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Older Age as a Prognostic Factor of Attenuated Pain Recovery after Shoulder Arthroscopy

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Abstract

Background—Shoulder pain and surgery are common among older adults. However, the extent to which older age affects recovery after shoulder surgery is not well understood.

Objective—To assess influence of older age on post-operative recovery factors three and six months after shoulder arthroscopy.

Design—Prospective Cohort Study

Setting—Institutional

Patients—Convenience sample of 139 individuals between 20 and 79 years of age who experienced shoulder pain, musculoskeletal dysfunction based on imaging and physician assessment, and were scheduled for an arthroscopic shoulder procedure.

Main Outcome Measures—Post-operative outcomes were compared among younger, middle-aged and older adults at pre-surgery, 3 months and 6 months after surgery using ANOVA modeling. Movement-evoked pain and an experimental laboratory correlate of pain processing were assessed at each time point. Older age influence on three and six month pain outcomes were determined via multivariate regression analyses after accounting for pre-operative, intra-operative, and post-operative prognostic factors.

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Results—Older adults had higher movement-evoked pain intensity ($F_{2,108} = 5.18$, $p=.007$) and experimental pain response ($F_{2,111} = 7.24$, $p=.001$) at three months compared to young and middle-aged adults. After controlling for key prognostic factors, older age remained a positive predictor of three-month movement-evoked pain ($R^2=.05$; St. Beta=.263, $p=.031$) and experimental pain response ($R^2=.07$; St. Beta=.295, $p=.014$). Further, older age remained a positive predictor of movement-evoked pain at six months ($R^2=.04$; St. Beta=.231, $p=.004$), despite no age group differences in outcome. Older age was found to be the strongest predictor of three and six month movement-evoked pain.

Conclusion—Older adults may experience more pain related to movement as well as endogenous pain excitation in the first few months after shoulder arthroscopy. Future age-related research should consider use of movement-evoked pain intensity and experimental pain response as pain outcomes, as well as the utility of such measures in clinical care.

INTRODUCTION

Over half of older adults experience some form of musculoskeletal pain [1–3]. Shoulder pain is particularly concerning because it affects up to 30% of community-dwelling adults over 50 years of age [4,5]. Because pain is a major indicator for shoulder surgery [6,7], it's not surprising that shoulder surgical procedures among this population are also high [8]. Specifically, arthroscopic rotator cuff repair is reportedly over 9 times higher in older adults compared to younger adults, and 10 year trends indicate a nearly 400% increase in shoulder surgery for seniors [9]. Moreover, the severity of rotator cuff disease and prevalence for affecting bilateral shoulders increases with age [10]. Despite these trends, age differences and age-related influence on postoperative shoulder pain recovery are poorly understood.

Older age is considered a prognostic factor of poor recovery for various postoperative recovery measures, including tendon healing [11,12] and functional recovery time [13]. In contrast, older age has not been associated with post-operative pain recovery [14]. However, few studies have been performed in this area and limitations exist with assessing pain post-operatively. First, the assessment time-frame for pain recovery post-operatively is often greater than one year [14,15], despite the onset of chronic post-operative pain occurring between two and six months after surgery [16–18]. Few patients, if any, would consider one year as reasonable for experiencing pain relief. Second, such studies often use Likert-type subscales to categorize pain over time or in situations of rest, activity, and sleep. Individuals report difficulty distinguishing pain intensity from decreased function with such scales [19], while research has identified less than optimum inter-scale correlation [20]. Visual analog scales (VAS) are also used, however, many older adults struggle with the VAS and/or the results don't correlate with other pain scales [21–23].

Movement-evoked pain and experimental pain response are two measures with potential for determining age-related influence on post-operative shoulder pain recovery. Movement-evoked pain is rated after the corresponding anatomical joint has been put in motion, which is important for orthopaedic conditions given the relationship between movement and pain behavior. Moreover, movement-evoked pain is potentially more precise than pain recall measures since measurement is assessed in real-time. Movement-evoked pain is reportedly

more intense than pain at rest and has been has different post-operative analgesic mechanisms, independent of age comparisons [24]. During experimental pain response testing, a standardized pain stimulus (e.g. thermal, mechanical) is applied to the skin of an individual to measure evoked pain intensity. The benefit of experimental pain response testing is that it's related to central pain processing [25,26], and previous research has found experimental pain response to be related to post-operative pain [27].

Therefore, our overall study purpose was to determine whether older age was a prognostic factor of pain recovery three and six months after shoulder arthroscopy. We first assessed how post-operative movement-evoked pain and experimental pain response differed among older adults compared to middle-aged and young adults. While previous research in non-musculoskeletal conditions suggests movement-evoked pain to be similar across age groups [21], we anticipated older adults to have higher movement-evoked pain given the relation of movement to an orthopaedic condition like shoulder pain. Additionally, we anticipated experimental pain response to be higher in older adults compared to young adults based on previous laboratory findings [28]. Our second aim was to determine the extent to which older age uniquely predicted three and six month movement-evoked pain and experimental pain response after accounting for key prognostic factors. Since age adversely influences other aspects of post-operative recovery, we anticipated similar findings using the enhanced pain measures previously described.

MATERIALS & METHODS

Study Cohort

Data originated from a sample of individuals with shoulder pain scheduled for shoulder arthroscopy at a university-affiliated outpatient orthopaedic surgical center from February 2009 to May 2012. Inclusion criteria were individuals be between 20 and 79 years of age; had complaints of pain limited to anterior, lateral, or posterior shoulder; had a diagnosis of musculoskeletal dysfunction based on imaging and physician assessment; and were scheduled for an arthroscopic shoulder procedure. Exclusion criteria included pain greater than three months in another anatomical region; prior shoulder surgery within the past year; shoulder-related fracture, tumor, or infection; current or previous chronic pain disorder diagnosis; current psychiatric management; gastrointestinal or renal illness. This study was approved by the _____.

Participants reported shoulder pain duration and intensity, shoulder disability level, and current medications. Physical testing assessed movement-evoked pain and experimental pain response. Participants then underwent shoulder arthroscopy, and returned three and six months post-operatively to re-collect information provided preoperatively as well as to re-assess pain outcome measures.

Pain Outcome Measures

Movement-Evoked Pain Intensity—Patients were instructed to elevate their arm in the frontal plane (i.e. shoulder abduction) as high as possible, and to rate pain intensity at their highest point. A 101-point numeric pain rating scale (NPRS) was used for this task (“No

pain”=0, “Worst pain intensity imaginable”=100). The 101-point NPRS has been determined to be a valid and sensitive rating scale for assessing musculoskeletal pain [29], and the NPRS is reportedly the preferred post-operative rating scale across age groups [30]. While (to our knowledge) movement-evoked pain has not been examined specifically for age group differences in a shoulder cohort, similar measures have assessed across age groups for other surgical conditions [21]. Moreover, movement-evoked pain has been used to examine recovery from knee total arthroplasty, which is an age-related surgical condition [24]. Shoulder abduction was used as it is a predominant motion of pain and/or risk factor of shoulder pain [31,32].

Experimental Pain Response—Experimental pain response was assessed using a temporal summation of second pain (TS) protocol. A train of 5 heat pulses of the same temperature (50°C) were applied to the thenar eminence of the hand on the involved extremity for .5 seconds (2.5 second interpulse interval) using a 2.5cm² surface area thermode connected to a PATHWAY Model Advanced Thermal Stimulator (ATS) (Medoc Advanced Medical Systems, Ramat Yishai, Israel). Using the numeric pain rating scale (NPRS), participants rated intensity of the second pain experienced after initial heat at each pulse, which is the pain experienced after the initial onset of heat. Pain rating after the first pulse was then subtracted from pain rating after the fifth pulse to determine pain intensity change over the 5 pulse train. Increased pain intensity change is considered temporal summation of second pain, which has been associated with central pain processing [25,26,33]. Notably, median nerve involvement for carpal-tunnel syndrome (CTS) was not assessed in our participants. However, this test is more specific to pain facilitation originating from c-nociceptive fibers, which have not been found to correlate with diagnostic CTS symptomatology [34].

Covariates

Demographics—Patients provided information pertaining to age, sex, and pain duration preoperatively. Participants were *a priori* categorized to young (20-39 years), middle-aged (40-59 years), or older (60-79 years) age groups for purposes of the planned data analyses. We included a middle-aged group based on previous epidemiologic findings of peak pain intensity during middle age [35], and identified differences in endogenous pain sensitivity and modulation found among middle-aged adults [36,37]. Pain duration was measured in the amount of symptom weeks from onset until the pre-operative session.

Pain Catastrophizing—Pain catastrophizing is an exaggerated negative response to a painful experience [38]. Pre-operative pain catastrophizing has been found to be a consistent factor influencing post-operative pain and/or disability [39–42]. In this study, we used the Pain Catastrophizing Scale (PCS), which consists of 13 items and a total score ranging from 0 to 52 (higher scores indicate higher pain catastrophizing).

Intra-Operative and Post-Operative Factors—We accounted for potential influence of arthroscopic procedures as determined by intra-operative report. Participants were dichotomously coded (yes, no) on whether they underwent acromion, biceps, bursa, capsular, chondral, labral, or rotator cuff (RCT) procedures. Further, while RCT severity has

not been found to predict post-operative pain [14,43,44], RCT procedures are reported to be the most painful of shoulder surgeries [45]. Therefore, we also assessed the invasiveness of the procedure (e.g. debridement, repair) as a covariate.

The potential for analgesic medication to influence post-operative pain was also accounted for. For the purpose of this study, analgesic medication was any drug deemed a peripheral analgesic, non-steroidal anti-inflammatory drug (NSAID), or opioid agent. At three and six months, patients provided a medication list which was then categorized by a single rater

_____.

Statistical Analysis

Analyses were completed using IBM® SPSS® Statistics software, Version 21 (2012, IBM® Corp; Armonk, NY). Alpha level was set at 0.05 for all statistical tests. Univariate ANOVA modeling was used to examine pre-operative group differences in continuous predictors (pain duration, pain catastrophizing); and outcome measures pre-operatively and three and six months post-operatively (movement-evoked pain, experimental pain response). Further, repeated measures ANOVA assessed changes in movement-evoked pain pre- to post-operatively and whether an age group by time interaction existed. To account for unequal sample size and potential variance heterogeneity across groups, differences were confirmed using Brown-Forsythe test. Further, Bonferroni correction was used to assess simple effects as it is considered a more conservative post-hoc measure. Chi-Square analyses were used to assess pre-operative group differences in categorical predictors (e.g. sex, arthroscopic procedure, analgesic medication use).

Influence of age group on movement-evoked pain and experimental pain response were examined using separate simple ordinary least squares (OLS) regression models at each time point. First, crude estimates were derived using simple regression. A similar analysis was also performed to assess the influence of arthroscopic procedure on post-operative movement-evoked or experimental pain. Factors demonstrating an association at $p < .10$ were then adjusted for age. Any factor maintaining association with post-operative outcomes after age-adjustment was then entered in all final hierarchical multiple regression models at each corresponding time point.

Final predictive models assessed age group influence after accounting for prognostic factors pre-operatively (e.g. pre-operative movement-evoked pain, pain duration, pain catastrophizing), intra-operatively (e.g. arthroscopic procedure) and postoperatively (e.g. analgesic medication use). For each model, pre-operative, intra-operative and post-operative prognostic factors were entered in the first block; while dummy-coded age groups were entered in the second block. To prevent multicollinearity within the models [46], *a priori* cut-off rules were established for factor inter-correlation ($r = .70$), tolerance ($.20$), and variance inflation (4).

RESULTS

One hundred thirty-nine individuals with shoulder pain underwent shoulder arthroscopy. Description of pre-operative characteristics of older adults ($n=30$), and comparison to young

(n=57) and middle-aged (n=52) adults, are presented in **Table 1**. Age groups did not differ on pain duration or pain catastrophizing. Pre-operatively, movement-evoked pain and experimental pain response did not differ between older and middle-aged adults, or older and young adults ($p>.05$). However, pre-operative movement-evoked pain was higher among middle-aged adults compared to younger adults ($F_{2,137} = 4.48, p=.013$) (**FIG 1, 2**).

Frequency of acromion ($X^2_{(2, N=109)} = 22.22, p<.001$), biceps ($X^2_{(2, N=109)} = 10.45, p=.001$), bursa ($X^2_{(2, N=109)} = 32.03, p<.001$), labral ($X^2_{(1, N=109)} = 18.32, p<.001$), and RCT ($X^2_{(1, N=109)} = 27.78, p<.001$) procedures differed for younger adults compared to middle-aged adults. Acromion ($X^2_{(1, N=87)} = 32.20, p<.001$), biceps ($X^2_{(1, N=87)} = 36.11, p<.001$), bursa ($X^2_{(1, N=87)} = 22.90, p<.001$), labral ($X^2_{(1, N=87)} = 18.05, p<.001$), and RCT ($X^2_{(1, N=87)} = 29.18, p<.001$) procedures also differed between younger and older adults. Between middle-aged and older adults, a difference existed in the frequency of biceps procedures ($X^2_{(1, N=82)} = 10.67, p=.002$).

At three months, frequency of analgesic medication differed between younger and middle-aged adults, ($X^2_{(2, N=86)} = 10.15, p=.003$) and younger and older adults ($X^2_{(2, N=75)} = 5.63, p=.025$). At six months, frequency of analgesic medication differed between younger and older adults ($X^2_{(2, N=70)} = 7.88, p=.007$) and middle-aged and older adults ($X^2_{(1, N=64)} = 5.69, p=.029$). Frequency distribution for arthroscopic procedure and analgesic medication are provided in **Table 1**.

Arthroscopic Procedure Influence on Post-Operative Outcomes

Unadjusted influence of arthroscopic procedures are presented in **Table 2**. At 3 months, only RCT invasiveness influenced movement-evoked pain after adjusting for age (RCT debridement, $R^2=.05, p=.016$). Arthroscopic procedures did not influence three-month experimental pain after adjusting for age ($p>.05$). At six months, and after adjusting for age, only capsular procedure influenced movement-evoked pain-intensity ($R^2=.04, p=.043$), while no arthroscopic factor influenced experimental pain ($p>.05$).

Age Group Differences and Influence on Post-Operative Movement-Evoked Pain

No age $\times$ time interaction existed for movement-evoked pain pre-operatively to three months post-operatively ($p>.05$). However, at three months, older adults had higher movement-evoked pain compared to young and middle-aged adults ($F_{2,108} = 5.18, p=.007$) (**FIG 1**). The final predictive model accounted for 20.7% of the variance in three month movement-evoked pain. After controlling for pre-operative, intra-operative and post-operative prognostic factors, older age accounted for approximately 5% of additional variance and was the strongest predictor (St. Beta=.263, $p=.031$) of three-month movement-evoked pain (**TABLE 3**).

No age $\times$ time interaction existed for movement-evoked pain pre-operatively to six months post-operatively ($p>.05$), and 6 month movement-evoked pain did not differ across age groups (**FIG 1**). The final predictive model accounted for 17.5% of the variance in six-month movement-evoked pain. After controlling for pre-operative, intra-operative and post-operative prognostic factors, older age accounted for approximately 4% of additional

variance, and was the strongest predictor (St. Beta=.231, $p=.040$) of six-month movement-evoked pain (**TABLE 4**).

Age Group Differences and Influence on Post-Operative Experimental Pain

Older adults had higher experimental pain response compared to young and middle-aged adults ($F_{2,111} = 7.24$, $p=.001$) at three months (**FIG 2**). The final predictive model accounted for 20.2% of the variance in three-month experimental pain response. After controlling for pre-operative, intra-operative and post-operative prognostic factors, older age remained a significant predictor and accounted for approximately 7% of additional variance in three-month experimental pain response (St. Beta=.295, $p=.014$) (**TABLE 3**).

At six months, experimental pain response did not differ across age groups (**FIG 2**). The final predictive model accounted for 17.3% of the variance in six-month experimental pain response, however older age was not a predictor after accounting for pre-operative experimental pain response, demographics and covariates (**TABLE 4**).

DISCUSSION

Older adults have increased prevalence of shoulder pain and surgery, yet the impact of older age on post-operative pain outcomes is poorly understood. This study assessed age group differences and influence using measures and a time frame better suited for assessing post-operative pain recovery. First, older adults reported higher pain ratings three months after surgery. Further, older age adversely influenced pain recovery at three and/or six months. Despite variance explained by older age being small (~4-7%), prediction was above and beyond factors pre-established prognostic factors like pre-operative pain, demographics, and covariates including psychological distress (pain catastrophizing), surgery type, and post-operative analgesic medication use. More importantly, older age was in many cases the strongest predictor of postoperative pain.

Post-operative non-musculoskeletal surgery studies have reported age to be a negative pain predictor - meaning that younger adults are actually at risk for experiencing higher pain [47,48]. Further, Fermont et al's recent systematic review of prognostic factors of RTC repair recovery did not find age to influence pain outcomes [14]. These previous findings would suggest that post-operative pain is less of an issue for older adults. However, prior examination in shoulder surgery studies may not have been conducive for assessing age influence on pain, given the longer study follow-up time. Second, prior psychometric assessment of pain in aging has highlighted difficulty in measuring pain among older adults, often because of the outcome measure itself [22,49]. In contrast, movement evoked-pain appears to be a better measure to assess age group differences and prognostic influence. Moreover, movement-evoked pain in conjunction with a numeric pain rating scale may be more ideal for older adults, as previous research has found no age group differences in post-operative movement-evoked pain when alternative metrics (e.g. VAS) were used [21].

Differential influence of older age on experimental pain response is particularly important as it is an indirect indication of central pain processing. Experimental pain stimuli are standardized such that changes in pain response can be assessed for the presence of

abnormal pain excitation and/or pain inhibition. Previous research in this area has elucidated enhanced pain excitation [50,51] and decrement in pain inhibition [52–54] among older adults compared to young adults. Based on these findings, Lautenbacher proposed an imbalance between endogenous excitatory and inhibitory processes which creates an excitatory state and increased pain predisposition with age [28]. In other words, the inhibitory capacity of older adults changes such that they are in constant state of pain excitation. Perhaps this imbalance is heightened postoperatively, predisposing older adults to an excitatory state in the months following shoulder surgery. Three-month post-operative convergence of higher movement-evoked pain and experimental pain response strengthens this argument, and suggests that attenuated pain recovery is a legitimate concern when treating older adults. Though not currently used as an age-related post-operative recovery measure, experimental pain response may be considered for future studies.

Limitations should be considered when interpreting findings and when developing future trials. First, age group differences were only assessed at two post-operative time points. The most significant age differences in pain occurred at three months, however, assessing pain at multiple time points around three month follow-up may better elucidate the course of pain recovery as it pertains to age. We also accounted for potential influence of arthroscopic procedure but not the cumulative effects of these procedures. Ascertaining the extent to which concomitant procedures are additive in their influence on post-operative outcomes is a future priority. Similarly, this study accounted for RCT invasiveness and actually found the less invasive procedure (debridement) to influenced post-operative movement-evoked pain after adjusting for age. However, we also note that a greater frequency of middle-aged and older adults underwent RCT procedures than younger adults, and that the study was not powered to test three-way interactions. Future work will determine whether age moderates the influence of surgical procedure invasiveness on post-operative outcomes. Finally, information pertaining to minimal clinically important difference (MCID) in post-operative movement-evoked pain is currently lacking and should be explored in future studies.

CONCLUSION

Movement-evoked pain intensity and experimental pain response were higher among older adults compared to young adults after shoulder arthroscopy. Older age uniquely contributed to pain outcomes even after accounting for other prognostic factors. Collectively, these findings highlight the importance of older age as a prognostic factor of post-operative pain recovery. Future age-related post-operative studies should consider movement-evoked pain intensity and experimental pain response for measuring pain, given the challenges in measuring pain among older adults.

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Figure 1.

Age Group Differences in Movement-Evoked Pain

Baseline = pre-operative measures; 3 Months = 3 month post-operative measures; 6 Months = 6 month post-operative measures; Brackets signify group differences ($p < .05$); Error bars represent 95% Confidence Intervals; Pain Intensity = Pain at end-range shoulder abduction on a 0-100 numeric pain rating scale (NPRS).

Figure 2.

Age Group Differences in Experimental Pain

Baseline = pre-operative measures; 3 Months = 3 month post-operative measures; 6 Months = 6 month post-operative measures; Brackets signify group differences ($p < .05$); Error bars represent 95% Confidence Intervals; Pain Summation = pain intensity change (0-100 numeric pain rating scale) between first heat pulse and fifth heat pulse over a 5 pulse train; Positive score is considered temporal summation of second pain or enhanced central pain excitation.

Table 1

Demographic and Prognostic Factors by Age Group

	Young (n=57)	Middle (n=52)	Older (n=30)	P
Mean Age	27.60 (5.90)	49.52 (5.39)	67.27 (5.36)	
Pain Duration (weeks)	47.30 (54.85)	88.44 (129.43)	71.29 (93.89)	.071
Pain Catastrophizing	11.12 (9.06)	12.17 (9.29)	8.06 (6.83)	.127
Female (%)	28	40	37	.397
<u>Procedure (%)</u>				
Acromion	18	62	80	<.001
Biceps	2	21	57	<.001
Bursa	16	69	67	<.001
Capsular	7	12	13	.588
Chondral	18	6	20	.106
Labral	88	50	45	<.001
Rotator Cuff	18	67	77	<.001
<u>Analgesic Medication (%)</u>				
3 Months	10	39	32	.005
6 Months	18	21	50	.009

Values for Mean Age, Pain Duration, and Pain Catastrophizing represent mean differences by age group pre-operatively (parentheses represent standard deviation). Pain Duration = shoulder pain in weeks; Pain Catastrophizing = total score on Pain Catastrophizing Scale (PCS); Procedure = yes/no per intra-operative report; Analgesic Medication = peripheral analgesic, non-steroidal anti-inflammatory drug (NSAID), or opioid agent taken at time of follow-up (3, 6 months).

Table 2

Arthroscopic Procedural Influence on Post-operative Outcomes

A) Movement Pain	3 Months R ²	6 Months R ²
Procedure (Y/N)		
Acromion	<0.001	0.004
Biceps	0.008	0.042 **
Bursa	<0.001	0.033 *
Capsular	0.001	0.049 **
Chondral	<0.001	<0.001
Labral	<0.001	0.050 **
Rotator Cuff	<0.001	0.002
Surgical Invasiveness		
Rotator Cuff Debridement	0.027 *	0.002
Rotator Cuff Repair	0.027 *	0.007
<hr/>		
B) Experimental Pain	3 Months R ²	6 Months R ²
Procedure (Y/N)		
Acromion	0.033 *	0.006
Biceps	0.044 **	0.053 **
Bursa	0.023	0.014
Capsular	0.001	<0.001
Chondral	0.004	0.001
Labral	<0.001	0.002
Rotator Cuff	0.027 *	0.053 **
Surgical Invasiveness		
Rotator Cuff Debridement	0.001	<0.001
Rotator Cuff Repair	0.026	0.070 ^

R^2 =unadjusted estimates

^^= $p<.001$

*= $p<.10$

**= $p<.05$

^= $p<.01$

Table 3

Influence on Three Month Post-Operative Outcomes

A)		Movement Pain		Experimental Pain	
R-Sq. Final Model (p-value)		.088 (.007)		.117 (<.01)	
Prognostic Factor		Beta	p	Beta	p
Middle Age (40-59y) *		0.052	.604	0.066	.501
Older Age (60-79y) *		0.314	.002	0.362	<.001

B)		Movement Pain		Experimental Pain	
R-Sq. Final Model (p-value)		.207 (.005)		.202 (.007)	
Prognostic Factor		Beta	p	Beta	p
Pre-operative Movement Pain		0.256	.015		
Pre-operative Experimental Pain				0.285	.003
Sex ¶		-0.208	.032	0.076	.421
Pain Duration		0.062	.508	-0.009	.920
Pain Catastrophizing		0.053	.577	-0.026	.787
RTC Debridement		-0.154	.138	-0.004	.972
RTC Repair		0.054	.640	0.001	.995
Analgesic Medication		-0.064	.531	0.055	.575
Middle Age (40-59y)		0.023	.848	0.015	.901
Older Age (60-79y)		0.263	.031	0.295	.014

Significant predictors are bolded. **A)** Crude estimate of age group influence on outcomes; **B)** Age group influence after accounting for prognostic factors.

* = Compared to Young Adults (20-39y)

¶ = Sex coded as 0 for male, 1 for female.

Table 4

Influence on Six Month Post-Operative Outcomes

A)		Movement Pain		Experimental Pain	
R-Sq. Final Model (p-value)		.056 (.054)		.040 (.127)	
Prognostic Factor		Beta	p	Beta	p
Middle Age (40-59y) *		0.196	.070	0.057	.593
Older Age (60-79y) *		0.241	.026	0.217	.045

B)		Movement Pain		Experimental Pain	
R-Sq. Final Model (p-value)		0.175 (.015)		0.173 (.021)	
Prognostic Factor		Beta	p	Beta	p
Pre-operative Movement Pain		0.150	.160		
Pre-operative Experimental Pain				0.281	.005
Sex ¶		0.025	.801	0.177	.082
Pain Duration		−0.026	.790	0.057	.561
Pain Catastrophizing		0.199	.044	−0.191	.056
Capsular Procedure		0.151	.150	−0.032	.760
Analgesic Medication		−0.035	.728	−0.111	.295
Middle Age (40-59y)		0.162	.145	0.008	.944
Older Age (60-79y)		0.231	.040	0.162	.157

Significant predictors are bolded. **A)** Crude estimate of age group influence on outcomes; **B)** Age group influence after accounting for prognostic factors.

* = Compared to Young Adults (20-39y)

¶ = Sex coded as 0 for male, 1 for female.