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Age Differences in Pain Characteristics and Its Impact on Patients  
Receiving Chemotherapy

by

Colette Jappy

THESIS

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# Age Differences in Pain Characteristics and Its Impact on Patients Receiving Chemotherapy

Colette Jappy

## ABSTRACT

Because older age is associated with increased cancer risk, and the population is aging at an exponential rate, the number of older oncology patients is increasing. Pain is one of the most common symptoms associated with cancer and its treatment. However, little information is available on age differences in the occurrence and characteristics of pain in oncology patients. The purposes of this study, in a sample of oncology outpatients receiving CTX ( $n = 671$ ) and who were experiencing cancer pain ( $n = 248$ ), noncancer pain ( $n = 144$ ), or both cancer and noncancer pain ( $n = 279$ ), were to evaluate for differences in demographic, clinical, and pain characteristics between younger (i.e.,  $<65$  years) and older ( $\geq 65$  years) patients. Among the three pain groups, significant differences in occurrence rates were found between the younger and older groups ( $p < .0001$ ). Post hoc contrasts demonstrated the following between group age-related differences: only cancer pain (41.6% versus 23.2%;  $p < .0001$ ), only noncancer pain (15.7% versus 38.7%;  $p < .0001$ ), and both cancer and noncancer pain (42.7% versus 38.1%;  $p = 0.320$ ;  $<65$  years versus  $\geq 65$  years, respectively). However, when age differences in pain characteristics were compared for each pain type, no major differences were identified. Findings from this study suggest that all oncology outpatients warrant comprehensive assessments of cancer and noncancer pain. In addition, the under treatment of pain remains a significant clinical problem. Regardless of the patient's age, clinicians need to tailor their pain treatments based on the type of pain.

Key words: age; pain; cancer; chemotherapy; age differences; pain characteristics; pain prevalence

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## INTRODUCTION

Because older age is associated with increased cancer risk,<sup>1,2</sup> and the United States population is aging at an exponential rate,<sup>3</sup> clinicians will be caring for an increasing number of older oncology patients. Pain is one of the most common symptoms associated with cancer and its treatment. Despite numerous efforts both nationally<sup>4</sup> and internationally<sup>5</sup> cancer pain remains a significant public health problem.<sup>6-8</sup>

In fact, in one systematic review<sup>6</sup> and one prospective evaluation,<sup>9</sup> prevalence rates for pain in oncology patients ranged from 33% to 67% depending on the stage of the patients' disease. However, neither of these papers described the occurrence rates for cancer and/or noncancer-related pain in patients undergoing active treatment. An equally important consideration in any evaluation of pain in oncology patients, particularly in older adults, is an evaluation of the co-occurrence of one or more chronic painful conditions (e.g., low back pain, osteoarthritis). In a recent study of 926 patients, we identified that 27.5% of oncology patients receiving chemotherapy (CTX) reported no pain, while 26.8% had only cancer pain, 15.6% had only noncancer pain, and 30.1% had both cancer and noncancer pain.<sup>10</sup>

In order to be able to provide optimal pain management to older adults with cancer, it is important to determine if their pain experiences differ from those of younger oncology patients. Only six studies were found that evaluated for age differences in pain in oncology patients.<sup>9,11-15</sup> In the first study, that used the Memorial Symptom Assessment Scale (MSAS) to evaluate pain,<sup>11</sup> while older patients had lower occurrence rates, no age differences were found in ratings of pain severity or frequency. However, older patients reported significantly less distress from their pain. In another study, that evaluated only lung cancer patients prior to surgery using the MSAS,<sup>14</sup> while no age-related differences in pain occurrence rates were found, older adults ranked their pain as more severe but less distressing than younger patients. In two studies that evaluated patients with advanced disease,<sup>12,13</sup> findings were inconsistent. In the first study,<sup>13</sup> no age-related differences were found over time, in the severity of persistent or breakthrough pain



or in the number of pain locations. In the second study,<sup>12</sup> older patients reported lower worst pain intensity scores than younger patients. In the most recent study that evaluated the psychometric properties of the Short-Form McGill Pain Questionnaire-2,<sup>15</sup> no age-related differences were found in the instrument's internal consistency, reliability, and convergent validity.

Neither of the pain prevalence studies,<sup>6,9</sup> nor the studies of age-related differences in pain in oncology patients,<sup>9,11-15</sup> provided any information on occurrence rates for cancer and noncancer pain. In addition, none of the studies cited above provided detailed information on age differences in a number of pain characteristics (i.e., severity, duration, qualities, locations, interference with function, pain relief, satisfaction with pain treatment). Therefore, the purposes of this study, in a sample of oncology outpatients receiving CTX (n = 671) and who were experiencing cancer pain (n = 248), noncancer pain (n = 144), or both cancer and noncancer pain (n = 279), were to evaluate for differences in demographic, clinical, and pain characteristics between younger (i.e., <65 years) and older ( $\geq$ 65 years) patients.

## **PATIENTS AND METHODS**

### **Patients and Settings**

This study is part of an ongoing, longitudinal study of the symptom experience of oncology outpatients receiving CTX. Eligible patients were  $\geq 18$  years of age; had a diagnosis of breast, gastrointestinal (GI), gynecological (GYN), or lung cancer; had received CTX within the preceding four weeks; were scheduled to receive at least two additional cycles of CTX; were able to read, write, and understand English; and gave written informed consent. Patients were recruited from two Comprehensive Cancer Centers, one Veteran's Affairs hospital, and four community-based oncology programs. A total of 1528 patients were approached and 926 consented to participate (60.6% response rate). The major reason for refusal was being overwhelmed with their cancer treatment.

### **Instruments**

A demographic questionnaire obtained information on age, gender, ethnicity, marital status, living arrangements, education, employment status, and income. Alcohol use was evaluated using the Alcohol Use Disorders Identification Test (AUDIT).<sup>16</sup>

The Karnofsky Performance Status (KPS) scale is widely used to evaluate functional status in patients with cancer and has well established validity and reliability.<sup>17</sup> Patients rated their functional status using the KPS scale that ranged from 30 (I feel severely disabled and need to be hospitalized) to 100 (I feel normal; I have no complaints or symptoms).<sup>17,18</sup>

The Self-Administered Comorbidity Questionnaire (SCQ) is a short and easily understood instrument that was developed to measure comorbidity in clinical and health service research settings.<sup>19</sup> The questionnaire consists of 13 common medical conditions that were simplified into language that could be understood without any prior medical knowledge. Patients were asked to indicate if they had the condition; if they received treatment for it; and did it limit their activities. For each condition, a patient can receive a maximum of 3 points. The total score

for the SCQ can range from 0 to 39. The SCQ has well-established validity and reliability and has been used in studies of patients with a variety of chronic conditions.<sup>20,21</sup>

Occurrence and characteristics of pain were evaluated using the Brief Pain Inventory.<sup>22</sup> Patients who responded yes to the question about having pain were asked to indicate if their pain was or was not related to their cancer treatment. Patients were categorized into one of four groups (i.e., no pain, only noncancer pain, only cancer pain, both cancer and noncancer pain). Patients rated the intensity of the pain (i.e., now, average, worst) using 0 (none) to 10 (excruciating) numeric rating scales (NRS). In addition, they provided information on the length of time they were in pain; how often their pain occurred; locations of their pain; quality of the pain; pain's level of interference with function; and their level of pain relief and satisfaction with pain treatment.

### **Study Procedures**

The study was approved by the Committee on Human Research at the University of California, San Francisco and by the Institutional Review Board at each of the study sites. Eligible patients were approached by a research staff member in the infusion unit to discuss participation in the study. Written informed consent was obtained from all patients. Patients completed questionnaires in their homes, a total of six times over two cycles of CTX (i.e., prior to CTX administration (i.e., recovery from previous CTX cycle), approximately 1 week after CTX administration (i.e., acute symptoms), approximately 2 weeks after CTX administration (i.e., potential nadir)). For this analysis, pain data from the enrollment assessment, that asked patients to report on their pain experience for the week prior to the administration of the next cycle of CTX, were analyzed. Medical records were reviewed for disease and treatment information.

### **Data Analysis**

Data were analyzed using SPSS version 22 (IBM, Armonk, NY). Descriptive statistics and frequency distributions were calculated for demographic and clinical characteristics.

For each type of pain (i.e., only cancer pain, only noncancer pain, and both cancer and noncancer pain), differences in demographic, clinical, and pain characteristics were evaluated using independent sample t-tests, Chi square analyses, or Kruskal-Wallis tests with Bonferroni corrected post hoc contrasts. A  $p$ -value of  $<.05$  was considered statistically significant. All calculations used actual values. Adjustments were not made for missing data. Therefore, the cohort for each of these analyses was dependent on the largest set of complete data between groups.

## RESULTS

### *Differences in Occurrence Rates of Pain*

Of the 925 patients who reported their age, 73.2% were <65 years of age and 26.8% were  $\geq 65$  years of age. As shown in Figure 1A, age-related differences in occurrence rates for pain were found across the four pain groups ( $\chi^2 = 45.15$ ,  $p < .0001$ ). Post hoc contrasts demonstrated the following between group age-related differences: no pain (25.7% versus 32.3%;  $p = 0.056$ ); only cancer pain (30.9% versus 15.7%;  $p < .0001$ ), only noncancer pain (11.7% versus 26.2%;  $p < .0001$ ), and both cancer and noncancer pain (31.8% versus 25.8%;  $p = 0.089$ ; <65 years versus  $\geq 65$  years respectively).

As shown in Figure 1B, when only the three pain groups were compared, significant differences in occurrence rates were found between the younger and older groups ( $\chi^2 = 43.11$ ,  $p < .0001$ ). Post hoc contrasts demonstrated the following between group age-related differences: only cancer pain (41.6% versus 23.2%;  $p < .0001$ ), only noncancer pain (15.7% versus 38.7%;  $p < .0001$ ), and both cancer and noncancer pain (42.7% versus 38.1%;  $p = 0.320$ ; <65 years versus  $\geq 65$  years, respectively).

### CANCER PAIN FINDINGS

#### *Differences in Demographic and Clinical Characteristics between Younger and Older Patients with Only Cancer Pain*

Of the 248 patients with only cancer pain, 15.7% were  $\geq 65$  years of age. As shown in Table 1, compared to younger patients, older patients with only cancer pain had more years of education; were less likely to be married or partnered or to report having child care responsibilities; and were more likely to live alone. Older patients had a higher number of comorbidities, higher SCQ scores, and a longer time since their cancer diagnosis. A higher percentage of the older patients reported high blood pressure, lung disease, diabetes, and osteoarthritis, as well as lower rates of breast cancer and higher rates of GYN cancer. They

were more likely to have received prior cancer treatment involving surgery and CTX, or surgery and RT, or CTX and RT.

*Differences in Pain Characteristics between the Younger and Older Patients with Only Cancer Pain*

As shown in Table 2, for the majority of the cancer pain characteristics, no differences were found between the younger and older patients. In terms of pain locations, older patients reported a lower number of pain locations, and a lower percentage reported pain in their shoulders and thighs. In terms of pain interference, older patients reported lower sleep interference scores. In terms of pain qualities, a lower percentage of older patients reported aching and throbbing.

NONCANCER PAIN FINDINGS

*Differences in Demographic and Clinical Characteristics between Younger and Older Patients with Only Noncancer Pain*

Of the 144 patients with noncancer pain, 45.1% were  $\geq 65$  years. As shown in Table 3, older patients had a higher number of comorbidities, higher SCQ scores, were less likely to be employed, and were more likely to have an income below \$30,000 or between \$30,000 to <\$70,000. These older patients experienced more heart disease, high blood pressure, lung disease, and osteoarthritis. Older patients were more likely to be a current smoker or have a history of smoking, and to have a diagnosis of lung cancer.

*Differences in Pain Characteristics between the Younger and Older Patients with Only Noncancer Pain*

As shown in Table 4, for the majority of noncancer pain characteristics, no differences were found between younger and older patients. In terms of pain interference, older patients reported less interference with sexual activity.

## BOTH CANCER AND NONCANCER PAIN FINDINGS

### *Differences in Demographic and Clinical Characteristics between Younger and Older Patients with Both Cancer and Noncancer Pain*

Of the 279 patients with both cancer and noncancer pain, 22.9% were  $\geq 65$  years. As shown in Table 5, older patients had a higher number of comorbidities and higher SCQ scores. In addition, a higher percentage of older adults reported heart disease, high blood pressure, lung disease, diabetes, and osteoarthritis. Older patients had higher rates of lung cancer and lower rates of breast cancer. A lower percentage of older patients reported child care responsibilities.

### *Differences in Pain Characteristics between the Younger and Older Patients with Both Cancer and Noncancer Pain*

As shown in Table 6, no differences were found in the majority of the pain characteristics between younger and older patients in this pain group. Older patients reported a lower number of pain locations. Older patients experienced less numbness and lower occurrence rates for pain in their head, shoulders, and lower arms.

## DISCUSSION

This study is the first to describe age-related differences in occurrence rates for three types of pain in a large sample of oncology patients receiving CTX. In addition, within each type of pain, age differences in a number of salient pain characteristics were evaluated. In terms of the overall occurrence of pain in the total sample, over 70% reported pain. This percentage is similar to previous reports,<sup>9,11</sup> but higher than found in a systematic review.<sup>6</sup> Reasons for the higher occurrence rates may relate to the fact that our sample was receiving active treatment in the form of CTX, our sample consisted of patients with breast, lung, GI and GYN cancers, our sample had a higher percentage of women, and older patients represented approximately 25% of the sample that experienced pain.

In terms of age differences in the occurrence rates for only cancer, only noncancer, and both cancer and noncancer pain, older oncology patients reported higher occurrence rates only for noncancer pain. This finding contrasts those from a study of patients with advanced cancer that found no age differences in occurrence rates for noncancer pain.<sup>15</sup> One potential explanation for this age-related difference in occurrence rates for only noncancer pain is the higher level of comorbidity in the older age group. Specifically older patients with noncancer pain reported higher rates of heart disease, lung disease, and osteoarthritis that are common medical conditions associated with pain. However, this explanation only partially explains these age differences because in the other two pain groups, the comorbidity profiles of the patients were similar. Additional research is warranted to determine the specific causes of noncancer pain in both younger and older oncology patients.

Across the three types of pain, for the majority of the pain characteristics, no age-related differences were found. This finding is consistent with the limited number of previous reports.<sup>9, 11,13,15</sup> Our results suggest that regardless of etiology, older patients experience pain with the same severity and level of interference as younger patients. Regardless of age or pain type, between 40% and 75% of patients in this current study experienced persistent pain (i.e., pain  $\geq$



three month duration). In addition all of these patients reported worst pain scores in the moderate range.<sup>23,24</sup> Finally, all of these patients reported that pain that interfered with function lasted approximately six hours per day and that the amount of pain relief they experiences was approximately 60%. Taken together, these findings suggest that regardless of age, oncology patients undergoing active treatment continue to experience moderate to severe pain that interferes with their ability to function.

This study provided an opportunity to evaluate, regardless of pain type, those demographic and clinical characteristics that differentiated between the older and younger patients. While not a surprising finding, older patients reported a significantly higher number of comorbidities and higher comorbidity scores. In terms of specific comorbidities, the ones that occurred at higher rates in the older patients were: heart disease, hypertension, lung disease, diabetes mellitus, and osteoarthritis. While previous studies cited that a higher level of comorbidity is associated with decreases in functional status,<sup>25,26</sup> no age-related differences were found in KPS scores. These findings suggest that older adults warrant a more comprehensive geriatric assessment to evaluate the impact of cancer, comorbidities, and pain on their ability to perform various activities of daily living.<sup>27-29</sup>

Several limitations warrant consideration. While the sample size was large, our results are generalizable to only an outpatient oncology population who was receiving CTX. Our sample included more women than men and the majority of patients had breast cancer. Therefore, while our results are consistent with the literature, gender and cancer type may have influenced our findings. Future studies need to evaluate for gender differences in pain in oncology patients. In addition, for each type of pain, our sample of older patients was smaller than the younger patients, particularly in the subset of patients with only cancer pain. While it is possible that fewer older patients had only cancer pain, future studies need to enroll equal numbers of older and younger patients to confirm our findings.

Despite these limitations, this study found that older oncology patients receiving CTX had a higher occurrence rate of noncancer pain. In addition, regardless of pain type, no age-related differences in pain characteristics were identified. These findings suggest that all oncology outpatients warrant comprehensive assessments of cancer and noncancer pain. In addition, findings from this study demonstrate the under treatment of pain and that clinicians need to tailor their pain treatments based on the type of pain. Future studies need to identify the specific causes of both cancer and noncancer pain, the impact of specific comorbidities on patients' pain experiences, and more detailed assessments of the impact of various types of pain on patients' functional status and quality of life.

Table 1. Differences in Demographic and Clinical Characteristics Between Younger and Older Patients with Only Cancer Pain

Characteristic	<65 years (1) N = 209	≥65 years (2) N = 39	Statistics
	Mean (SD)	Mean (SD)	
Age (years)	51.81 (9.45)	70.47 (4.24)	t = -19.81; p < .0001
Education (years)	16.35 (2.86)	18.00 (2.83)	t = -3.31; p = .001
Body mass index (kg/m <sup>2</sup> )	26.16 (5.33)	25.20 (4.90)	t = 1.05; p = .296
Karnofsky Performance Status score	77.90 (11.18)	78.68 (12.12)	t = -.39; p = .696
Number of comorbidities	1.99 (1.15)	2.56 (1.41)	t = -2.40; p = .021
SCQ score	4.72 (2.40)	5.79 (3.07)	t = -2.08; p = .043
AUDIT score	3.04 (2.65)	3.37 (3.72)	t = -0.56; p = .574
Time since cancer diagnosis (years)	1.81 (2.94)	4.92 (7.33)	U, p=.010
Time since cancer diagnosis (median)	0.42	0.84	
Number of prior cancer treatments	1.70 (1.57)	2.05 (1.30)	t = -1.31; p = .193
Number of metastatic sites including lymph node involvement	1.23 (1.30)	1.44 (1.17)	t = -.90; p = .369
Number of metastatic sites excluding lymph node involvement	0.78 (1.10)	1.03 (1.06)	t = -1.27; p = .206
	% (N)	% (N)	
Gender			FE; p = .211
Female	78.9 (165)	69.2 (27)	
Male	21.1 (44)	30.8 (12)	
Transgender*	0.0 (0)	0.0 (0)	
Ethnicity			X <sup>2</sup> = 5.71; p = .127
White	67.0 (138)	82.1 (32)	
Black	9.2 (19)	5.1 (2)	
Asian or Pacific Islander	15.0 (31)	2.6 (1)	
Hispanic Mixed or Other	8.7 (18)	10.3 (4)	
Married or partnered (% yes)	74.4 (154)	56.4 (22)	FE; p = .032
Lives alone (% yes)	14.1 (29)	28.2 (11)	FE; p = .035
Child care responsibilities (% yes)	29.9 (61)	0.0 (0)	FE; p < .0001
Care of adult responsibilities (% yes)	5.2 (10)	5.6 (2)	FE; p = 1.000
Currently employed (% yes)	41.1 (85)	28.2 (11)	FE; p = .154
Income			KW; p = .148
< \$30,000	9.9 (19)	12.1 (4)	
\$30,000 to <\$70,000	18.8 (36)	30.3 (10)	
\$70,000 to < \$100,000	19.8 (38)	18.2 (6)	
≥ \$100,000	51.6 (99)	39.4 (13)	
Specific comorbidities (% yes)			
Heart disease	3.8 (8)	7.7 (3)	FE; p = .387
High blood pressure	22.0 (46)	43.6 (17)	FE; p = .008
Lung disease	7.7 (16)	20.5 (8)	FE; p = .033
Diabetes	5.7 (12)	15.4 (6)	FE; p = .045
Ulcer or stomach disease	2.4 (5)	0.0 (0)	FE; p = 1.000
Kidney disease	0.0 (0)	2.6 (1)	FE; p = .157
Liver disease	6.2 (13)	15.4 (6)	FE; p = .091
Anemia or blood disease	10.0 (21)	7.7 (3)	FE; p = 1.000
Depression	18.2 (38)	15.4 (6)	FE; p = .821
Osteoarthritis	3.3 (7)	15.4 (6)	FE; p = .008
Back pain	17.7 (37)	10.3 (4)	FE; p = .348

Rheumatoid arthritis	1.9 (4)	2.6 (1)	FE; p = .578
Exercise on a regular basis (% yes)	69.2 (144)	56.4 (22)	FE; p = .138
Smoking, current or history of (% yes)	28.8 (59)	45.9 (17)	FE; p = .053
Cancer diagnosis			$\chi^2 = 21.82$ ; p < .0001
Breast	46.9 (98)	15.4 (6)	1>2
Gastrointestinal	28.7 (60)	25.6 (10)	NS
Gynecological	17.2 (36)	46.2 (18)	2>1
Lung	7.2 (15)	12.8 (5)	NS
Reason for current treatment			
Curative	82.4 (168)	59.0 (23)	FE; p = .002
Palliative	17.6 (36)	41.0 (16)	
Type of prior cancer treatment			$\chi^2 = 14.07$ ; p = .003
No prior treatment	21.0 (43)	7.7 (3)	NS
Only surgery, CTX, or RT	47.8 (98)	41.0 (16)	NS
Surgery & CTX, or Surgery & RT, or CTX & RT	16.1 (33)	41.0 (16)	2>1
Surgery & CTX & RT	15.1 (31)	10.3 (4)	NS

Abbreviations: AUDIT = Alcohol Use Disorders Identification Test, CTX = chemotherapy, FE = Fisher's Exact, kg = kilograms, KW = Kruskal Wallis, m<sup>2</sup> = meter squared, NS = not significant, RT = radiation therapy, SCQ = Self-Administered Comorbidity Questionnaire, SD = standard deviation, U = Mann-Whitney U test

\*Chi Square analysis done without the transgender patient in the analysis

Table 2. Differences in Pain Characteristics Between Younger and Older Patients with Only Cancer Pain

Characteristic	<65 years N = 209	≥65 years N = 39	Statistics
	Mean (SD)	Mean (SD)	
Pain now	1.53 (1.93)	1.13 (1.52)	t = 1.13; p = .260
Average pain	2.73 (1.85)	2.30 (1.77)	t = 1.18; p = .238
Worst pain	5.61 (2.54)	5.11 (2.72)	t = 1.00; p = .319
Number of days per week that pain occurs	2.68 (2.38)	2.41 (2.16)	t = .61; p = .541
Hours per day the pain lasts	8.43 (8.28)	6.51 (6.85)	t = 1.45; p = .154
Number of pain locations (out of 45)	8.91 (8.56)	6.18 (4.74)	t = 2.66; p = .010
Amount of pain relief (0% to 100%)	69.57 (28.36)	62.61 (34.27)	t = 1.06; p = .291
Satisfaction with pain treatment	7.53 (2.62)	7.21 (2.06)	t = .61; p = .546
Pain interference			
General activity	2.73 (2.79)	2.06 (2.55)	t = 1.27; p = .205
Mood	2.92 (2.62)	2.25 (2.20)	t = 1.56; p = .127
Walking ability	2.55 (2.87)	2.53 (3.16)	t = .03; p = .976
Normal work	3.31 (3.11)	2.50 (2.92)	t = 1.35; p = .180
Relations with other people	1.95 (2.42)	2.03 (2.57)	t = -.19; p = .853
Sleep	3.25 (2.95)	2.31 (2.28)	t = 2.06; p = .045
Enjoyment of life	2.96 (2.81)	3.25 (3.28)	t = -.53; p = .597
Sexual activity	3.46 (3.89)	2.06 (3.80)	t = 1.87; p = .063
Mean interference score	2.88 (2.48)	2.36 (2.19)	t = 1.12; p = .263
	% (N)	% (N)	
Took pain medications in the last week (% yes)	60.7 (122)	52.9 (18)	FE; p = .451
Length of time with pain related to cancer or treatment:			
Less than one week	15.7 (32)	22.2 (8)	x <sup>2</sup> = 3.27; p = .774
One to two weeks	9.3 (19)	5.6 (2)	
About one month	13.7 (28)	8.3 (3)	
Two to three months	23.0 (47)	19.4 (7)	
Three to six months	14.7 (30)	22.2 (8)	
Seven months to one year	8.3 (17)	8.3 (3)	
Greater than 1 year	15.2 (31)	13.9 (5)	
How often pain occurs:			
Continuously	15.4 (29)	10.3 (3)	x <sup>2</sup> = 5.07; p = .534
Several times a day	31.4 (59)	31.0 (9)	
Once or twice a day	16.0 (30)	6.9 (2)	
Several times a week	20.2 (38)	27.6 (8)	
Less than 3 to 4 times per month	10.6 (20)	13.8 (4)	
Once or twice a month	5.9 (11)	6.9 (2)	
Less than once a month	0.5 (1)	3.4 (1)	
Pain Qualities			
Aching	80.2 (158)	62.5 (20)	FE; p = .037
Throbbing	34.5 (68)	15.6 (5)	FE; p = .040
Shooting	37.1 (73)	21.9 (7)	FE; p = .112
Stabbing	28.6 (56)	28.1 (9)	FE; p = 1.00
Gnawing	20.5 (40)	12.5 (4)	FE; p = .344
Sharp	43.1 (85)	50.0 (16)	FE; p = .565

Tender	45.2 (89)	37.5 (12)	FE; p = .449
Burning	21.9 (43)	31.2 (10)	FE; p = .262
Exhausting	36.7 (72)	25.8 (8)	FE; p = .312
Tiring	52.3 (103)	53.1 (17)	FE; p = 1.000
Penetrating	24.4 (48)	28.1 (9)	FE; p = .662
Nagging	41.8 (82)	38.7 (12)	FE; p = .845
Numb	29.1 (57)	34.4 (11)	FE; p = .538
Miserable	31.1 (61)	25.0 (8)	FE; p = .540
Unbearable	10.7 (21)	3.1 (1)	FE; p = .328
Pain Locations			
Head	24.5 (48)	21.2 (7)	FE; p = .827
Neck	11.2 (22)	9.1 (3)	FE; p = 1.000
Shoulders	42.9 (84)	21.2 (7)	FE; p = .021
Upper arms	16.3 (32)	6.1 (2)	FE; p = .184
Lower arms	14.3 (28)	3.0 (1)	FE; p = .090
Hands	26.5 (52)	21.2 (7)	FE; p = .668
Throat	8.2 (16)	0.0 (0)	FE; p = .137
Chest	32.1 (63)	30.3 (10)	FE; p = 1.000
Thorax	19.9 (39)	15.2 (5)	FE; p = .638
Abdomen	49.5 (97)	54.5 (18)	FE; p = .707
Genitalia	12.8 (25)	6.1 (2)	FE; p = .386
Lower back	33.7 (66)	24.2 (8)	FE; p = .321
Buttocks	24.5 (48)	18.2 (6)	FE; p = .512
Thighs	36.2 (71)	9.1 (3)	FE; p = .002
Calve	31.1 (61)	21.2 (7)	FE; p = .306
Feet	29.1 (57)	36.4 (12)	FE; p = .416

Abbreviations: FE = Fisher's Exact, SD = standard deviation

Table 3. Differences in Demographic and Clinical Characteristics Between Younger and Older Patients with Only Non-Cancer Pain

Characteristic	<65 years (1) N = 79	≥ 65 years (2) N = 65	Statistics
	Mean (SD)	Mean (SD)	
Age (years)	54.24 (8.75)	71.78 (5.81)	t = -14.38; p < .0001
Education (years)	16.25 (3.30)	16.11 (2.87)	t = 0.26; p = .795
Body mass index (kg/m <sup>2</sup> )	27.22 (6.65)	25.40 (6.08)	t = 1.68; p = .094
Karnofsky Performance Status score	81.43 (11.32)	85.19 (11.78)	t = -1.84; p = .068
Number of comorbidities	2.39 (1.33)	3.31 (1.51)	t = -3.86; p < .0001
SCQ score	5.30 (2.93)	6.88 (3.23)	t = -3.06; p = .003
AUDIT score	2.48 (2.25)	2.43 (1.30)	t = 0.12; p < .911
Time since cancer diagnosis (years)	2.05 (3.47)	3.19 (4.45)	U, p = .225
Time since cancer diagnosis (median)	0.60	0.89	
Number of prior cancer treatments	2.01 (1.63)	1.86 (1.62)	t = 0.55; p = .580
Number of metastatic sites including lymph node involvement	1.33 (1.35)	1.32 (1.11)	t = 0.03; p = .977
Number of metastatic sites excluding lymph node involvement	0.86 (1.16)	0.88 (.94)	t = -0.09; p = .928
	% (N)	% (N)	
Gender			FE; p = 1.000
Female	83.5 (66)	81.5 (53)	
Male	16.5 (13)	16.9 (11)	
Transgender*	0.0 (0)	1.5 (1)	
Ethnicity			x <sup>2</sup> = 0.59; p = .899
White	76.3 (58)	81.2 (52)	
Black	6.6 (5)	4.7 (3)	
Asian or Pacific Islander	10.5 (8)	9.4 (6)	
Hispanic Mixed or Other	6.6 (5)	4.7 (3)	
Married or partnered (% yes)	72.2 (57)	56.2 (36)	FE; p = .054
Lives alone (% yes)	15.2 (12)	28.1 (18)	FE; p = .066
Child care responsibilities (% yes)	15.8 (12)	6.2 (4)	FE; p = .109
Care of adult responsibilities (% yes)	11.6 (8)	5.1 (3)	FE; p = .222
Currently employed (% yes)	44.2 (34)	16.9 (11)	FE; p = .001
Income			KW; p = .001
< \$30,000	11.9 (8)	25.0 (14)	
\$30,000 to <\$70,000	19.4 (13)	35.7 (20)	
\$70,000 to < \$100,000	14.9 (10)	12.5 (7)	
≥ \$100,000	53.7 (36)	26.8 (15)	
Specific comorbidities (% yes)			
Heart disease	1.3 (1)	12.3 (8)	FE; p = .011
High blood pressure	29.1 (23)	49.2 (32)	FE; p = .016
Lung disease	7.6 (6)	30.8 (20)	FE; p < .0001
Diabetes	11.4 (9)	12.3 (8)	FE; p = 1.000
Ulcer or stomach disease	1.3 (1)	1.5 (1)	FE; p = 1.000
Kidney disease	1.3 (1)	1.5 (1)	FE; p = 1.000
Liver disease	5.1 (4)	4.6 (3)	FE; p = 1.000
Anemia or blood disease	12.7 (10)	6.2 (4)	FE; p = .261
Depression	20.3 (16)	18.5 (12)	FE; p = .835
Osteoarthritis	10.1 (8)	38.5 (25)	FE; p < .0001
Back pain	34.2 (27)	43.1 (28)	FE; p = .304

Rheumatoid arthritis	5.1 (4)	12.3 (8)	FE; p = .139
Exercise on a regular basis (% yes)	67.1 (53)	66.2 (43)	FE; p = 1.000
Smoking, current or history of (% yes)	25.6 (20)	47.6 (30)	FE; p = .008
Cancer diagnosis			$\chi^2 = 18.90; p < .0001$
Breast	48.1 (38)	30.8 (20)	NS
Gastrointestinal	34.2 (27)	18.5 (12)	NS
Gynecological	10.1 (8)	20.0 (13)	NS
Lung	7.6 (6)	30.8 (20)	2>1
Reason for current treatment			
Curative	73.1 (57)	72.3 (47)	
Palliative	26.9 (21)	27.7 (18)	FE; p = 1.000
Type of prior cancer treatment			
No prior treatment	18.4 (14)	23.1 (15)	
Only surgery, CTX, or RT	34.2 (26)	30.8 (20)	$\chi^2 = 1.61; p = .658$
Surgery & CTX, or Surgery & RT, or CTX & RT	28.9 (22)	33.8 (22)	
Surgery & CTX & RT	18.4 (14)	12.3 (8)	

Abbreviations: AUDIT = Alcohol Use Disorders Identification Test, CTX = chemotherapy, FE = Fisher's Exact, kg = kilograms, KW = Kruskal Wallis, m<sup>2</sup> = meter squared, NS = not significant, RT = radiation therapy, SCQ – Self-Administered Comorbidity Questionnaire, SD = standard deviation, U = Mann-Whitney U test

\*Chi Square analysis done without transgender in the analysis



Table 4. Differences in Pain Characteristics Between Younger and Older Patients with Only Non-Cancer Pain

Characteristic	< 65 years N = 79	≥ 65 years N 65	Statistics
	Mean (SD)	Mean (SD)	
Pain now	1.37 (1.80)	1.55 (1.98)	t = -0.54; p = .593
Average pain	2.84 (1.88)	2.98 (2.04)	t = -0.37; p = .710
Worst pain	5.42 (2.69)	5.40 (2.69)	t = 0.05; p = .958
Number of days per week that pain occurs	1.65 (2.32)	1.68 (2.18)	t = -0.06; p = .953
Hours per day the pain lasts	5.29 (6.60)	6.22 (8.14)	t = -0.67; p = .502
Number of pain locations (out of 45)	4.67 (5.33)	5.37 (3.60)	t = -0.85; p = .399
Amount of pain relief (0% to 100%)	71.39 (31.18)	59.44 (31.80)	t = 1.61; p = .112
Satisfaction with pain treatment	7.55 (2.66)	7.20 (2.92)	t = 0.61; p = .541
Pain interference			
General activity	2.28 (2.92)	1.75 (2.18)	t = 1.19; p = .236
Mood	1.99 (2.46)	1.59 (2.17)	t = 0.95; p = .344
Walking ability	2.06 (2.98)	2.60 (2.90)	t = -1.06; p = .293
Normal work	2.30 (2.80)	2.47 (2.40)	t = -0.38; p = .707
Relations with other people	.93 (1.52)	.78 (1.42)	t = 0.58; p = .565
Sleep	2.24 (2.60)	2.05 (2.45)	t = 0.43; p = .668
Enjoyment of life	2.62 (2.77)	2.21 (2.75)	t = 0.83; p = .407
Sexual activity	1.85 (3.10)	.62 (1.99)	t = 2.65; p = .009
Mean interference score	2.00 (2.01)	1.73 (1.61)	t = 0.81; p = .421
	% (N)	% (N)	
Took pain medications in the last week (% yes)	42.5 (31)	50.8 (30)	FE; p = .382
Length of time with pain not related to cancer or treatment:			
Less than one week	10.4 (8)	13.3 (8)	x <sup>2</sup> = 10.92; p = .091
One to two weeks	3.9 (3)	6.7 (4)	
About one month	7.8 (6)	1.7 (1)	
Two to three months	14.3 (11)	1.7 (1)	
Three to six months	7.8 (6)	13.3 (8)	
Seven months to one year	7.8 (6)	6.7 (4)	
Greater than 1 year	48.1 (37)	56.7 (34)	
How often pain occurs:			
Continuously	11.3 (8)	17.2 (10)	x <sup>2</sup> = 4.32; p = .633
Several times a day	21.1 (15)	20.7 (12)	
Once or twice a day	18.3 (13)	12.1 (7)	
Several times a week	22.5 (16)	19.0 (11)	
Less than 3 to 4 times per month	15.5 (11)	10.3 (6)	
Once or twice a month	7.0 (5)	13.8 (8)	
Less than once a month	4.2 (3)	6.9 (4)	
Pain Qualities			
Aching	69.9 (51)	76.3 (45)	FE; p = .438
Throbbing	39.7 (29)	25.9 (15)	FE; p = .136
Shooting	24.7 (18)	12.3 (7)	FE; p = .115
Stabbing	26.0 (19)	16.9 (10)	FE; p = .291
Gnawing	16.4 (12)	11.9 (7)	FE; p = .619
Sharp	31.5 (23)	25.9 (15)	FE; p = .562

Tender	30.1 (22)	25.9 (15)	FE; p = .697
Burning	16.4 (12)	12.1 (7)	FE; p = .619
Exhausting	17.8 (13)	15.3 (9)	FE; p = .816
Tiring	34.2 (25)	37.3 (22)	FE; p = .719
Penetrating	27.4 (20)	20.3 (12)	FE; p = .416
Nagging	41.1 (30)	39.0 (23)	FE; p = .859
Numb	15.1 (11)	19.0 (11)	FE; p = .640
Miserable	23.3 (17)	15.3 (9)	FE; p = .278
Unbearable	6.8 (5)	5.1 (3)	FE; p = .731
Pain Locations			
Head	27.5 (19)	17.5 (10)	FE; p = .208
Neck	5.8 (4)	14.0 (8)	FE; p = .137
Shoulders	20.3 (14)	24.6 (14)	FE; p = .668
Upper arms	5.8 (4)	5.3 (3)	FE; p = 1.000
Lower arms	7.2 (5)	7.0 (4)	FE; p = 1.000
Hands	8.7 (6)	19.3 (11)	FE; p = .116
Throat	2.9 (2)	3.5 (2)	FE; p = 1.000
Chest	5.8 (4)	1.8 (1)	FE; p = .377
Thorax	13.0 (9)	14.0 (8)	FE; p = 1.000
Abdomen	10.1 (7)	5.3 (3)	FE; p = .510
Genitalia	0.0 (0)	1.8 (1)	FE; p = .452
Lower back	40.6 (28)	49.1 (28)	FE; p = .371
Buttocks	20.3 (14)	31.6 (18)	FE; p = .157
Thighs	29.0 (20)	45.6 (26)	FE; p = .064
Calve	24.6 (17)	42.1 (24)	FE; p = .055
Feet	18.8 (13)	17.5 (10)	FE; p = 1.000

Abbreviations: FE = Fisher's Exact, SD = standard deviation

Table 5. Differences in Demographic and Clinical Characteristics Between Younger and Older Patients with Both Cancer and Non-Cancer Pain

Characteristic	< 65 years (1) N = 215	≥ 65 years (2) N = 64	Statistics
	Mean (SD)	Mean (SD)	
Age (years)	51.48 (9.47)	71.88 (5.57)	t = -21.47; p < .0001
Education (years)	15.64 (2.74)	16.13 (3.60)	t = -0.99; p = .327
Body mass index (kg/m <sup>2</sup> )	26.28 (6.22)	26.77 (4.81)	t = -0.58; p = .564
Karnofsky Performance Status score	75.87 (11.76)	76.72 (14.56)	t = -0.41; p = .685
Number of comorbidities	2.86 (1.52)	3.69 (1.46)	t = -3.88; p < .0001
SCQ score	6.70 (3.62)	8.16 (3.49)	t = -2.85; p = .005
AUDIT score	2.85 (2.40)	2.37 (1.44)	t = 1.18; p = .242
Time since cancer diagnosis (years)	2.06 (3.81)	3.58 (7.48)	U, p = .825
Time since cancer diagnosis (median)	0.47	0.47	
Number of prior cancer treatments	1.79 (1.58)	1.83 (1.57)	t = -0.19; p = .852
Number of metastatic sites including lymph node involvement	1.33 (1.31)	1.58 (1.32)	t = -1.35; p = .178
Number of metastatic sites excluding lymph node involvement	.87 (1.14)	1.09 (1.19)	t = -1.33; p = .183
	% (N)	% (N)	
Gender			
Female	86.5 (186)	78.1 (50)	FE; p = .116
Male	13.5 (29)	21.9 (14)	
Transgender	0.0 (0)	0.0 (0)	
Ethnicity			x <sup>2</sup> = 8.51; p = .037
White	62.8 (130)	77.8 (49)	NS
Black	6.3 (13)	9.5 (6)	NS
Asian or Pacific Islander	14.5 (30)	4.8 (3)	NS
Hispanic Mixed or Other	16.4 (34)	7.9 (5)	NS
Married or partnered (% yes)	55.2 (117)	58.7 (37)	FE; p = .666
Lives alone (% yes)	24.8 (53)	35.9 (23)	FE; p = .082
Child care responsibilities (% yes)	32.1 (67)	7.9 (5)	FE; p < .0001
Care of adult responsibilities (% yes)	13.7 (27)	5.3 (3)	FE; p = .103
Currently employed (% yes)	27.0 (58)	19.4 (12)	FE; p = .249
Income			
< \$30,000	29.6 (58)	28.6 (16)	KW; p = .692
\$30,000 to <\$70,000	23.0 (45)	25.0 (14)	
\$70,000 to < \$100,000	13.3 (26)	19.6 (11)	
≥ \$100,000	34.2 (67)	26.8 (15)	
Specific comorbidities (% yes)			
Heart disease	3.7 (8)	18.8 (12)	FE; p < .0001
High blood pressure	28.8 (62)	64.1 (41)	FE; p < .0001
Lung disease	11.2 (24)	25.0 (16)	FE; p = .008
Diabetes	7.4 (16)	17.2 (11)	FE; p = .029
Ulcer or stomach disease	9.3 (20)	10.9 (7)	FE; p = .639
Kidney disease	.5 (1)	3.1 (2)	FE; p = .133
Liver disease	5.6 (12)	7.8 (5)	FE; p = .553
Anemia or blood disease	20.5 (44)	14.1 (9)	FE; p = .282
Depression	31.6 (68)	21.9 (14)	FE; p = .160
Osteoarthritis	16.7 (36)	32.8 (21)	FE; p = .008
Back pain	46.5 (100)	48.4 (31)	FE; p = .887
Rheumatoid arthritis	5.6 (12)	4.7 (3)	FE; p = 1.000
Exercise on a regular basis (% yes)	68.6 (144)	56.2 (36)	FE; p = .073
Smoking, current or history of (% yes)	35.2 (75)	49.2 (31)	FE; p = .055

Cancer diagnosis			$\chi^2 = 19.56; p < .0001$
Breast	43.7 (94)	25.0 (16)	1>2
Gastrointestinal	24.7 (53)	26.6 (17)	NS
Gynecological	23.3 (50)	20.3 (13)	NS
Lung	8.4 (18)	28.1 (18)	2>1
Reason for current treatment			
Curative	75.5 (157)	67.2 (43)	FE; $p = .198$
Palliative	24.5 (51)	32.8 (21)	
Type of prior cancer treatment			
No prior treatment	19.6 (42)	22.2 (14)	$\chi^2 = 6.50; p = .090$
Only surgery, CTX, or RT	44.9 (96)	33.3 (21)	
Surgery & CTX, or Surgery & RT, or CTX & RT	18.2 (39)	31.7 (20)	
Surgery & CTX & RT	17.3 (37)	12.7 (8)	

Abbreviations: AUDIT = Alcohol Use Disorders Identification Test, CTX = chemotherapy, FE = Fisher's Exact, kg = kilograms, KW = Kruskal Wallis,  $m^2$  = meter squared, NS = not significant, RT = radiation therapy, SCQ = Self-Administered Comorbidity Questionnaire, SD = standard deviation, U = Mann-Whitney U test

Table 6. Differences in Pain Characteristics Between Younger and Older Patients with Both Cancer and Non-Cancer Pain

Characteristic	<65 years N = 215	≥65 years N = 64	Statistics
	Mean (SD)	Mean (SD)	
Pain now	2.25 (2.16)	2.09 (2.21)	t = 0.52; p = .606
Average pain	3.35 (2.07)	3.61 (1.85)	t = -0.85; p = .398
Worst pain	6.75 (2.42)	6.74 (2.03)	t = 0.04; p = .971
Number of days per week that pain occurs	3.52 (2.33)	3.36 (2.73)	t = 0.43; p = .672
Hours per day the pain lasts	9.09 (8.32)	7.26 (7.34)	t = 1.52; p = .131
Number of pain locations (out of 45)	10.54 (8.68)	6.69 (3.92)	t = 4.92; p < .0001
Amount of pain relief (0% to 100%)	68.75 (26.96)	67.20 (28.65)	t = 0.35; p = .727
Satisfaction with pain treatment	6.95 (2.50)	6.79 (2.62)	t = 0.41; p = .685
Pain interference			
General activity	3.93 (2.92)	3.16 (2.82)	t = 1.85; p = .065
Mood	3.79 (2.79)	3.24 (2.79)	t = 1.36; p = .175
Walking ability	3.38 (3.07)	3.37 (3.00)	t = 0.03; p = .977
Normal work	4.13 (3.16)	3.85 (3.10)	t = 0.62; p = .539
Relations with other people	2.92 (2.92)	2.60 (2.70)	t = 0.77; p = .441
Sleep	4.19 (3.09)	3.61 (2.94)	t = 1.30; p = .194
Enjoyment of life	4.04 (2.90)	4.13 (2.99)	t = -0.21; p = .833
Sexual activity	4.42 (4.08)	3.24 (4.05)	t = 1.83; p = .068
Mean interference score	3.84 (2.49)	3.43 (2.27)	t = 1.16; p = .246
	% (N)	% (N)	
Took pain medications in the last week (% yes)	71.3 (149)	74.6 (47)	FE; p = .749
Length of time with pain related to cancer or treatment:			
Less than one week	10.1 (21)	9.7 (6)	x <sup>2</sup> = 2.04; p = .916
One to two weeks	13.0 (27)	9.7 (6)	
About one month	10.6 (22)	16.1 (10)	
Two to three months	18.8 (39)	16.1 (10)	
Three to six months	17.8 (37)	16.1 (10)	
Seven months to one year	13.0 (27)	14.5 (9)	
Greater than 1 year	16.8 (35)	17.7 (11)	
Length of time with pain not related to cancer or treatment:			
Less than one week	9.2 (17)	10.3 (6)	x <sup>2</sup> = 2.21; p = .899
One to two weeks	3.8 (7)	1.7 (1)	
About one month	5.4 (10)	5.2 (3)	
Two to three months	5.4 (10)	6.9 (4)	
Three to six months	6.0 (11)	3.4 (2)	
Seven months to one year	6.5 (12)	10.3 (6)	
Greater than 1 year	63.6 (117)	62.1 (36)	
How often pain occurs:			
Continuously	18.1 (36)	15.3 (9)	x <sup>2</sup> = 5.56; p = .474
Several times a day	23.1 (46)	30.5 (18)	
Once or twice a day	16.6 (33)	10.2 (6)	
Several times a week	21.1 (42)	25.4 (15)	
Less than 3 to 4 times per month	10.1 (20)	6.8 (4)	
Once or twice a month	8.0 (16)	5.1 (3)	

Less than once a month	3.0 (6)	6.8 (4)	
Pain Qualities			
Aching	84.6 (176)	79.4 (50)	FE; p = .337
Throbbing	48.3 (100)	44.4 (28)	FE; p = .666
Shooting	35.7 (74)	33.3 (21)	FE; p = .765
Stabbing	32.2 (67)	24.2 (15)	FE; p = .272
Gnawing	21.6 (44)	23.0 (14)	FE; p = .860
Sharp	48.6 (101)	37.1 (23)	FE; p = .146
Tender	49.0 (102)	48.4 (30)	FE; p = 1.000
Burning	24.2 (50)	30.2 (19)	FE; p = .409
Exhausting	46.2 (96)	33.9 (21)	FE; p = .108
Tiring	67.5 (141)	57.4 (35)	FE; p = .170
Penetrating	28.6 (59)	27.1 (16)	FE; p = .871
Nagging	49.8 (103)	47.6 (30)	FE; p = .776
Numb	40.3 (83)	19.0 (12)	FE; p = .002
Miserable	37.8 (79)	34.9 (22)	FE; p = .767
Unbearable	15.8 (33)	16.1 (10)	FE; p = 1.000
Pain Locations			
Head	44.7 (92)	29.0 (18)	FE; p = .039
Neck	23.8 (49)	14.5 (9)	FE; p = .159
Shoulders	49.0 (101)	33.9 (21)	FE; p = .042
Upper arms	23.8 (49)	17.7 (11)	FE; p = .386
Lower arms	19.9 (41)	3.2 (2)	FE; p = .001
Hands	28.6 (59)	19.4 (12)	FE; p = .189
Throat	12.6 (26)	6.5 (4)	FE; p = .250
Chest	30.1 (62)	25.8 (16)	FE; p = .633
Thorax	28.6 (59)	22.6 (14)	FE; p = .417
Abdomen	38.8 (80)	35.5 (22)	FE; p = .658
Genitalia	8.7 (18)	9.7 (6)	FE; p = .802
Lower back	55.3 (114)	41.9 (26)	FE; p = .082
Buttocks	31.6 (65)	27.4 (17)	FE; p = .638
Thighs	45.1 (93)	35.5 (22)	FE; p = .191
Calve	39.3 (81)	25.8 (16)	FE; p = .070
Feet	36.4 (75)	32.3 (20)	FE; p = .650

Abbreviations: FE = Fisher's Exact, SD = standard deviation

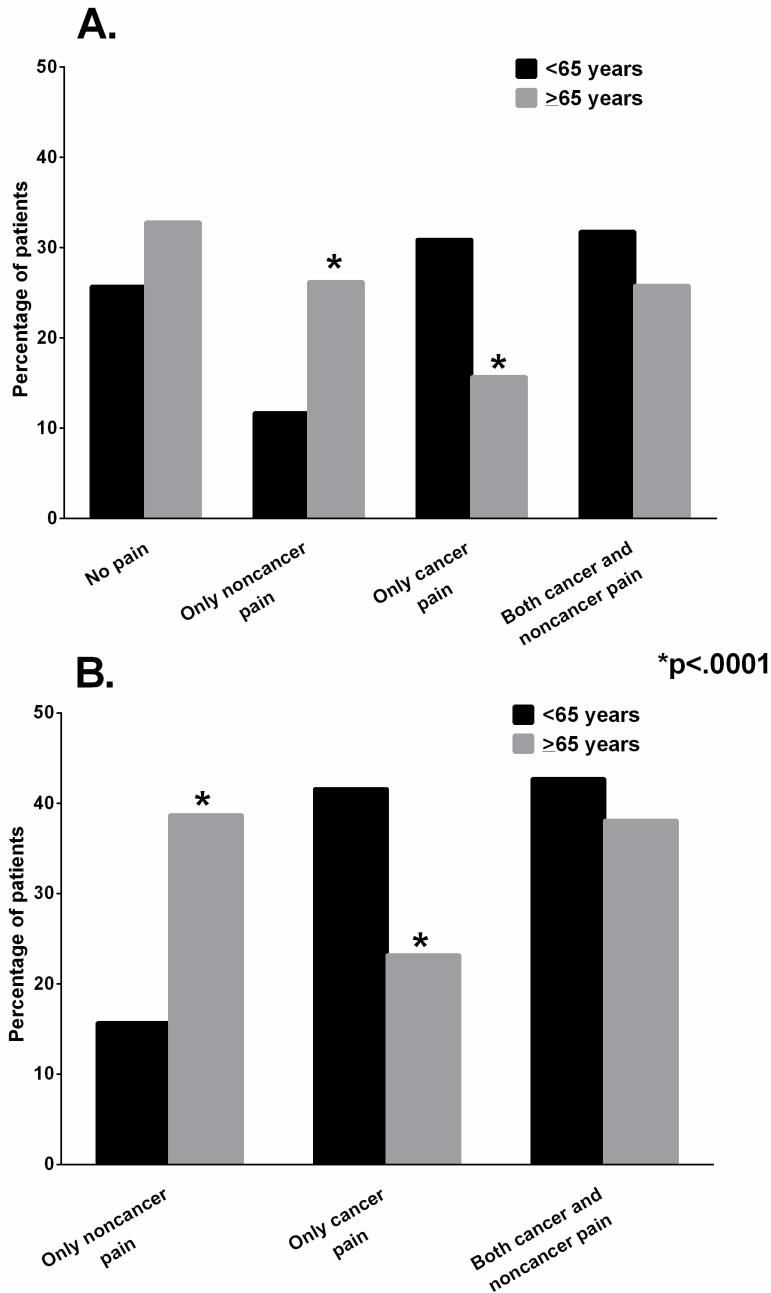


Figure 1A: Differences among older ( $\geq 65$  years) and younger ( $< 65$  years) oncology outpatients in the occurrence rates for no pain, only noncancer pain, only cancer pain, and both cancer and both cancer and noncancer pain.

Figure 1B: Differences among older ( $\geq 65$  years) and younger ( $< 65$  years) oncology outpatients in the occurrence rates for only noncancer pain, only cancer pain, and both cancer and both cancer and noncancer pain.

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