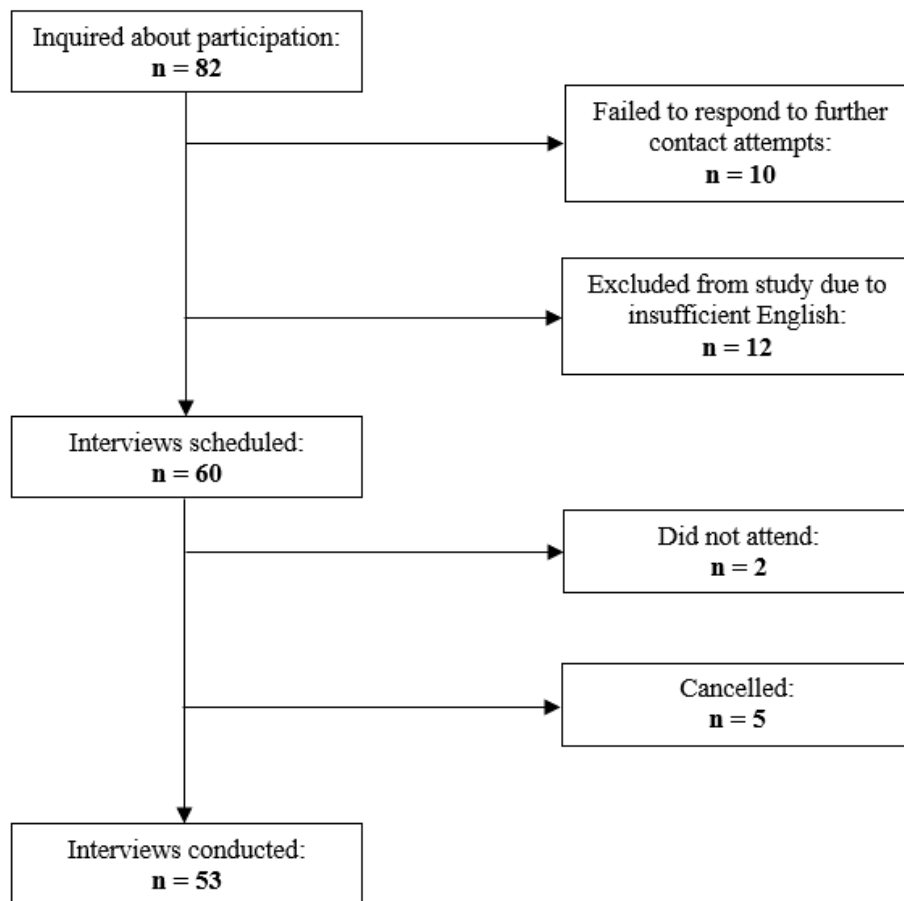


Figure 4. Consort diagram of HCWs

Participant Characteristics

Demographic and clinical information is presented in Table 1. The mean age of HCWs was 38.58 ± 11.93 years, and most participants were female (86.8%). The sample primarily consisted of nurses (83.0%) specializing in palliative care or oncology (47.2%). The majority (56.6%) of the HCWs had specialized training in pain management. The average PCS score was 22.26 ± 11.55 (range: 3 to 46), which is considered a low score²⁰³. Sixteen HCWs (30.2%) scored ≥ 30 on the PCS, a clinically relevant cut-off that has been associated with high levels of pain catastrophizing²⁰³. The average DECS score was 30.35 ± 3.46 (range: 20 to 35), indicating high levels of empathic concern among this HCW sample²⁰⁹.

Table 1. Demographic and Clinical Characteristics of HCWs

	Total (n=53)
Demographic Factors	
<i>Age</i>	38.58 ± 11.93
<i>Gender</i>	
Female	46 (86.8)
Male	7 (13.2)
Clinical Factors	
<i>Discipline</i>	
Nurse	44 (83.0)
Physician	8 (15.1)
<i>Specialty</i>	
Pain and Anesthesia	6 (11.3)
Palliative Care/Oncology	25 (47.2)
Cardiology	8 (15.1)
Other Related Specialties	9 (17.0)
<i>Specialized Training in Pain Management</i>	
Yes	30 (56.6)
No	14 (26.4)
<i>Clinical Experience</i>	
Total Years Practicing	12.88 ± 12.02
Years in Specialty	9.07 ± 8.11
Years in Pain Assessment	10.93 ± 9.19
Years in Palliative Oncology	7.02 ± 7.44
Years in Geriatrics	8.94 ± 8.55
Years with Cognitively Impaired Patients	8.71 ± 8.64
<i>Number of Advanced Cancer Patients per Month</i>	21.1 ± 15.69
<i>Percentage of Patients</i>	
Older (65+)	68.81 ± 17.71
Psychological Factors	
<i>Pain Catastrophizing Scale (PCS)</i>	22.26 ± 11.55
<i>Davis Empathic Concern Scale (DECS)</i>	30.35 ± 3.46

Values are mean ± SD or frequency (%). Adapted from Graham et al¹³.

Qualitative-Quantitative Content Analysis

Fifty-three transcripts were read and scored by V. C. and P. H. Cohen's kappa²¹⁹ was $k = 0.887$, indicating almost perfect interrater reliability²²⁰. There were 174 coding discrepancies out of 5300 (3.3%) total codings between V. C. and P. H. Of those, 167 were resolved through discussion; G. C. served as a tiebreaker for the remaining seven discrepancies.

The descriptive characteristics of the CPDS scores for each delirium subtype (i.e.: INT, DEL, HYPO, HYPER, MIX) are presented in Table 2. The mean CPDS scores for each delirium subtype are: CPDS INT (3.75 ± 2.24), CPDS DEL (5.70 ± 2.58), CPDS HYPO (2.92 ± 1.72), CPDS HYPER (3.83 ± 2.21), and CPDS MIX (1.91 ± 1.97).

Table 2. Descriptive Characteristics of CPDS Scores

CPDS Scores	
CPDS INT	3.75 ± 2.24 (8)
CPDS DEL	5.70 ± 2.58 (13)
CPDS HYPO	2.92 ± 1.72 (7)
CPDS HYPER	3.83 ± 2.21 (10)
CPDS MIX	1.91 ± 1.97 (6)

Values are mean $\pm$ SD (range).

Bivariate Analyses: Identifying Candidate Correlates

Table 3 and Table 4 present Pearson's correlation coefficients, t-tests, and one-way ANOVAs between CPDS scores and each continuous and categorical variable, by patient subgroup. The results of the t-tests and one-way ANOVAs, as well as the candidate correlates identified for inclusion in the multivariable linear regression models, are described below.

Group Differences in CPDS Scores:

Gender: Compared to men, women scored significantly higher on the CPDS for both DEL (6.00 ± 2.44 versus 3.71 ± 2.75 ; $t_{51} = 2.27$, $p = 0.027$) and HYPO (3.09 ± 1.72 versus 1.86 ± 1.35 ; $t_{51} = 1.80$, $p = 0.078$) patient groups. There were no significant differences in CPDS scores between men and women for INT (3.29 ± 2.63 versus 3.83 ± 2.20 ; $t_{51} = 0.59$, $p = 0.558$), HYPER (2.57 ± 1.51 versus 4.02 ± 2.25 ; $t_{51} = 1.65$, $p = 0.106$), and MIX (2.14 ± 2.12 versus 1.87 ± 1.97 ; $t_{51} = -0.34$, $p = 0.736$) patient groups.

Discipline: Compared to physicians, nurses scored significantly higher on the CPDS for DEL (6.07 ± 2.48 versus 3.63 ± 2.39 ; $t_{50} = 2.58$, $p = 0.013$), HYPO (3.11 ± 1.73 versus 1.88 ± 1.46 ; $t_{50} = 1.90$, $p = 0.063$), and HYPER (4.00 ± 2.24 versus 2.50 ± 1.31 ; $t_{50} = 1.83$, $p = 0.074$) patient groups. There were no significant differences in CPDS scores between nurses and physicians for INT (3.82 ± 2.19 versus 3.38 ± 2.77 ; $t_{50} = 0.51$, $p = 0.616$) and MIX (1.82 ± 1.99 versus 2.00 ± 1.77 ; $t_{50} = -0.24$, $p = 0.810$) patient groups.

Specialized Training in Pain Management: HCWs who received specialized training in pain management scored significantly higher than those without such training on the CPDS INT (4.03 ± 2.28 versus 2.50 ± 1.56 ; $t_{42} = 2.27$, $p = 0.028$). However, HCWs who received specialized training in pain management scored significantly lower than those without such training on the CPDS MIX (1.57 ± 1.85 versus 2.86 ± 1.92 ; $t_{42} = -2.13$, $p = 0.039$). There were no significant differences in CPDS scores between HCWs who did and did not receive specialized training in pain management for DEL (6.33 ± 2.51 versus 5.43 ± 2.77 ; $t_{42} = 1.08$, $p = 0.287$), HYPO (2.80 ± 1.79 versus 2.93 ± 1.64 ; $t_{42} = -0.23$, $p = 0.821$), and HYPER (3.73 ± 2.10 versus 3.86 ± 2.18 ; $t_{42} = -0.18$, $p = 0.858$) patient groups.

Specialty: There was a statistically significant difference in CPDS DEL scores between specialties as determined by a one-way ANOVA ($F_{3,44} = 2.71$, $p = 0.057$). A Tukey post hoc test revealed that CPDS DEL scores were significantly higher among HCWs specializing in palliative care and oncology (6.32 ± 2.34 , $p = 0.151$) and cardiology (7.13 ± 2.10 , $p = 0.094$), compared to those in other specialties (4.22 ± 2.22); HCWs specializing in palliative care and oncology and those specializing in cardiology did not significantly differ from one another ($p = 0.858$). There were no statistically significant differences in CPDS scores between those specializing in pain and anesthesia (4.67 ± 3.83), and any of the other specialty groups. Similarly, there was a statistically significant difference in CPDS HYPER scores between specialties ($F_{3,44} = 4.00$, $p = 0.013$). A Tukey post hoc test revealed that CPDS HYPER scores were significantly higher among HCWs specializing in palliative care and oncology (4.60 ± 2.29 , $p = 0.043$) and other related specialties (4.11 ± 2.03 , $p = 0.237$), compared to those in pain and anesthesia (2.00 ± 1.41). In addition, HCWs specializing in palliative care and oncology scored significantly higher on the CPDS HYPER than those specializing in cardiology (2.38 ± 1.85 , $p = 0.057$). There were no statistically significant differences in CPDS scores between HCWs specializing in pain and anesthesia, palliative care and oncology, cardiology, and other related specialties for INT (2.83 ± 2.64 versus 3.88 ± 2.09 versus 3.88 ± 2.70 versus 3.89 ± 2.42 , respectively; $F_{3,44} = 0.36$, $p = 0.785$), HYPO (2.00 ± 2.53 versus 3.32 ± 1.84 versus 3.25 ± 1.39 versus 2.56 ± 1.13 , respectively; $F_{3,44} = 1.16$, $p = 0.336$), and MIX (1.00 ± 2.00 versus 2.32 ± 2.04 versus 1.38 ± 1.77 versus 2.22 ± 2.28 , respectively; $F_{3,44} = 0.97$, $p = 0.415$) patient groups.

Table 3. Continuous Candidate Correlates of CPDS Scores for each Patient Group

	CPDS INT (N = 53)	CPDS DEL (N = 53)	CPDS HYPO (N = 53)	CPDS HYPER (N = 53)	CPDS MIX (N = 53)
Demographic					
Age	.117 (.419)	-.047 (.744)	.170 (.239)	-.234 (.102)	-.006 (.969)
Clinical					
Total Years Practicing	.191 (.192)	-.151 (.306)	.247 (.090)	-.215 (.142)	.032 (.827)
Years in Specialty	.026 (.853)	-.105 (.456)	.206 (.138)	-.141 (.315)	-.118 (.398)
Years in Pain Assessment	.189 (.175)	-.104 (.457)	.264 (.056)	-.140 (.316)	.024 (.865)
Years in Palliative Oncology	.003 (.982)	-.086 (.561)	.245 (.093)	-.037 (.805)	.068 (.646)
Years in Geriatrics	-.209 (.154)	-.056 (.706)	.063 (.672)	.088 (.551)	-.116 (.434)
Years with Cognitively Impaired Patients	-.104 (.482)	-.086 (.559)	.009 (.949)	.106 (.472)	.160 (.277)
Number of Advanced Cancer Patients per Month	-.053 (.706)	-.066 (.640)	.019 (.893)	.128 (.362)	-.114 (.416)
Percentage of Older Patients	-.139 (.322)	.188 (.178)	.211 (.129)	.002 (.990)	.068 (.630)
Psychological					
PCS	-.319 (.020)	-.095 (.499)	.020 (.885)	.205 (.140)	.054 (.700)
DECS	-.217 (.119)	-.116 (.406)	-.091 (.517)	.303 (.027)	.123 (.379)

Bold = met criteria for inclusion in regression analyses ($p < 0.25$).

PCS: Pain Catastrophizing Scale. DECS: Davis Empathic Concern Scale.

Values are R (p).

Table 4. Categorical Candidate Correlates of CPDS Scores for each Patient Group

	CPDS INT (N = 53)	CPDS DEL (N = 53)	CPDS HYPO (N = 53)	CPDS HYPER (N = 53)	CPDS MIX (N = 53)
T-Tests					
Gender	.121 (.558)	.784 (.027)	.362 (.078)	.639 (.106)	.314 (.736)
Discipline	1.417 (.616)	.063 (.013)	.146 (.063)	1.341 (.074)	.176 (.810)
Specialized Training in Pain Management	2.508 (.028)	.292 (.287)	.073 (.821)	.000 (.858)	.219 (.039)
ANOVA					
Specialty	.356 (.785)	2.706 (.057)	1.159 (.336)	3.998 (.013)	.971 (.415)

Bold = met criteria for inclusion in regression analyses (T-tests: $p < 0.083$, ANOVA: $p < 0.25$).

Values are F (p).

Candidate Correlates for Inclusion in Multivariable Linear Regression Models:

Table 3 and Table 4 present the candidate correlates for inclusion in the backward selection multivariable linear regression models. The correlates that met the criteria for inclusion ($p < 0.25$ for Pearson's correlations and one-way ANOVA tests; $p < 0.083$ for the independent t-tests) are presented in bold.

INT: Six candidate correlates were identified for inclusion in the multivariable linear regression models for CPDS INT: total years practicing ($p = 0.192$), years in pain assessment ($p = 0.175$), years in geriatrics ($p = 0.154$), PCS ($p = 0.020$), DECS ($p = 0.119$), and specialized training in pain management ($p = 0.028$). Total years practicing and years in pain assessment were positively associated with the CPDS scores; years in geriatrics, PCS, and DECS were negatively associated with them. HCWs who received specialized training in pain management scored significantly higher than those who did not receive such training on the CPDS INT ($p = 0.028$).

DEL: Four candidate correlates were identified for inclusion in the multivariable linear regression models for CPDS DEL: percentage of older patients ($p = 0.178$), gender ($p = 0.027$), discipline ($p = 0.013$), and specialty ($p = 0.057$). A higher percentage of older patients cared for was positively correlated with higher CPDS scores for DEL. Women scored significantly higher than men on the CPDS DEL. Nurses scored significantly higher than physicians on the CPDS DEL. HCWs specializing in palliative care and oncology, as well as cardiology, had significantly higher CPDS DEL scores than those in other related specialties.

HYPO: Eight candidate correlates were identified for inclusion in the multivariable linear regression models for CPDS HYPO: HCW age ($p = 0.239$), total years practicing ($p = 0.090$), years in specialty ($p = 0.138$), years in pain assessment ($p = 0.056$), years in palliative oncology

($p = 0.093$), percentage of older patients ($p = 0.129$), gender ($p = 0.078$), and discipline ($p = 0.063$). HCW age, total years practicing, years in specialty, years in pain assessment, years in palliative oncology, and percentage of older patients were all positively correlated with CPDS HYPO scores. Women scored significantly higher than men on the CPDS HYPO. Nurses scored significantly higher than physicians on the CPDS HYPO.

HYPER: Six candidate correlates were identified for inclusion in the multivariable linear regression models for CPDS HYPER: HCW age ($p = 0.102$), total years practicing ($p = 0.142$), PCS ($p = 0.140$), DECS ($p = 0.027$), discipline ($p = 0.074$), and specialty ($p = 0.013$). HCW age and total years practicing were negatively correlated with CPDS HYPER scores; PCS and DECS were positively correlated with them. Nurses scored significantly higher than physicians on the CPDS HYPER. CPDS HYPER scores were significantly higher among HCWs specializing in palliative care and oncology and other related specialties compared to those in pain and anesthesia. In addition, HCWs specializing in palliative care and oncology scored significantly higher than those specializing in cardiology on the CPDS HYPER.

MIX: One candidate correlate for CPDS MIX, specialized training in pain management, was identified for inclusion in the multivariable linear regression models ($p = 0.039$). HCWs who received specialized training in pain management scored significantly lower than those without such training on the CPDS MIX.

All variables except for years of experience with cognitively impaired patients and number of advanced cancer patients per month met the criteria for inclusion in the backward selection regression models. Association tests (i.e.: Pearson's correlations and chi-square tests) to determine multicollinearity among the variables revealed that age, total years practicing, years in specialty, and years in pain assessment were all highly correlated with one another ($r > 0.7$ for

all correlations). Discipline was strongly associated with both gender ($\Phi = .613$, $p = .001$) and specialized training in pain management ($\Phi = .436$, $p = .010$).

To ensure that a wide variety of HCW characteristics were included in the analyses, age, instead of total years practicing, years in specialty, and years in pain assessment, was retained as a candidate correlate for inclusion in the final models. This variable was chosen as different measures of clinical experience (i.e.: years in palliative oncology, years in geriatrics) were already included in the analyses. Therefore, its inclusion allowed for different HCW characteristics to be tested (i.e.: age and clinical experience). Specialized training in pain management was removed from the analysis as it had the most missing data²²¹. Discipline, instead of gender, was retained to provide new insights and extend the findings of a recent qualitative study⁵⁹, which found nurses and physicians differed in the tools and pain characteristics used to assess and manage pain in older adults with cancer and delirium.

In total, eight candidate correlates (age, discipline [nurse or physician], specialty [pain and anesthesia, palliative care and oncology, cardiology, or other related specialties], years of experience in palliative oncology, years of experience in geriatrics, percentage of older patients, PCS, and DECS) were identified for inclusion in the five multivariable linear regression models, with CPDS scores for each patient subgroup (i.e.: INT, DEL, HYPO, HYPER, and MIX) as the outcome variables. The reference categories used in all regression models for discipline and specialty are nurse and palliative care and oncology, respectively. All eight candidate correlates were included in each of the regression models. This number falls within the recommended range of 5-10 candidate correlates for our given sample size²²⁶.

Multivariable Linear Regression Models

The results of the multivariable linear regression analyses are presented in Table 5. Details on the tests conducted to assess multivariable linear regression assumptions for each model can be found in Appendix B.

CPDS INT: The model for CPDS INT (see second column in Table 5) explained 19.4% of the variance in HCW CPDS scores for this patient group ($R^2 = 0.194$, $F_{3,40} = 3.214$, $p = 0.033$). This model included two significant variables – one demographic variable, older HCW age; and one clinical variable, fewer years of experience with geriatrics. There was also one non-significant variable that was retained in this model: a higher percentage of older patients cared for was associated with lower CPDS INT scores. No psychological variables were retained in this model. An examination of tolerance and VIF values revealed no multicollinearity.

CPDS DEL: The model for CPDS DEL (see third column in Table 5) explained 18.9% of the variance in HCW CPDS scores for this patient group ($R^2 = 0.189$, $F_{2,41} = 4.773$, $p = 0.014$). This model included one significant variable, discipline, where higher scores on the CPDS DEL were significantly associated with being a nurse rather than a physician. There was also one variable that made a non-significant contribution to the model: HCWs specializing in other related specialties was associated with lower CPDS DEL scores compared to those specializing in palliative care and oncology. No demographic or psychological variables were retained in this model. Tolerance and VIF values revealed no multicollinearity.

CPDS HYPO: The model for CPDS HYPO (see fourth column in Table 5) was non-significant and explained 12.4% of the variance in HCW CPDS scores for this delirium subtype ($R^2 = 0.124$, $F_{2,41} = 2.908$, $p = 0.066$). Only two non-significant variables were retained in this

model – one demographic variable, discipline, where nurses scored higher than physicians on the CPDS HYPO; and one clinical variable, greater number of years of experience in palliative oncology. No psychological variables were retained in this model. An examination of the tolerance and VIF values revealed no multicollinearity.

CPDS HYPER: The model for CPDS HYPER (see fifth column in Table 5) explained the greatest amount of variance, 36.7%, and included one significant clinical variable, specialized training in palliative care and oncology (compared to both pain and anesthesia and cardiology). This model also included two non-significant demographic variables, younger HCW age and discipline (i.e.: nurses scored higher than physicians on the CPDS HYPER); and one psychological variable, higher PCS scores. Tolerance and VIF values revealed no multicollinearity.

CPDS MIX: The model for MIX did not retain any variables. These variables did not explain any of the variance in the scores, and thus the model was non-significant.

Table 5. Multivariable Backwards Linear Regression Correlates of CPDS Scores

	CPDS INT (N = 53) β (SE) ^a	CPDS DEL (N = 53) β (SE) ^a	CPDS HYPO (N = 53) β (SE) ^a	CPDS HYPER (N = 53) β (SE) ^a	CPDS MIX (N = 53) β (SE) ^a
Demographic					
Age	.480* (.035)			-.203 (.025)	
Clinical					
Physician		-.315* (1.000)	-.254 (.690)	-.259 (.811)	
Pain and Anesthesia				-.311* (.884)	
Cardiology				-.391** (.779)	
Other Related Specialties		-.269 (.923)			
Years in Palliative Oncology			.238 (.187)		
Years in Geriatrics	-.494** (.310)				
Percentage of Older Patients	-.251 (.019)				
Psychological					
PCS				.238 (.027)	
DECS					
R² (p)	.194 (.033)	.189 (.014)	.124 (.066)	.367 (.003)	

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Bold = variables that made a significant contribution to each model.

PCS: Pain Catastrophizing Scale. DECS: Davis Empathic Concern Scale.

^a Standard Error

DISCUSSION

Novel findings from the present study support the biopsychosocial model of pain and aging⁸², as we identified that multiple biopsychosocial correlates are associated with the number of pain cues HCWs use to judge pain in older patients with advanced cancer who are cognitively intact, or who have delirium, including hypoactive and hyperactive subtypes. This is the first study, to our knowledge, to examine the relationship between HCWs' factors and the number of pain cues they report using for pain judgments in this vulnerable population. Although some similarities were observed across models, the number of reported pain cues for each cognitive status and delirium subtype had unique correlates, demonstrating the differences in factors associated with how many pain cues are used for pain assessments among these different patient groups. Age, discipline, specialty, years of experience in palliative oncology, years of

experience in geriatrics, percentage of older patients, and pain catastrophizing each contributed, either significantly or non-significantly, in at least one of the models. Interestingly, no HCW factors were retained in the mixed delirium model, and no variable made a significant contribution to all models. Although this was not a pain judgment study, these findings are an important first step in understanding HCWs' pain judgments in older adults with advanced cancer and delirium. In addition, this study contributed to the development of the CPDS¹³, as the results demonstrated construct validity. We were able to identify relationships between CPDS scores and HCW biopsychosocial factors that have been theoretically associated with pain judgments.

In the following section, both significant and non-significant findings are discussed, as this is the first study to examine relationships and patterns between HCW factors and their pain judgments about this patient population. Each finding, whether significant or non-significant, is important in helping us refine the biopsychosocial model of pain and aging⁸² and can inform the development of subsequent studies regarding the association between HCW factors and their pain judgments about older adults with advanced cancer and delirium.

Biopsychosocial Model of Pain and Aging

As the biopsychosocial model of pain and aging⁸² suggests, pain and pain assessment are influenced by many factors. Delirium is a patient factor which can interfere with the self-report of pain, and pain expression^{4,8,9}. The behavioural manifestations of pain and delirium can overlap, thus interfering with the HCWs' ability to accurately decode pain cues^{4,5,9,13}. The model also proposes that HCW factors can influence the decoding of pain cues and subsequent pain judgments⁸². The interaction between delirium and HCW factors can impact pain judgments,

leading to overestimations or underestimations of pain by HCWs, thus impacting subsequent assessments and treatment in this patient population.

The present study tested and refined the biopsychosocial model of pain and aging⁸², and offers a revised model (Figure 5). The findings support the theory presented in the original model that patient factors may alter pain expression and hinder self-report, which can influence HCWs' judgments of pain⁸². The present study focused on reports of pain judgments in older adults with advanced cancer and delirium. It was found that the presence and subtype of delirium influences HCWs' pain judgments in this patient population; this may be due to the differences in behavioural presentations between patients with and without delirium, as well as the different subtypes. In revising the model⁸², delirium was added to the Patient Factors section to reflect our findings. The findings of the present study also support the theory presented in the original model⁸² that HCW factors influence pain judgments in older adults with advanced cancer and delirium. The findings also offer new insight into the relationships between specific HCW factors and pain judgments in this patient population, which justifies its revision. HCW factors were retained, changed, added, and removed.

Retained HCW Factors. Consistent with previous studies that found a relationship between observer age and the recognition of pain cues^{143–146}, HCW age was found to be associated with pain judgments. Specifically, HCW age was significantly correlated with the number of reported pain cues for patients who are cognitively intact, and non-significantly associated with the number of reported pain cues for patients with hyperactive delirium. Therefore, HCW age was retained in the revised model.

Although the current study did not include pain beliefs and knowledge as a HCW factor, Ghandeharian and colleagues⁵⁹ recently conducted a qualitative study exploring HCWs'

knowledge and beliefs about pain in older adults with advanced cancer. It was found that HCWs provided inconsistent beliefs about opioid use, as well as the priority of pain management during delirium⁵⁹. These results support the retention of this HCW factor in the revised model.

Changed HCW Factors. In the original biopsychosocial model of pain and aging⁸², the HCW factor experience was included. The present study expanded on this and explored different aspects of clinical experience (i.e.: discipline, specialty, years of experience in geriatrics, years of experience in palliative oncology, percentage of older patients cared for) and their associations with pain judgments.

Consistent with previous studies^{59,166,167,169–171}, discipline was found to be significantly associated with the number of reported pain cues for patients with delirium where the subtype was not specified, as well as non-significantly associated for patients with hypoactive and hyperactive delirium subtypes. Physicians described using fewer pain cues than nurses for all three patient groups.

Consistent with previous literature¹⁶³, specialty was also correlated with the number of described pain cues for patients with hyperactive delirium, as well as patients with delirium where the subtype was not specified. Specifically, HCWs specializing in cardiology, as well as pain and anesthesia, reported significantly fewer pain cues compared to those specializing in palliative care and oncology for patients with hyperactive delirium. In addition, specializing in other related specialties (i.e.: geriatrics, ophthalmology, operating room/surgery, ICU, critical care, emergency room, family medicine), was non-significantly associated with fewer described pain cues compared to specializing in palliative care and oncology for patients with delirium where the subtype was not specified.

Consistent with previous studies^{10,156,158,159}, years of experience in geriatrics was significantly correlated with the number of described pain cues for patients who are cognitively intact. Specifically, more years of experience in geriatrics was associated with fewer reported pain cues for this patient group. However, more years of experience in palliative oncology yielded more described pain cues for patients with hypoactive delirium, which conflicts with previous findings^{10,156,158,159}.

Percentage of older patients cared for per month was also found to be non-significantly associated with pain judgments. Specifically, HCWs caring for a higher percentage of older patients described using fewer pain cues as a basis for their pain judgments for patients who are cognitively intact.

The results of the present study demonstrate that different aspects of clinical experience are uniquely associated with pain judgments in older adults with advanced cancer and delirium. In the revised model, experience was changed to discipline, specialty, years of experience in geriatrics, years of experience in palliative oncology, and percentage of older patients cared for per month. This was done to reflect the nuances in the relationships between these different measures of clinical experience and pain judgments in this patient population.

Added HCW Factors. In the literature, there is evidence to suggest that pain catastrophizing is associated with pain judgments^{183–185}. However, this HCW factor was not included in the original biopsychosocial model of pain and aging⁸². Nonetheless, the present study examined the association between pain catastrophizing and pain judgments in older patients with advanced cancer and delirium. It was found that pain catastrophizing was non-significantly associated with the number of reported pain cues used for patients with hyperactive delirium. Specifically, HCWs who scored higher on the PCS²⁰³ reported using more pain cues

for this patient group than those who scored lower on the PCS. Although non-significant, these results warrant the inclusion of pain catastrophizing as a HCW factor in the revised model.

Removed HCW Factors. Empathy was included in the original biopsychosocial model of pain and aging⁸² as there was evidence to suggest its association with pain perception in others^{171,194,195}. However, this variable was not retained in any of the final models in the present study, which warranted its removal from the revised model. In addition, perception and distress/burden were not included in the present study, so they were not reflected in the revised model. Nonetheless, these factors may still be important influences of pain judgments about older adults with advanced cancer and delirium and should not be permanently discounted. Future research should focus on testing these factors so that the model can be further refined.

In summary, the present study served as a preliminary test and refinement of the biopsychosocial model of pain and aging⁸². HCW factors in the model⁸² were retained, changed, added, and removed to reflect the results of the current study. Age, discipline, specialty, years of experience in palliative oncology, years of experience in geriatrics, percentage of older patients cared for per month, and pain catastrophizing were all found to be associated, whether significantly or non-significantly, with pain judgments about older patients with advanced cancer and delirium, which justifies their inclusion in the revised model. However, as this was a preliminary test and validation of the model⁸², replication and further refinement through future studies is needed to further examine the relationships and patterns between HCW factors and their pain judgments about this vulnerable patient population.

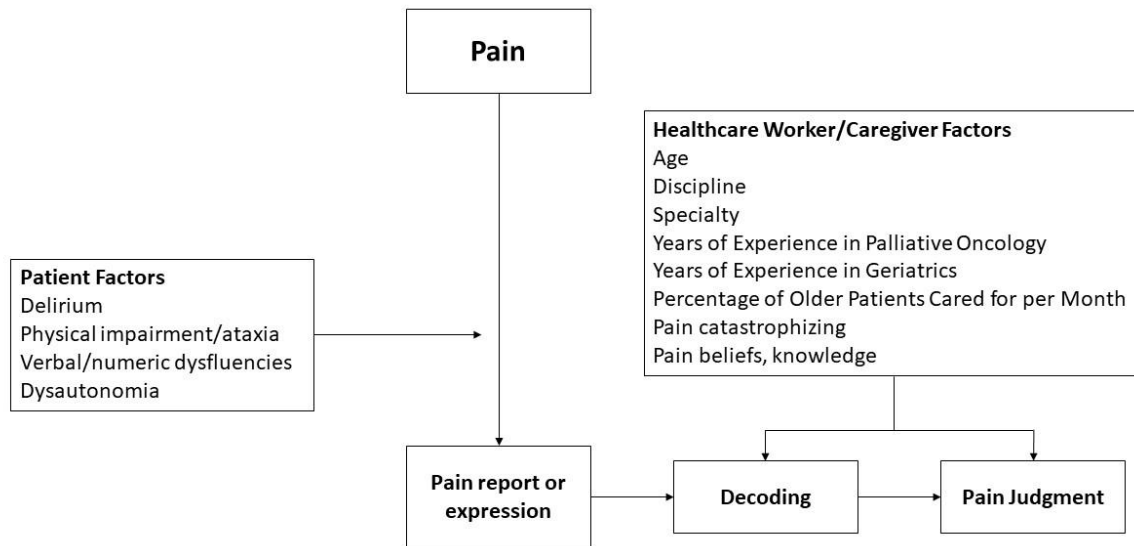


Figure 5. Lower half of the revised Biopsychosocial Model of Pain and Aging.

Correlates Across Models

The models refined in the present study supported the biopsychosocial model of pain and aging⁸². The number of reported pain cues for each cognitive status (i.e.: cognitively intact and delirium) was correlated with different HCW factors, demonstrating the uniqueness in factors that are associated with how many pain cues HCWs report using for pain judgments in older advanced cancer patients with and without delirium. The number of reported pain cues used to judge pain in patients who are cognitively intact was significantly correlated with HCW age and years of experience in geriatrics, whereas the number of reported pain cues for patients with delirium was significantly associated with discipline. As pain report or expression differs based on cognitive status^{4,8,9,66,71,86}, it is possible that different HCW factors may be playing a role in determining how many pain cues they may use to judge pain in patients who are cognitively intact versus cognitively impaired. Self-report of pain is considered the “gold standard” for assessing pain in cognitively intact older adults^{83,84}. Graham and colleagues¹³ determined that

HCWs mentioned *self-report* most frequently as one of the pain cues they use to determine pain in this population. However, in patients with delirium, where verbal communication is impaired, pain judgments are primarily based on other behavioural cues¹³. It is possible that different HCW factors may be influencing the number of pain cues used depending on the differences in behavioural presentations between older advanced cancer patients with and without delirium. However, this study examined the number of pain cues mentioned in interviews, which may differ from the number of cues used in actual clinical care. Therefore, this explanation remains speculative and requires further research. Nonetheless, these findings are an important first step in determining the differences in factors influencing HCWs' pain judgments between patients who are cognitively intact and those with delirium.

Interesting findings emerged when looking at the HCW factors associated with the number of described pain cues across the delirium subtypes (i.e.: hypoactive, hyperactive, and mixed). The number of reported pain cues when describing patients with hypoactive delirium were non-significantly correlated with discipline and years of experience in palliative oncology. Moreover, the model itself was non-significant and only explained 12.4% of the variance in the number of described pain cues for this patient population. It is possible that this is due to the difficulty of assessing pain in this particular type of delirium¹³. The characteristics of hypoactive delirium, such as confusion and sedation, complicate pain assessment due to an inability to provide reliable verbal self-report of pain, as well as their behavioural overlap with pain. When HCWs express that it is difficult to determine if patients are in pain, it is possible that their own demographic, professional, and psychological characteristics may be explaining less of the variance in how many pain cues they use to judge pain, and that the difficulty in pain assessment for this subtype is a more influential factor. Previous literature describes diagnostic uncertainty

as the “subjective perception of an inability to provide an accurate explanation of the patient’s health problem”²²⁷. Beresford²²⁸ reported three main sources of diagnostic uncertainty: technical, which arises from incomplete or inadequate scientific data on the disease or its treatments; personal, which arises from poor communication between the HCW and the patient; and conceptual, which arises from difficulty applying data to clinical situations. It is possible that the HCWs in this study experienced uncertainty when judging pain in older adults with advanced cancer and hypoactive delirium due to the limited scientific data available, their inability to effectively communicate with the patient, and the complexity of their cases. The literature also suggests that diagnostic uncertainty is common among HCWs caring for patients with more complex symptom presentations²²⁹. Whaley and colleagues²²⁹ conducted a retrospective chart review examining clinicians’ diagnostic processes for patients presenting with acute cough. They found clinicians were more likely to express diagnostic uncertainty in patients with an increasing number of possible diagnoses²²⁹. The HCWs in the present study may have experienced uncertainty as the behavioural cues they reported using to assess pain in this patient population could be due to either cancer pain or delirium. Future research should include diagnostic uncertainty to further our understanding of the influence it has on pain judgments about older adults with advanced cancer and delirium. This variable could be measured using a 5-point Likert scale to determine HCWs’ degree of uncertainty as to whether the behavioural cues they observe in patients with each of the different delirium subtypes are from pain.

HCWs specializing in pain and anesthesia, as well as cardiology, described using significantly fewer pain cues than those specializing in palliative care and oncology as a basis for their pain assessments in patients with hyperactive delirium. This model accounted for 36.7% of

the variance in the number of reported pain cues used for this patient population, which is considerably higher than the hypoactive model. This may be because pain is more apparent in patients with hyperactive delirium than hypoactive delirium. Graham and colleagues¹³ determined that HCWs identified 13 different types of pain cues for patients with hyperactive delirium but only 9 different types of pain cues for patients with hypoactive delirium. There were also significant differences in the frequency with which cues were stated for patients with these two subtypes¹³. For example, significantly more HCWs stated *yelling* and *agitation* when describing pain in patients with hyperactive delirium, whereas *does not want to move* was stated by significantly more HCWs when describing pain in patients with hypoactive delirium¹³. It is possible that *yelling* and *agitation* are more “obvious” pain cues than *does not want to move*. Therefore, the differences in the amount and type of reported pain cues used between these two subtypes may explain why pain is seemingly more evident in patients with hyperactive delirium than those with hypoactive delirium. In addition, previous research suggests that greater experience with a particular group of individuals may lead to better and more confident pain assessments¹⁹⁷. Sloman and colleagues¹⁹⁷ surveyed nurses on their knowledge of pain in older adults. They found that HCWs specializing in both geriatrics and palliative care were significantly more knowledgeable than HCWs in other specialties regarding pain reactions and pain management in this patient population¹⁹⁷. This may, in part, explain why HCWs specializing in palliative care and oncology reported using more pain cues than those specializing in pain and anesthesia and cardiology to judge pain in patients with hyperactive delirium. However, it remains unclear as to whether a higher number of reported pain cues is indicative of more accurate pain judgments.

Pain behaviours and delirium symptoms have been categorized into several symptom clusters^{65,230}. A symptom cluster is defined as multiple symptoms that are related to each other and occur together²³¹. For example, pain behaviour clusters include facial/vocal expressions of distress (e.g.: grimacing, moaning, crying), body movements/postures (e.g.: protective behaviours), negative affect (e.g.: agitation, aggression), and avoidance of activity²³⁰. Delirium clusters include agitation and mood lability⁶⁵ (rapid mood changes where strong feelings or emotions, such as uncontrollable crying, occur²³²). The identification of symptom clusters is important as they can provide crucial information regarding assessment and treatment of the underlying condition²³³. For example, recognizing pain behaviour clusters in patients with advanced cancer can lead to the provision of analgesics to minimize discomfort²³³.

However, previous literature suggests that there is some overlap in pain and delirium symptom clusters, which can create significant challenges to the assessment of pain^{4,9,131}. Bruera and colleagues¹³¹ compared pain intensity ratings of patients with cancer pain before, during, and after hyperactive delirium. Patients provided self-report before and after, and HCWs rated pain during delirium¹³¹. They found that pain intensity ratings were similar before and after the delirium episode but were significantly higher during it, therefore suggesting that HCWs misattributed behavioural cues to pain rather than delirium¹³¹. To further understand how HCWs judge pain and how they differentiate it from delirium, Gagliese and colleagues⁴ conducted a retrospective chart review. They found that while HCWs judged pain to be highly prevalent in this population, many of the observational assessments did not specify which behavioural cues were used to determine pain presence, and none of the chart notations explained how HCWs distinguished pain from delirium. In addition, Graham and colleagues¹³ found that pain cues described for the different subtypes of delirium overlapped with symptoms of that specific

delirium subtype. For example, HCWs reported using *aggression* for patients with hyperactive delirium¹³. Taken together, these results demonstrate that HCWs may be confusing pain and delirium symptom clusters, which can lead to challenges in pain assessment in this vulnerable patient population. However, it remained unclear as to how these HCWs made these pain judgments.

The results of the present study suggest that the identification of symptom clusters is influenced by demographic, clinical, and psychological HCW factors. Specifically, HCW factors play the biggest role in identifying symptom clusters in patients with hyperactive delirium. However, this may be because the symptom clusters associated with pain and hyperactive delirium present similarly to one another. Consequently, this could lead to both the undertreatment and overtreatment of pain^{6,73–77}. If pain clusters are mistaken for delirium clusters, it may lead to the underestimation and undertreatment of pain. Pain undertreatment has been associated with anxiety, suffering, cognitive impairment, and poorer quality of dying and death^{78,79}. In addition, pain undertreatment can also exacerbate delirium^{73,75,76}, thus worsening behavioural symptoms and its consequences. Conversely, if delirium clusters are mistaken for pain clusters, this could lead to the overestimation and overtreatment of pain^{6,74}. This may lead to unnecessary provision of opioids, which can worsen delirium and exacerbate the pain behaviours^{6,74,77}. Future research should focus on further developing and using a standardized pain assessment tool, as it may help with the distinction between pain and delirium symptom clusters and improve pain assessment and treatment in this population.

Similar to the hypoactive model, the model for the mixed subtype did not retain any variables. Difficulty in assessing pain in patients with mixed delirium may also be one of the more influential factors as opposed to other HCW factors. As stated above, diagnostic

uncertainty regarding pain in patients who present with this delirium subtype may be playing a bigger role than other HCW factors (e.g.: age, years of experience, pain catastrophizing) in determining how many pain cues are used to judge pain in patients with mixed delirium. The characteristics of mixed delirium also complicate pain assessment due to an inability to provide reliable verbal self-report of pain, as well as their behavioural overlap with pain. Therefore, HCWs may experience uncertainty as to whether these patients are in pain or experiencing delirium symptoms. In addition, it is possible that many HCWs do not have any clinical experience with this specific delirium subtype, as mixed delirium is not very common^{3,67,69,70}. Previous research has found that greater experience with a particular illness or group of individuals may lead to better and more confident pain assessments¹⁹⁷. Therefore, it is possible that inexperience with patients with mixed delirium may be a more influential factor than HCW factors in the number of pain cues used to judge pain in patients with this delirium subtype. Future research could look at experience with specific delirium subtypes as a potential factor influencing their pain judgments about these patient populations.

In summary, HCW factors are associated with the number of pain cues used to judge pain in patients who are cognitively intact, as well as those with delirium. Age, discipline, specialty, years of experience in palliative oncology, years of experience in geriatrics, percentage of older patients, and pain catastrophizing each played a role in most of the models, suggesting that HCW factors may, in part, influence pain assessments in these patient populations. Although no significant variables were retained in the hypoactive model and no variables were retained in the mixed model, other biopsychosocial factors, such as diagnostic uncertainty and clinical experience with the delirium subtypes, may influence the number of cues used to judge pain in patients with these delirium subtypes. Some models retained fewer variables than others,

suggesting that other patient or HCW biopsychosocial factors not included in this study may be more influential factors when making pain judgments in these patients. While some variables were common across multiple models, no variable showed up in all of them, highlighting the variability in reported pain cues used to make pain judgments about each patient group. These distinct HCW factors may be important for understanding the differences in pain management between patients who are cognitively intact and those with delirium, as well those with the hypoactive, hyperactive, and mixed subtypes. However, caution is warranted when interpreting these findings, due to the limited amount of variance explained and small sample size of the current study. Future research in a clinical setting with a larger sample size can be conducted to further understand these findings. In the next section, the contribution of each correlate is discussed separately.

Correlates of the Number of Reported Pain Cues

Demographic Correlates

In this study, HCW age was associated with the number of reported pain cues for patients who are cognitively intact, as well as patients with hyperactive delirium. Specifically, older HCW age was significantly associated with a greater number of described pain cues for older patients who are cognitively intact but non-significantly associated with fewer described pain cues for patients with hyperactive delirium. The findings of the current study extend those found in previous literature describing an own-age bias^{143,144}, where younger and older adults are better at recognizing facial expressions in people closer in age to them as opposed to those of different ages. Although this study did not examine the recognition of facial pain expressions, we found that older HCWs reported using more pain cues than younger HCWs to judge pain in older

patients who are cognitively intact. This suggests that older HCWs are able to identify more pain cues in older patients as they are closer in age to them. However, the findings also extend conflicting results found in the existing literature that report a decline in accuracy of facial expression recognition with age^{145,146}. It remains unclear as to whether the use of more pain cues is reflective of more accurate pain judgments. Future research could examine the relationship between the number of cues used to judge pain and accuracy of pain judgments about older adults who are cognitively intact.

In contrast, in patients with hyperactive delirium, older HCWs reported using fewer pain cues than younger HCWs as a basis for their pain judgments. These findings extend the previous literature describing an age-related decline in accuracy of facial expression recognition^{145,146}, possibly due to age-related changes in the brain²³⁴. As patients with hyperactive delirium have a tendency to display a wide range of pain cues¹³, it is possible that, due to these age-related changes, older HCWs may have more difficulty recognizing certain pain cues (e.g.: more subtle ones). As a result, older HCWs may use fewer pain cues than younger HCWs to judge pain in this patient group. However, due to the lack of statistical significance, interpreting these results should be done with caution.

The conflicting associations between HCW age and the number of described pain cues for these two patient groups may reflect differences in patient cognitive status. The results of the current study may suggest that younger HCWs are better than older HCWs at distinguishing between symptoms of delirium and pain behaviours, which is not an issue with patients who are cognitively intact. However, as the behavioural manifestations of pain and delirium are nonspecific and present similarly to one another^{4,9}, younger HCWs may actually be conflating pain with delirium. As a result, this may be contributing to the higher number of described pain

cues in patients with hyperactive delirium as opposed to patients who are cognitively intact. However, this explanation is speculative and requires further research. Nonetheless, the results of the current study may be explained, in part, by the age-related changes in recognition of expressions and behaviours indicating pain.

It is possible that there is some shared variance between HCW age and experience when looking at the number of described pain cues for patients who are cognitively intact and those with hyperactive delirium. Shared variance indicates how two variables change together²¹⁶.

As stated above, this study found that older HCWs describe using more pain cues than younger HCWs for patients who are cognitively intact. This may be due to an own-age bias^{143,144}, where younger and older adults recognize facial expressions better in people of their own age than in people of other ages. There is evidence to suggest that the own-age bias^{143,144} may be influenced by experience in interacting with people of similar or different ages²³⁵. Harrison and Hole²³⁵ had undergraduate students and trainee teachers view facial photographs of children and young adults, and then later asked them to identify those photographs from a larger selection. It was found that while undergraduate students were faster and more accurate at recognizing faces of their own age, trainee teachers recognized the children's faces more quickly than own-age faces and with similar accuracy²³⁵. Although this study²³⁵ did not focus on HCWs and facial expressions of pain, these results suggest that experience with a particular age-group may underlie the relationship between own-age bias and pain judgments. The older HCWs in the current study may have had more experience interacting with people and patients of similar age to them; therefore, they are able to identify more pain cues in this patient population.

In contrast, older HCWs reported using fewer pain cues than younger HCWs as a basis for their pain judgments in patients with hyperactive delirium. Experience may also underlie this

relationship; there is evidence to suggest that greater experience leads to an adaptation effect^{10,156,158–161}, where the basis of an observer's judgment may depend on previous experiences they have had with similar stimuli¹⁵⁶. Prkachin and colleagues¹⁵⁶ examined the effects of exposure on pain judgments. Participants were asked to view video clips of multiple shoulder pain patients undergoing a painful treatment and to determine pain presence and intensity (i.e.: none, moderate, severe); the video clips varied in the frequency of facial expressions indicating severe pain¹⁵⁶. It was found that participants who had greater exposure to severe pain expressions were less likely than those who had less exposure to judge moderately painful expressions as painful¹⁵⁶. It is possible that older HCWs are likely to have more experience than younger HCWs with pain assessments, and may use their memory of extreme clinical experiences as a calibration standard and make pain judgments according to that¹⁵⁶. However, this is a methodological issue that is typically found in pain judgment studies; the present study interviewed HCWs on their experiences judging pain, which eliminates the effect of exposure on their responses. The use of interviews allowed for probing and clarification of any questions, as well as time to reflect on their experiences judging pain in this patient population²³⁶. Nonetheless, adaptation effects may be prevalent in a clinical setting where older HCWs are judging pain in older adults with advanced cancer and delirium. Adaptation effects may cause HCWs to experience emotional distancing towards a patient's pain as a defense mechanism against continued exposure^{158–161}, especially in the palliative care setting, where pain is highly prevalent^{164,165}. Ablett and colleagues¹⁶⁵ explored hospice nurses' experiences of working in palliative care. A theme that emerged from the semi-structured interviews was developing resilience by maintaining professional boundaries¹⁶⁵. The authors explain that these boundaries serve as a protective function against the emotional distress of working in this patient

setting¹⁶⁵. Although this study¹⁶⁵ did not look at how pain judgments were affected by this distancing, it can be suggested that distancing in oncology-related specialties may be associated with underestimations of patients' pain. In the present study, older HCWs who had prolonged exposure to severe pain due to working in the palliative care setting may have tended to unintentionally overlook some pain cues. This may explain the lower number of reported pain cues older HCWs use to identify pain in patients with hyperactive delirium.

The conflicting associations between HCW age, experience, and the number of described pain cues for these two patient groups may reflect differences in patient cognitive status. The results of the current study suggest that older HCWs are better than younger HCWs at judging pain in older adults who are cognitively intact, as they have had more experience in providing care for that patient group, which may contribute to an own-age bias^{143,144}. However, older HCWs may be discounting pain cues due to adaptation effects and emotional distancing^{10,156,158–161} in patients with hyperactive delirium, where pain is seemingly more prevalent and evident¹³. Taken together, these results suggest that experience plays a modulating role in the relationship between age and pain judgments in this patient population, and this role is influenced by patient cognitive status. However, this relationship between age, experience, and pain assessments is speculative and can be a topic for future research to examine.

It is important to note that our sample was limited to HCWs who are working-age adults. This small age range may have impacted our results, as it may have reduced the correlation coefficient between age and the number of reported pain cues for each patient group^{147–151}. A small age range could also threaten external validity by limiting the generalizability of results to individuals within this age range²³⁷. However, as HCWs are typically of working-age^{238,239}, the results may be generalized to other HCWs.

This proposed relationship between HCW age, experience, and pain judgments can be explained by experience-guided learning. Experience-guided learning, or experiential learning²⁴⁰, is the process of learning through direct experience and subsequent reflection in order to increase knowledge and develop skills. In healthcare, learning is often experiential and continues throughout a HCW's career^{241–244}. This includes attending team meetings/briefings, observation, mentoring²⁴⁵, and even through daily professional experiences²⁴⁶. It is possible that experiential learning occurs through daily professional experiences for HCWs judging pain in older adults with advanced cancer and delirium. These experiences then inform subsequent pain assessment strategies. Consequently, pain assessment in this patient population is complicated by the behavioural overlap between pain behaviours and delirium symptoms^{4,5,13}, as well as the lack of a standardized pain assessment tool, which can lead to both the undertreatment and overtreatment of pain^{6,73–77}. As a result, it is crucial that pain assessment strategies for this vulnerable patient population be optimized, in order to increase the quality of care they receive.

Clinical Experience Correlates

In the present study, years of experience in geriatrics was significantly correlated with the number of reported pain cues for patients who are cognitively intact. Specifically, more years of experience in geriatrics was associated with fewer described pain cues for this patient group. These results are consistent with previous literature where greater clinical experience has been associated with greater underestimations of patients' pain^{10,156,158,159}. It has been found that greater clinical experience leads to an adaptation effect^{10,156,158–161} where the basis of a HCW's clinical judgment may depend on their previous assessment experiences. As a result, HCWs may experience emotional distancing from their patients' illness and associated complications as a

defense mechanism against continued exposure^{158–161}. It is possible that the HCWs in this study with more years of experience in geriatrics may have experienced emotional distancing from older patients' pain due to their continued exposure to cancer and its symptoms, such as pain and pain behaviours, in this patient population. Consequently, these HCWs may have unintentionally overlooked certain pain cues as indicators of pain and failed to report them in their interviews.

Interestingly, years of experience in palliative oncology was non-significantly correlated with the number of reported pain cues for patients with hypoactive delirium, where more years of experience in palliative oncology yielded more described pain cues for this patient group. These findings conflict with the previous literature regarding adaptation effects as a result of greater experience^{10,156,158,159}. However, this paradox in findings may be explained by the distribution of years of experience in each area of specialty. The HCWs in the present study, on average, had fewer years of experience in palliative oncology than in geriatrics. Therefore, it is possible that these HCWs may not have been subject to adaptation effects from their years of experience in palliative oncology, as they have not had as much prolonged exposure to cancer and palliative care.

There is also some evidence to suggest that clinical experience in certain specialties is associated with knowledge gaps regarding pain^{197,247}. Nguyen and colleagues²⁴⁷ surveyed nurses from a geriatric hospital on their knowledge and attitudes regarding pain management. It was found that these nurses, who had experience in geriatrics, displayed significant knowledge deficits regarding pain management²⁴⁷. It is possible that the HCWs in the present study with experience in geriatrics also had knowledge gaps regarding pain and pain management, thus contributing to fewer reported pain cues for patients who are cognitively intact. In contrast,

Sloman and colleagues¹⁹⁷ found that nurses with experience in palliative care demonstrated the least amount of knowledge gaps with regards to pain reactions and pain management in older adults¹⁹⁷. This suggests that the HCWs in the current study who have greater experience in palliative care and oncology may be more knowledgeable than those with less experience regarding pain reactions for patients with hypoactive delirium. As a result, these HCWs may be able to better identify pain cues in this patient population. However, as stated previously, it is possible that these HCWs are conflating pain behaviours with delirium symptoms; future research is needed in this area. In addition, it is imperative to interpret these findings with caution due to the lack of statistical significance.

Specialty was also correlated with the number of reported pain cues for patients with hyperactive delirium, as well as patients with delirium when the subtype was not specified. Specifically, HCWs specializing in pain and anesthesia, as well as cardiology, reported significantly fewer pain cues compared to those specializing in palliative care and oncology for patients who have hyperactive delirium. In addition, specializing in other related specialties (i.e.: geriatrics, ophthalmology, operating room/surgery, ICU, critical care, emergency room, family medicine), was non-significantly associated with fewer described pain cues compared to specializing in palliative care and oncology for patients with delirium when the subtype was not specified.

As Sloman and colleagues¹⁹⁷ suggest, experience in certain specialties, such as palliative care, may lead to greater knowledge of pain and pain assessment, which may contribute to more effective methods of assessing and managing pain. In the present study, HCWs specializing in palliative care and oncology described more pain behaviours than those specializing in the other specialty groups, which may be because they are more knowledgeable about pain and pain

behaviours. As a result, these HCWs may be more attuned to certain pain cues which may be overlooked by HCWs in other specialties, such as cardiology, ophthalmology, and family medicine. However, as stated previously, these HCWs may be mistaking delirium symptoms with pain behaviours, which could be inflating the number of described pain cues.

In addition, although anesthesiologists are primarily responsible for pain management related to surgery²⁴⁸, there is evidence to suggest that HCWs in this specialty are conservative when it comes to analgesic administration²⁴⁹ for pain. This may be indicative of conservative pain judgments. Although this study, conducted by Ward and colleagues²⁴⁹, was looking at postoperative pain management and treatment, it suggests that anesthesiologists may also be conservative in their pain judgments in other illnesses, such as advanced cancer. In the context of the current study, HCWs specializing in pain and anesthesia may have been more conservative than those specializing in palliative care and oncology when describing the pain cues they use to judge pain.

In the current study, HCWs caring for a higher percentage of older patients per month described using fewer pain cues as a basis for their pain judgments in patients who are cognitively intact; however, this relationship was non-significant. Consistent with what was found for years of experience in geriatrics, these findings may also be explained by adaptation effects¹⁵⁶. The HCWs in this study providing care for a greater number of older patients with advanced cancer may have experienced emotional distancing as a defense mechanism due to the magnitude of exposure to pain and pain behaviours in older adults, therefore resulting in pain underestimations. These pain underestimations may have translated into using a lower number of pain cues than HCWs who cared for fewer older patients. In addition, these findings may also be explained by knowledge deficits regarding pain among HCWs working with older

populations. As Nguyen and colleagues²⁴⁷ suggest, HCWs primarily working in geriatrics exhibit knowledge gaps regarding pain and pain management for older patients. It is possible that the HCWs in the current study who mostly work with older adults may not be as knowledgeable about pain behaviours, therefore contributing to fewer described pain cues. However, as this model retained this variable non-significantly, it is important that we interpret these findings with caution, and replication is needed.

Discipline was associated with the number of reported pain cues for patients with delirium where the subtype was not specified, as well as patients with hypoactive and hyperactive delirium subtypes. For all three patient groups, physicians described using fewer pain cues than nurses. A few possible explanations for this are described below.

A recent qualitative study examining HCW beliefs about pain in older adults with advanced cancer and delirium found that physicians believed that analgesic administration should be delayed while the cause of delirium is investigated⁵⁹. Physicians also believed that, for hyperactive patients, sedatives should be given first to ease the pain assessment process and to ensure the safety of the patients and HCWs⁵⁹. These findings suggest that physicians may be prioritizing delirium over pain management. Our findings extend these suggesting that physicians may be attributing these behaviours to delirium rather than pain, leading to underestimations of pain. It is important that we do not over-interpret this explanation as the sample size of physicians in the qualitative study⁵⁹, as well as this study, was small (n = 8 for both) and may not reflect the beliefs and practices of all physicians providing care for this patient population. Future research with a larger sample size to replicate these findings is needed.

It is also possible that the differences in the number of reported pain cues between nurses and physicians may be due to the amount of time HCWs spend with their patients. Butler and

colleagues²⁵⁰ determined that intensive care unit (ICU) nurses spend more time in their patients' rooms than physicians. Although the ICU is a different environment from palliative care, it can be suggested that nurses may be better than physicians at recognizing pain cues in their patients as they have more direct interaction with them; physicians may be overlooking certain pain behaviours due to a lack of direct contact with these patients. As the amount of time HCWs spend with their patients may lead to improved patient care²⁵¹, it is possible that the nurses in the present study have developed a better provider-patient relationship and are able to recognize more subtle pain cues, or pain cues that are specific to certain patients, therefore contributing to the higher number of reported pain cues used to judge pain in the aforementioned patient groups. The relationship between discipline, time spent with patients, and pain assessments remains speculative and requires further research.

In this study, discipline was strongly associated with gender suggesting that this variable may underlie the observed relationship. Previous literature suggests that there may be a female advantage to decoding non-verbal pain cues, with reports that women are more accurate¹⁵⁶ and faster¹⁵⁷ at recognizing and decoding facial expressions indicating pain than men. Since most of the nurses in the present study were women, it is possible that these gender-related differences played a role in how many pain cues they use to judge pain in their patients.

Discipline was also strongly associated with specialized training in pain management in this study, where nurses were more likely than physicians to have received some sort of specialized training or education in pain management. Previous literature suggests that specialized training in pain management may improve the recognition of facial cues indicating pain¹⁷⁶. As most physicians in this study did not receive such training, it is possible that they are not as effective as nurses at recognizing pain behaviours. There is also evidence to suggest that

HCWs with specialized training are generally more knowledgeable about pain management in older patients who are cognitively intact or cognitively impaired^{173,174,200,252}. This training may include how to detect pain in cognitively intact patients, and how to distinguish pain from delirium. The nurses in this study may be more knowledgeable in pain management and pain reactions than physicians, which may lead to their increased ability to recognize pain cues in older adults with advanced cancer who are either delirious or cognitively intact.

Although the evidence suggests that nurses may be better than physicians at making pain judgments about older adults with advanced cancer and delirium, it is important to note that more described pain cues may be indicative of inflated pain judgments due to the behavioural overlap of pain behaviours and delirium symptoms. As stated previously, future research is needed to examine how HCWs distinguish pain from delirium.

The present study included various measures of clinical experience that are commonly found in the existing literature, such as years of experience^{10,156,158,159}, specialty^{163–165}, and discipline^{59,166–171}. However, there are other measures of clinical experience, such as workload and team collaboration, that may also be associated with pain judgments.

Previous literature has described an association between HCW workload and its impact on pain assessment and management^{253–257}. Othman and colleagues²⁵⁴ had oncology nurses complete a questionnaire about nurses' knowledge and behaviours regarding cancer pain management, as well as barriers to effective cancer pain control. They found that over 75% of nurses consider inadequate staffing as a barrier to effective pain management in patients with cancer. Insufficient staffing leads to an increased workload, which may lead to improper pain assessment and documentation, and a failure to administer pain medication in a timely manner^{255,256}. Onsongo²⁵⁶ observed and interviewed nurses from a hospital oncology unit in

order to explore barriers related to cancer pain management. It was found that the nurses were overwhelmed with various tasks, some of which were not related to patient care²⁵⁶.

Consequently, this heavy workload resulted in nurses often delaying or missing the administration of pain medication²⁵⁶. Similar results have been observed in a geriatric setting, where nurses' pain management practices in post-operative older adults were negatively impacted by heavy workloads²⁵⁷. Taken together, these results suggest that workload may be associated with pain assessment in older adults with advanced cancer and delirium. As the nursing workload required by patients with advanced cancer is high²⁵⁸, it is possible that this may negatively impact the assessment and management of pain in this patient population. Future research should include this measure of clinical experience when examining the factors associated with pain judgments about these patients.

Although limited, there is some evidence to suggest that the level of collaboration between nurses and physicians is related to pain management²⁵⁷. Youngcharoen and colleagues²⁵⁷ examined HCW factors associated with nurses' pain assessment and management practices in older patients undergoing surgery. They found that higher collaboration between nurses and physicians is associated with better pain assessment and management practices in this patient population²⁵⁷. Although this study²⁵⁷ did not examine this relationship in a palliative care setting, the results may be generalized. Collaborative practice is important in palliative care²⁵⁹; high collaboration between nurses and physicians can improve teamwork in clinical decision-making, and create the most appropriate care plans for patients^{259,260}. The relationship between team collaboration and pain assessment in older adults with advanced cancer and delirium is a topic for future research to examine.

There is some evidence to suggest that an individual's personal experience of pain may influence how they judge pain in others^{139,160,261–264}. Prkachin and colleagues¹⁶⁰ examined the relationship between different kinds of exposure to pain and observers' pain judgments. Undergraduate students with and without a history of living with an individual with chronic pain viewed videotapes of shoulder pain patients participating in physiotherapy assessments¹⁶⁰. They were then asked to rate the pain experienced by the patients¹⁶⁰. They found that observers who had lived with an individual with chronic pain were more likely than those who had not to give higher pain ratings¹⁶⁰. Further, Ruben and Hall¹³⁹ had undergraduate students view video clips of individuals undergoing an experimentally-induced pain procedure and asked them to rate the pain observed in the clips. They were also asked to complete questionnaires regarding their experiences with acute and chronic pain¹³⁹. The ratings were then compared to ratings made by the observed individuals¹³⁹. It was found that having a family history of pain, as well as past experiences of observing another person in pain, were significantly associated with more accurate pain judgments¹³⁹. Taken together, these results^{139,160} demonstrate that there is an association between having exposure to pain in a non-clinical setting and pain judgments.

Interesting results were found when examining the effect of an observer's personal painful experiences on pain recognition and judgments^{261,262,265}. Botvinick and colleagues²⁶⁵ conducted functional magnetic resonance imaging (fMRI) as participants viewed video clips showing facial expressions of pain. Participants also received painful and non-painful thermal stimulation²⁶⁵. It was found that viewing facial expressions of pain engaged the same areas of the brain that are engaged in the first-hand experience of pain²⁶⁵. These results suggest that personal pain may inform the recognition and judgment of others' pain²⁶⁵. Danziger and colleagues²⁶¹ further explored this by having patients with congenital insensitivity to pain (CIP; a

rare medical condition characterized by severely impaired pain perception from birth²⁶⁶) and healthy undergraduate students listen to verbal presentations of painful scenarios; view video clips of facial pain expressions; and view video clips of pain-inducing events without pain behaviours²⁶¹. They were then asked to rate the pain in each of the scenarios or video clips²⁶¹. Their emotional empathy was also measured²⁶¹. They found that the ratings for the verbally presented painful scenarios, as well as the facial pain expressions did not differ between the patients with CIP and the undergraduate students²⁶¹. However, the patients with CIP had significantly lower pain ratings than the undergraduate students for the pain-inducing events²⁶¹. These results suggest that personal experience of pain may not be necessary for recognizing painful experiences; however, it may be necessary for rating pain in patients where behavioural cues are absent or hard to decipher²⁶¹. Interestingly, it was also found that pain judgments inferred from facial pain expressions, and ratings of pain-inducing events, were strongly associated with empathy in patients with CIP²⁶¹. Danziger and colleagues²⁶² expanded on this through an fMRI study and found that patients with CIP showed an increased activity in the areas of the brain responsible for empathy when observing others' pain. These results suggest that people who do not have personal experiences with pain rely more heavily on empathy to infer others' pain²⁶².

Although these studies^{139,160,261,262,265} did not examine HCWs' pain judgments, the results suggest that a HCW's personal experience with pain may also contribute to their understanding and assessment of pain in their patients; to our knowledge, this relationship has not yet been examined among HCWs. This is another example of experiential learning²⁴⁰, where personal experiences inform HCWs' understanding of pain and pain assessments in their patients. In the present study, it is possible that personal experiences of pain may have informed

how many pain cues HCWs used to judge pain in older adults with advanced cancer and delirium. However, this association is speculative, and future research should consider this kind of exposure to pain when looking at relationships between HCW factors and their pain judgments in this vulnerable patient population.

Psychological Correlates

Pain catastrophizing was non-significantly associated with the number of reported pain cues used for patients with hyperactive delirium. Specifically, HCWs who scored higher on the PCS described more pain cues for this patient group than those who scored lower on the PCS. Pain catastrophizing has been previously associated with a heightened perception of pain in others^{183–185} and an increased reliance on pain behaviours as a basis for pain judgments¹⁸³. In the present study, the HCWs who scored higher on the PCS also reported using a greater number of pain cues as a basis for their pain judgments in patients with hyperactive delirium. Sullivan and colleagues¹⁸³ hypothesize that individuals who score lower on measures of pain catastrophizing are more likely to discount pain behaviours as an unreliable source of information to judge another person's pain. It is possible that the HCWs in the current study with higher PCS scores are not discounting pain cues when assessing pain in hyperactive patients. Although this is favourable in preventing pain underestimations, this may be problematic, due to the overlap of pain behaviours and delirium symptoms^{4,9}. These HCWs may not be able to distinguish pain from delirium, which can lead to mistreatment of either pain or delirium. As these results were non-significant, interpreting these results should be done with caution. The relationship between pain catastrophizing and deciphering between pain and delirium symptoms is a topic for future research to examine.

Empathy was also thought to potentially influence HCWs' pain judgments; interestingly, this variable was not retained in any of the final models. Similar to pain catastrophizing, empathy has also been previously associated with an increased perception of pain in others^{171,194,195}. There was a small range of empathy scores in this study (range = 20—35), which may have contributed to the lack of significance. A limited range of scores has statistical implications, such as a reduced correlation coefficient between variables^{147–151}. It is imperative that we do not overinterpret these findings, as this factor may still be an important influence of pain judgments about older adults with advanced cancer and delirium. Future research should focus on testing this variable in a larger sample size of HCWs where a wider range of scores may be represented.

When discussing the results of the present study, it is important to consider the impact of the analytic parameters employed for building the multivariable linear regression models. We adopted a conservative approach when selecting the cut-offs and significance levels used to identify candidate correlates and assess multicollinearity, as well as selecting the inclusion and exclusion criteria for the final models. These cut-offs, significance levels, and criteria were used to ensure that the most important variables were included and retained in the models²²³. They also ensured that variables that were highly correlated with one another were not entered into the models together²²⁴. The use of more liberal criteria for these parameters would have allowed for the inclusion of variables that are less important²⁶⁷ or redundant²¹⁵. This would have caused the coefficient estimates to become less precise, therefore weakening the overall models²¹⁵. The results would not have been an accurate representation of the relationships between HCW factors and their reports of pain judgments in older adults with advanced cancer and delirium, as HCW factors that are less important would have been included and retained in the final models²¹⁵. In

addition, having highly correlated HCW factors in the regression models would have led to difficulties in determining the individual effects of each HCW factor on the number of reported pain cues²⁶⁸. Therefore, the use of a more conservative analytic approach resulted in a more precise and stronger model where meaningful conclusions could be made about the results.

Although each HCW factor retained in the regression models is associated with pain judgments about older adults with advanced cancer and delirium, their relative importance should be considered. This can be determined by comparing the standardized regression coefficients of each HCW factor within each model; the variables with the highest standardized regression coefficient in each model are most important²¹⁵. Years of experience in geriatrics and specialty are the most important HCW factors associated with the number of reported pain cues for patients who are cognitively intact and those with hyperactive delirium, respectively.

Discipline is the most important HCW factor associated with the number of reported pain cues for patients with hypoactive delirium, as well as patients with delirium where the subtype was not specified. These results demonstrate that HCWs' pain judgments about this patient population are predominantly influenced by their clinical experience; there are significant differences in pain assessment strategies among HCWs with varying years of experience working in geriatrics, as well as between nurses and physicians, and different specialties.

Consequently, these differences can lead to variations and inconsistencies in pain treatment and management in this vulnerable population. Educational interventions, which have previously shown to increase pain literacy among HCWs⁵⁷, may help minimize these inconsistencies and variations in patient care. For example, all HCWs who assess, treat, and manage pain in older adults with advanced cancer and delirium could attend mandatory, periodic educational sessions that include a standardized approach to pain assessment for this vulnerable population. This

would ensure that all HCWs, regardless of discipline, specialty, and years of experience working with this population, will receive the same educational training, which can greatly improve the quality of care these patients receive at the end of life.

Gender and Cultural Competence

Gender. Although the present study included many important HCW factors, it is possible that other factors, such as gender biases^{152,167,269}, also influence pain judgments and should be considered. Research examining the relationship between patient gender and pain assessments has shown that observers, regardless of their gender, underestimate pain in both men¹⁵² and women^{167,269}. Robinson and colleagues¹⁵² had undergraduate men and women view video clips of men and women undergoing an experimentally-induced pain procedure and asked them to rate the pain observed in the clips. They also assessed the participants' gender role expectations of pain¹⁵². The authors found that both men and women participants underestimated pain in both men and women¹⁵². However, they significantly underestimated pain in men more than women, as they believed men have greater pain endurance¹⁵². In contrast, Wandner and colleagues¹⁶⁷ found that HCWs rated low-back pain intensity higher in men than women when observing virtual human patient profiles. They also found that both male and female HCWs were more willing to administer opioids to men than women¹⁶⁷. The authors hypothesize that this may be due to the belief that men are less likely than women to report their pain, or display pain behaviours, unless they are experiencing high levels of pain.

HCWs' gender related beliefs about pain may be supported by evidence regarding gender differences in clinical pain^{270–274}. Cimas and colleagues²⁷³ analyzed gender differences in prevalence of chronic musculoskeletal in older adults across 14 European countries. They found

that pain prevalence was significantly higher in women than men²⁷³. When examining gender differences in pain severity among patients with cancer, Alodhayani and colleagues²⁷⁴ found that female patients reported more moderate to severe levels of pain than male patients. Taken together with the findings mentioned above, the beliefs that men have greater pain endurance than women, and that men are less likely than women to report their pain, can be supported by the evidence that pain is more prevalent and intense in women than men. However, as pain is subjective and a unique experience to an individual^{22,23}, it is important that HCWs be mindful of any biases they may hold regarding gender and the experience of pain; these biases may impact the quality of care they provide their patients.

It is also important to consider how patient gender may be interacting with HCW age/experience. Although limited, there is some evidence to suggest an interaction between observer age and observed gender when looking at judgments²⁷⁵. Siyanova-Chanturia and colleagues²⁷⁵ had children, undergraduate students, and older adults from various educational and professional backgrounds decide whether or not certain words could be associated with both masculine and feminine roles. They found that older adults are less likely than younger adults to suppress their gender-related biases they hold²⁷⁵. However, this study did not look at this relationship in HCWs and how it impacts their pain judgments, making it difficult to generalize these findings. Nonetheless, it can be speculated that gender-related beliefs regarding pain may be held more strongly by HCWs who are older/have more clinical experience, as they have been exposed to more patients than younger/less experienced HCWs. These HCWs may have observed these gender differences in clinical pain over a longer period and may make assumptions regarding pain among men and women. However, understanding the relationship between patient gender, and HCW age/experience requires further research.

Taken together, the results of these studies^{152,167} suggest that HCWs' pain judgments are also influenced by gender-related beliefs they may hold regarding pain. However, these beliefs may be supported by evidence suggesting gender differences in clinical pain^{270–274}. These beliefs may also be associated with HCW age/experience. Due to the nature of the present study, patient gender and HCW gender expectations regarding pain were not included. However, future research could examine this through a pain judgment study, where HCWs can assess pain in older adults with advanced cancer and delirium in a clinical setting. They can also complete a questionnaire that assesses their gender expectations regarding pain. This approach would allow for the collection of patient data, such as gender, as well as HCWs' age/experience, and gender-related beliefs. Through this, the relationship between gender expectations regarding pain and pain judgments in this patient population can be examined. This could also allow for the investigation of the relationship between patient gender and HCW age/experience.

Cultural Competence. Cultural competence is another HCW factor that should be considered as a potential influence of pain judgments²⁷⁶. Cultural competence in healthcare is the ability to effectively interact with people from different cultures, which can improve healthcare experiences and outcomes^{277,278}. Pain expression and report are largely influenced by cultural factors, such as the beliefs a particular culture holds about pain^{279,280}. For example, Chou and colleagues²⁸⁰ report that in Taiwanese culture, patients with cancer may not report or behaviourally express their pain or accept using analgesics as they believe that pain is a necessary part of life. HCWs who are not aware of these cultural beliefs surrounding pain might incorrectly interpret such behaviours as an indication that the patient is not experiencing pain, which could lead to inadequate pain management. In addition, other cultural factors, such as gender roles within different cultures, or the belief in fate, may also impact pain expression and

report in patients with cancer²⁸¹. Therefore, it is important that HCWs are culturally sensitive and culturally competent when providing care for their patients. Kuhlmann and colleagues²⁷⁶ examined the relationship between nurses' cultural sensitivity and pain attitudes. They found that cultural sensitivity was significantly associated with pain knowledge and attitudes, suggesting that nurses who are more culturally sensitive are more likely to assess, manage, and treat pain using a biopsychosocial approach²⁷⁶.

Although limited, there is some evidence to suggest that HCW cultural competence is associated with patient outcomes, particularly patient satisfaction, in a geriatric setting²⁸². Chen²⁸² examined the relationship between adult day care caregivers' cultural competence and older Chinese patients' satisfaction regarding their care. It was found that cultural competence among caregivers was positively associated with patient satisfaction²⁸². Although this study²⁸² provides insight into the relationship between cultural competence and patient satisfaction among older adults, it did not specifically look at this relationship in a palliative care setting, or included patients who are cognitively impaired. To our knowledge, this relationship has yet to be examined among those patient populations. The influence of cultural competence on patient care and outcomes should be considered in future studies examining palliative care and cognitively impaired populations, including those with advanced cancer and delirium; they may have unique outcomes, such as pain management, that may be impacted by it.

The consideration of cultural competence may impact the development of a standardized pain assessment tool, especially one for patients with cancer and delirium. Pain responses are largely influenced by culture and are generally either stoic or expressive; this may impact the pain behaviours that are expressed²⁸³. For example, patients who adopt a more stoic response to pain may elicit fewer pain behaviours than those who have a more expressive response to pain²⁸³.

As pain and delirium present similarly to one another^{4,9}, it is important that the pain assessment tool developed for this patient population is sensitive to cultural differences in pain expression.

It is also important to consider how cultural competence may interact with HCW age/experience. The literature presents mixed results regarding this relationship^{284–287}, with studies reporting positive^{284–286} and negative²⁸⁷ associations between cultural competence and HCWs' age/years of experience. Almutairi and colleagues²⁸⁴ found that older HCWs scored higher on a measure of cultural competence. They attribute this to an accumulation of professional experience caring for patients of diverse ethnicities and cultures²⁸⁴. In contrast, Schenk and colleagues²⁸⁷ found that a longer career duration was associated with lower scores on a measure of cultural competence among HCWs. They hypothesize that socialization among culturally diverse groups may be more common among younger/less experienced HCWs, which may allow them to be more culturally competent than older/more experienced HCWs²⁸⁷. These inconsistent findings may be due to methodological differences between studies, such as differences in subject populations and questionnaires measuring cultural competence, making it difficult to draw conclusions about the relationship between HCW cultural competence and age/experience. In addition, there are no existing studies looking at this relationship among HCWs caring for older adults with advanced cancer and delirium, or how this relationship impacts pain judgments in this vulnerable population. Future research clarifying this relationship is needed.

Understanding cultural competence and how it impacts patient outcomes is especially important for HCWs in Toronto, Ontario, where almost 56% of the population reports belonging to one or more of over 250 ethnic origins^{288,289}. As HCWs in Toronto interact with a wide range of cultures and ethnicities, it is crucial that the care they provide is culturally competent; this

may improve patient outcomes. Zghal and colleagues²⁹⁰ explored this relationship through a study conducted in Windsor, another culturally diverse city in Ontario²⁹¹. New immigrants completed surveys that included measures of patient-perceived HCW cultural competence, as well as health-related quality of life²⁹⁰. It was found that experiencing discrimination negatively impacted psychosocial determinants of health, but not physical health²⁹⁰. In addition, higher levels of trust in their provider was associated with better physical health²⁹⁰. These results suggest that patients report better outcomes when they perceive their HCWs to be culturally competent²⁹⁰. However, this study focused on patients' perceptions of HCW cultural competence, which may not be reflective of cultural competence measured in HCWs. Moreover, this study was not conducted in Toronto. To our knowledge, a study examining this relationship among Toronto HCWs and patients has not yet been conducted. Nonetheless, these results are an important first step in understanding the impact of HCW cultural competence on patient outcomes in a diverse city, such as Toronto, and future research is needed.

Taken together, the results of the current study support the biopsychosocial model of pain and aging⁸², and the need to consider the influence of HCW factors on pain judgments about older adults with advanced cancer and delirium. Many of the factors identified in this model⁸² (i.e.: HCW age, different measures of clinical experience, and pain catastrophizing score) were found to be important correlates of the number of described pain cues for most of the cognitive status and delirium subtype patient groups; each correlate was either demographical, professional, or psychological, which also supports this multidimensionality. However, when judging pain in patients with hypoactive and mixed delirium subtypes, other HCW factors not included in the model⁸², such as diagnostic uncertainty, inexperience with certain subtypes of delirium, as well as issues of gender and cultural competence may also be contributing to pain

judgments made by HCWs about these patient populations. It is important to include these factors in future studies to further refine the biopsychosocial model of pain and aging⁸² and deepen our understanding of HCW factors influencing pain judgments. Nonetheless, these results demonstrated that judging pain in older adults with advanced cancer and delirium is a biopsychosocial phenomenon and provide promising targets for future pain communication strategies and education on pain assessment for HCWs.

In addition, this study illustrated the variability in the correlates across patient cognitive status and delirium subtypes, with each model displaying its own unique correlates. These findings highlight the need to consider cognitive status and different delirium subtypes simultaneously to further our understanding of cancer pain and pain judgments across the delirium spectrum.

Limitations, Strengths, and Future Directions

The present study has several limitations that should be acknowledged. Firstly, this study analyzed data collected from semi-structured interviews. Therefore, this study relies on HCWs' reports of pain cues that they use for pain assessments, as opposed to pain judgments made during actual clinical care. As the pain-communication process involves both the individual experiencing pain and the individual to whom they are communicating this experience¹⁰, the pain cues stated in the interviews may not be an accurate reflection of pain assessment during clinical practice as the HCWs were not directly assessing patients. Research studies involving interviews are often prone to recall bias, where study participants may not accurately remember previous events or experiences due to long recall periods²⁹². As the HCWs in the current study were asked to recall which pain cues they use to judge pain in older adults with advanced cancer and

delirium, it is possible that they may not have accurately remembered their experiences. However, as these HCWs work in specialties where judging pain is common, it is likely that little time has passed between making pain judgments and the interview, thus minimizing recall bias. Also, as the biopsychosocial model of pain and aging⁸² suggests, patient factors (e.g.: age²⁹³, gender^{152,167,264,269,293}, and culture^{280,281}) may also influence HCWs' pain assessments. Patient factors were not included due to the nature of this study, but future research could include these factors to examine the interactions between HCW and patient factors and their relationship to HCW pain judgments in older adults with advanced cancer and delirium. In addition, response bias, such as demand characteristics, is common in research studies involving interviews^{292,294}, and may have been present in the current study. As the HCWs were aware of the study objectives and that their responses were to be used in research about pain, it is possible they may have tailored their responses to fit those purposes. However, it is likely that any response bias was minimal due to the way the questions were worded and asked. Although there might be a difference in what HCWs report doing in an interview and what they chart having done, the retrospective chart review study⁴ allows us to begin to triangulate our findings.

Secondly, although the sample size of the current study appears small, it is still comparable to other pain judgment studies including various observer and observed populations^{158,170,171,183}. Due to the small sample size, the number of variables included in the regression analyses was limited to ensure adequate power. Furthermore, the models looking at the number of described pain cues for hypoactive and mixed patient groups explained little variance in the scores. It is possible that other HCW factors not considered in the study (e.g., difficulty and experience in assessing pain in patients with specific subtypes of delirium) may be related to how many pain cues they use to judge pain in older adults with advanced cancer

experiencing these delirium subtypes. Nonetheless, this study was the first, to our knowledge, to examine these HCW factors in a multivariate way. Replication with a larger sample size and more potential HCW and patient variables is a possibility for future research.

To our knowledge, this was the first study to examine multiple HCW factors influencing how many pain cues they use for pain assessments in advanced cancer patients with delirium. We were able to identify unique factors that are associated with pain judgments between patients who are cognitively intact and patients with delirium, as well as among the different subtypes of delirium. As pain and delirium often occur together, future research examining how these HCW factors influence the deciphering of pain behaviours from symptoms of delirium is needed. These results support the biopsychosocial model of pain and aging⁸² and have contributed to our understanding pain assessment in older adults with advanced cancer and delirium.

The current study can inform the development of a future pain judgment study to replicate and extend its findings regarding the impact various HCW factors have on pain assessment in older patients with advanced cancer and delirium. For example, HCWs with experience in pain and anesthesia, palliative care, oncology, and other related specialties can use the Cancer Pain and Delirium Scale (CPDS)¹³ in a clinical setting while assessing pain in older adults with advanced cancer and delirium. This approach would reduce recall bias, as the HCWs would be filling out the CPDS at the same time as pain assessments. As this approach would not include an interview, where the data would be generated from participant self-report, response bias would be reduced, as well. This approach can also account for patient factors (e.g.: age, gender) as this study would allow for the collection of that data, as well. It may also generate a larger sample size, which can allow for the inclusion of more HCW variables, as well as a better

understanding of the relationships between HCWs factors and their pain judgments in this patient population.

Future pain judgment studies can also further validate the CPDS. For example, HCWs can complete the CPDS while viewing video clips of older patients with advanced cancer and delirium undergoing a standard and medically necessary painful procedure (e.g.: injections, repositioning in bed)^{110,295}. The use of video clips would ensure that wide ranges of pain cues, pain intensities, and delirium presentations are represented^{296–298}; these are not guaranteed in a clinical setting. The scores on the tool can then be examined for other aspects of validity and reliability. For example, sensitivity can be assessed by having HCWs complete the CPDS for patients during rest and during a painful procedure, and then comparing the scores for each event. Similar procedures have been used in the development and validation of pain scales for other patient populations^{109,299}. This study can also further examine the relationships between HCW factors, patient factors, and their pain judgments in this patient population. The results of these future studies can improve pain assessment and management in older adults with advanced cancer and delirium.

The findings of the present study can also inform the development of educational interventions targeted at HCWs that focus on the improvement of pain assessment in older adults with advanced cancer and delirium. HCWs have consistently exhibited knowledge gaps regarding pain in older people with and without cognitive impairments^{57,59,197–199,247}. However, previous research has shown that, following a brief educational intervention, HCWs demonstrated significant knowledge gains regarding pain in older adults⁵⁷. Based on the results of the current study, educational interventions could include strategies to differentiate pain from delirium, as well as a standardized approach to pain assessment and management in this

population. This standardized approach could include the use of the CPDS¹³. Our findings demonstrate the need for a pain assessment strategy that considers the unique issues found in patients with delirium at the end of life, thus challenging the current guidelines for pain assessment in this population⁸⁵. Consideration of differentiating between pain behaviours and delirium symptoms, as well as the use of a standardized pain assessment tool could extend the guidelines⁸⁵, as these are not currently included. In addition, it is important that both nurses and physicians receive the same educational training. A recent qualitative study found that nurses and physicians differed in their beliefs about pain management in older patients with advanced cancer and delirium⁵⁹, which the author hypothesizes may be due to differences in education. In the present study, nurses and physicians differed on the number of reported pain cues used to assess pain in these patient groups, which may be due to differences in pain assessment strategies. Having an educational intervention aimed at both nurses and physicians that includes a standardized approach to pain assessment in this vulnerable population can greatly improve the quality of care these patients receive at the end of life.

CONCLUSION

In conclusion, the findings of the present study support the biopsychosocial model of pain and aging⁸² and the need to consider HCW factors as influences of their pain judgments in older adults with advanced cancer and delirium. HCW CPDS scores for older advanced cancer patients who are cognitively intact, have delirium, as well as hypoactive and hyperactive subtypes were correlated with various HCW factors. While some variables made an appearance in multiple models, each model was unique, suggesting the variability in influential HCW factors based on patient cognitive status and delirium subtype. Our study extends previous findings by

filling in some of the gaps with regards to pain assessment in this vulnerable population. Future research can confirm the role of these HCW factors, as well as extend to other HCW factors, in the assessment of pain in older advanced cancer patients with delirium.

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APPENDIX A: QUESTIONNAIRES

Demographic and Professional Data Collection Sheet

Delirium Study

(ST1- DECS-HCW)

Time: _____

HCW #: _____

Date: ____/____/____

HCW Initials: _____

Please provide the following demographic and professional information.

1. Age: _____

2. Gender: _____

3. Discipline: Physician / RN

4. Specialty: _____

5. Sub-Specialty: _____

6. Institution of Study: _____

7. Number of years in practice / Year of Graduation: _____/_____

8. Number of years working in your Specialty: _____

9. Years of experience in pain assessment: _____

10. Years of experience in Palliative care / Oncology: _____

11. Years of experience working with geriatrics: _____

12. Years of experience working with cognitively impaired patients: _____

13. Number of advanced cancer patients you care for per month: _____

14. Percentage of patient in your care: Older (≥ 65 years) _____% Younger _____%

15. Specialized Training in Pain management: _____

16. Date training received: _____

HCW Interview Sample Questions

Knowledge/Attitudes

1. Tell me about your experiences working with older cancer patients.
2. What is your impression of the pain experienced by older cancer patients?
3. Describe your usual approach to pain assessment for older people.
 - a. How does this differ from your approach with younger people?
4. How does the experience of cancer pain change with age?
5. How should pain management protocols be tailored to patients of different ages?
6. Tell me about your experiences working with older cancer patients who are cognitively impaired?
7. What is your impression of the pain experienced by older cancer patients during delirium?
8. How does pain differ in older cancer patients with hyperactive, hypoactive, or mixed delirium?
9. What is your impression of the relationship between opioids, pain, and delirium in older cancer patients? (Probe any concerns expressed about opioid use.)
10. How should cancer pain be managed in older patients with delirium?
11. What barriers/obstacles/challenges have you encountered when assessing or managing pain in older cancer patients with delirium? (Probe for patient, family, HCPs, and system-based barriers).

Generation of Pain Cues

1. How do you recognize pain (behavioral and clinical cues) in patients with each subtype of delirium?
 - a. Which of these cues are the most important?
 - b. Which of these cues are the most common?
2. Are there different cues for mild, moderate, and severe pain?
 - a. How can you tell them apart?
3. How do you differentiate pain from other symptoms or sources of discomfort such as agitation? (Probe any symptoms or sources of discomfort mentioned.)
4. How confident do you feel about your ability to detect pain in older people with hyperactive/hypoactive/mixed delirium (0-10 NRS)
5. How can you tell if older patients with delirium (hyperactive/hypoactive/mixed) have adequate pain control?

HCPs = health care professionals; NRS = Numerical Rating Scale.

Pain Catastrophizing Scale

Delirium Study

(ST2P2-PCS-HCW)

Time: _____
Date: ____/____/____

Study ID#: _____

Pain Catastrophizing Scale

Below is a list of thirteen statements which describe different thoughts and feelings associated with pain. By using the scale below, please tell me which degree best describes your thoughts and feelings when you are experiencing pain.

RATING	0	1	2	3	4
MEANING	Not at all	To a slight degree	To a moderate degree	To a great degree	All the time

When I'm in pain ...

Number	Statement	Rating
1	I worry all the time about whether the pain will end.	
2	I feel I can't go on.	
3	It's terrible and I think it's never going to get any better	
4	It's awful and I feel that it overwhelms me.	
5	I feel I can't stand it anymore	
6	I become afraid that the pain will get worse.	
7	I keep thinking of other painful events	
8	I anxiously want the pain to go away	
9	I can't seem to keep it out of my mind	
10	I keep thinking about how much it hurts.	
11	I keep thinking about how badly I want the pain to stop	
12	There's nothing I can do to reduce the intensity of the pain	
13	I wonder whether something serious may happen.	

Researcher's Initials: _____

Page 1 of 1

Version Date: 14-Oct-2011

Davis Empathic Concern Scale

Delirium Study

(ST1-DECS-HCW)

Time: _____
Date: ____/____/____

HCW #: _____
HCW Initials: _____

Davis Empathic Concern Scale

Below is a list of 7 statements which ask you what thoughts and feelings you have in various situations. By using the scale below, please choose the appropriate number which best describes you. Read each item carefully and answer as honestly as you can.

Answer Scale	1	2	3	4	5
MEANING	Does not describe me well	Describes me slightly	Describes me to a moderate degree	Describes me to a greater degree	Describes me very well

Number	Statement	Rating
1	I often have tender, concerned feelings for people less fortunate than me	
2	Sometimes I don't feel very sorry for other people when they are having problems	
3	When I see someone being taken advantage of, I feel kind of protective towards them	
4	Other people's misfortunes do not usually disturb me a great deal	
5	When I see someone being treated unfairly, I sometimes don't feel very much pity for them	
6	I am often quite touched by things that I see happen	
7	I would describe myself as a pretty soft-hearted person	

Researcher's Initials: _____

Page 1 of 1

Version Date: 14-Oct-2011

Cancer Pain and Delirium Scale

Time: _____
Date: _____

Study ID #: _____
Video #: _____

The Cancer Pain and Delirium Scale

	Seen Spontaneously	Evoked during activity/procedure	Intensity Of Behaviour			Duration			Due to Pain or Delirium				
			Mild	Moderate	Severe	Brief	Periodic	Constant	Pain	Delirium	Both	Neither	Uncertain
Vocalizations													
Self Report of Pain	☐	☐	1	2	3	1	2	3	1	2	3	4	5
Asking For Help	☐	☐	1	2	3	1	2	3	1	2	3	4	5
Moaning or groaning	☐	☐	1	2	3	1	2	3	1	2	3	4	5
Yell/scream/shout/call out	☐	☐	1	2	3	1	2	3	1	2	3	4	5
Crying	☐	☐	1	2	3	1	2	3	1	2	3	4	5
Facial Expression													
Grimace	☐	☐	1	2	3	1	2	3	1	2	3	4	5
Furrowed brow	☐	☐	1	2	3	1	2	3	1	2	3	4	5
Body													
Guarding	☐	☐	1	2	3	1	2	3	1	2	3	4	5
Favouring a body part	☐	☐	1	2	3	1	2	3	1	2	3	4	5
Holding a body part	☐	☐	1	2	3	1	2	3	1	2	3	4	5
Tense/Rigid/Stiff	☐	☐	1	2	3	1	2	3	1	2	3	4	5
Unusual posture in bed	☐	☐	1	2	3	1	2	3	1	2	3	4	5
Difficulty in moving/Restricted range of motion	☐	☐	1	2	3	1	2	3	1	2	3	4	5
Gripping/Clenching fists	☐	☐	1	2	3	1	2	3	1	2	3	4	5
General Behaviour													
Aggression Example: Abusive behavior, lashing out, hitting people	☐	☐	1	2	3	1	2	3	1	2	3	4	5
Agitation Example: Trying to leave, pulling at medical equipment	☐	☐	1	2	3	1	2	3	1	2	3	4	5
Restlessness Example: Always changing positions, rolling in bed	☐	☐	1	2	3	1	2	3	1	2	3	4	5
Withdrawal Example: Wants to be left alone, does not want to engage in activity	☐	☐	1	2	3	1	2	3	1	2	3	4	5
Not interested in interaction Example: Resistant to interactions, responds to interactions negatively	☐	☐	1	2	3	1	2	3	1	2	3	4	5
Other													
Change in Respiration Example: Rapid/increase, shallow/deep/heavy	☐	☐	1	2	3	1	2	3	1	2	3	4	5
Comment													
Note any thing else that you observed that you attribute to pain in this patient.													

Version Date: 10-March-2016

Pain in Older Cancer Patients with Delirium: Development of an Observational Measure
Dr. Lucia Gagliese

APPENDIX B: MODEL ASSUMPTION TESTING

INT

The INT model met the assumptions for linearity, normality, and homoscedasticity using visual inspections of partial regression plots, a histogram, and a residuals scatterplot, respectively. All standardized residuals were below the cut-off 3.3, indicating no outliers. The average Variance Inflation Factor (VIF) value for this model was 1.490, indicating no multicollinearity. The Durbin-Watson statistic was 1.588, suggesting no autocorrelation.

DEL

Visual inspections for linearity, normality, and homoscedasticity indicated that the DEL model met those assumptions. There were no outliers in this model, as all standardized residuals were below the cut-off of 3.3. The average VIF value was 1.010, suggesting no multicollinearity. The Durbin-Watson statistic was 2.154, indicating no autocorrelation.

HYPO

The HYPO model met the assumptions for linearity, normality, and homoscedasticity using visual inspections. All standardized residuals were below 3.3, indicating no outliers. There was no multicollinearity in this model, as the average VIF value was 1.001. There was no autocorrelation, as the Durbin-Watson statistic was 2.273.

HYPER

Linearity, normality, and homoscedasticity assumptions were all met for the HYPER model; visual inspections were used to determine this. No outliers were found in this model, as all standardized residuals were below 3.3. The average VIF value was 1.096, indicating no multicollinearity. The Durbin-Watson statistic was 1.605, suggesting no autocorrelation.

MIX

No assumption testing was done on the MIX model, as no variables were retained.