Association of Complementary and Integrative Health Interventions with Opioid Use among Veterans with Musculoskeletal Disorders and PTSD

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- No conflicts of interest.
- The views expressed are those of the presenters and do not necessarily reflect the position or policy of the Dept. of Veterans Affairs or US government.
- Funding: HSR&D IIR 16-262 to Drs. Joseph Goulet and Qing Zeng (MPI).

- This is a work in progress…

Session Outline

- Background
- Aims of the Project
- Current analysis
- Additional information, given time

Pain Management is a VA priority

- Up to 50% of Veterans in VA care report pain
- The number of Veterans with LBP is growing
- ℞ opioids are a factor in overdose deaths
- VA costs for low back pain care ~ $2.2 billion

Cifu et al., 2013; Haskell et al., 2006; Sinnott, 2009; CDC; Ilgen et al, 2016; Yu et al., 2003

Introduction

- Opioid misuse has become a serious public health issue worldwide.
  - They are a leading cause of death in the USA.
- CIH interventions may help reduce opioid related harms.
- However, "the evidence base regarding the effectiveness of select CIH interventions for reducing opioid use is extremely limited." (QUERI ESP)
- Veterans with PTSD are at higher risk for opioid related harms given the potential mutual reinforcement of PTSD and pain.
  - Does CIH reduce opioid initiation and harms?
- We examined CIH use among Veterans with musculoskeletal disorders (MSD) and compared opioid dispenses by PTSD status.

Aims

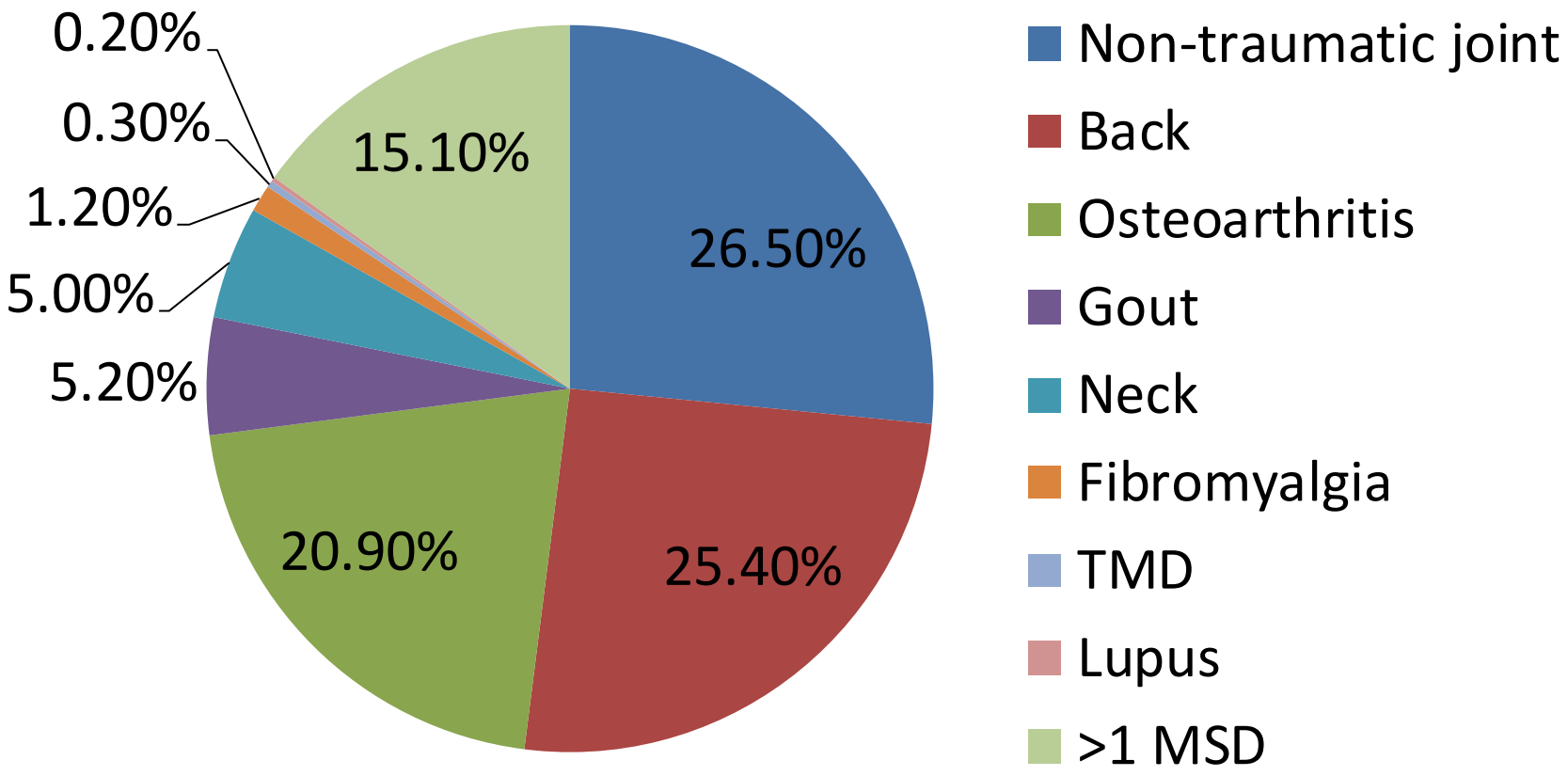
- The aims of the study are to determine:
  - 1) whether and to what extent CIH may mitigate opioid treatment among Veterans with MSD diagnoses;
  - 2) whether the relationship between CIH and opioid treatment differs among Veterans with and without PTSD.

- H0: Among Veterans with MSD, CIH receipt will reduce the likelihood of opioid dispenses, dose, and duration, and the benefit would be more pronounced among Veterans with PTSD.

Methods MSD

- We identified Veterans with ICD-9/10-CM MSD diagnoses including; joint, back, and neck disorders
- Inclusion: 2+ outpatient visits within 18 months, *or* 1+ inpatient visit with an MSD dx, 2005 - 2017.
  - The first MSD diagnosis date is the index date.
- Demographic and clinical data extracted from CDW *prior to and following* the MSD index date, including:
  - Non-MSD diagnoses, e.g., PTSD
  - Dispensed opioid prescriptions
  - Pain intensity numeric rating scores (NRS)

Proportion of Veterans with Specific MSD



Methods CIH

- Data on CIH was identified using natural language processing (NLP) on progress notes, and CPT/ICD codes where available.

Procedure	CPT code	Definition
Acupuncture	97810, 97811, 97813, 97814	15 minute increments of Acupuncture involving 1 or more needles, with or without electrical stimulation
Massage	97124	15 minutes increments of massage, including stroking, compression, percussion
Biofeedback	90901, 90911, 90875, 90876	Individual biofeedback training by any modality, with or without psychotherapy, ranging from 20 to 50 minutes.
Hypnotherapy	90880	Hypnotherapy

- Veterans were considered as having received CIH if a target text indicative of any of these modalities were identified and verified by annotation.

- Annotation consisted of snippets extracted using a window of 10 words +/- the query term of interest (e.g., yoga, acupuncture).

- The NLP algorithm (a trained SVM) had 86% accuracy and was able to identify 101,628 patients not identified in structured data (a 226% increase).

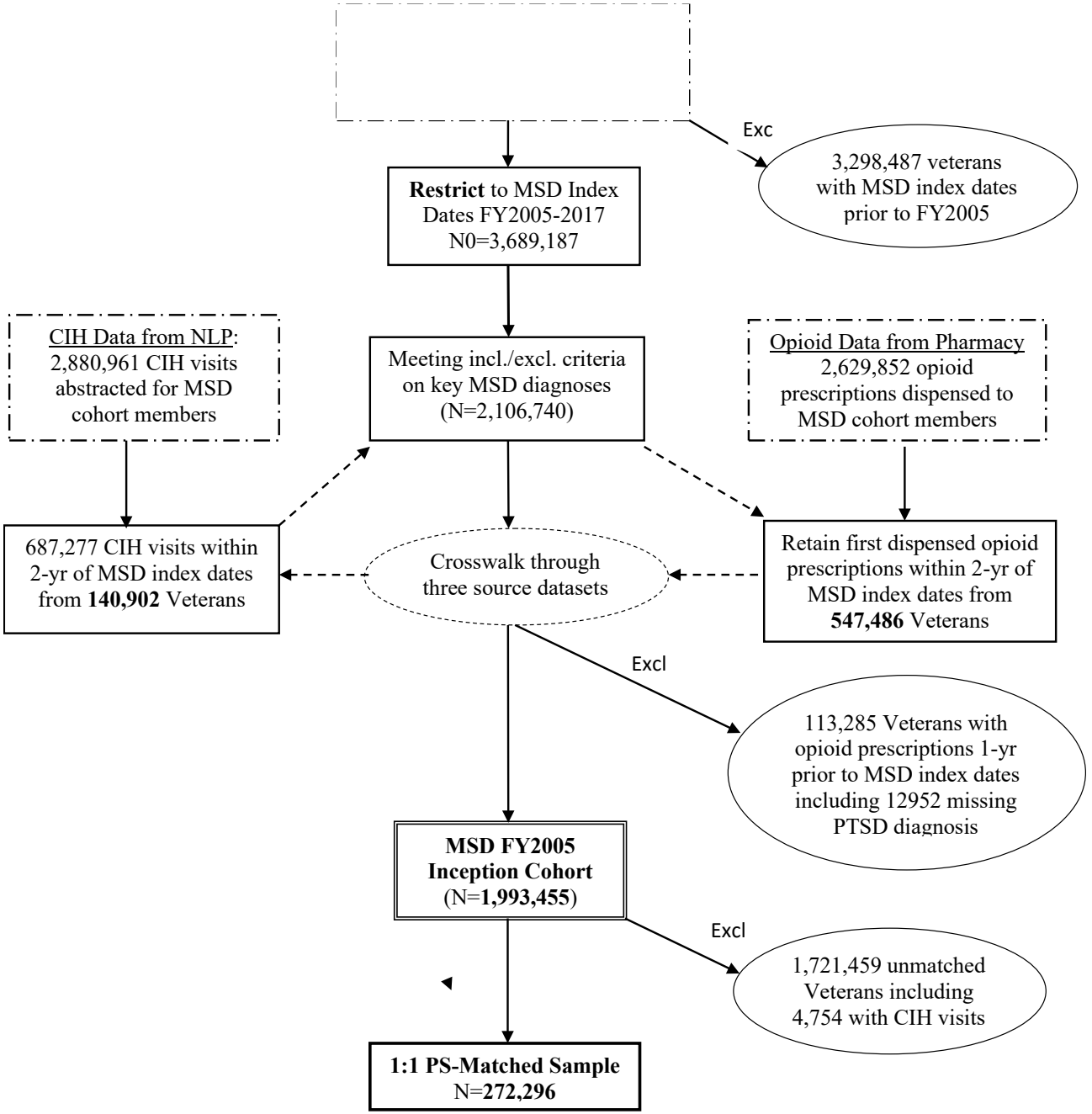
Annotation

- Veteran Smith tried yoga recently, she said it didn't help with the back pain.
- Patient unwilling to attend acupuncture clinic.
- Mr. Jones will consider biofeedback in the future if pain persists.
- Currently practicing Tai chi at local community center.
- *Not about dose, duration, or impact of CIH, about receipt Y/N.*

For the current analysis

- Cannot have fibromyalgia or osteoporosis, may be contra-indications for CIH.
- No VA opioid active in the year prior to index date.
  - An at-risk sample
- Logistic regression estimated a PS for CIH receipt (Y/N) for each Veteran, with 17 a priori selected covariates
- Then, used a greedy nearest neighbor match to select one control for each CIH recipient based on Mahalanobis distance with a caliper of ≤ 0.20 logit (PS)

Figure 1. A Flowchart of Study Cohort Assembly



Analyses

- We used a Cox proportional hazard model to test our hypothesis.
- The event of interest was an opioid dispense (Y/N)
- Time was defined as the days from MSD index to the first opioid dispensed during a 2-year follow-up period.
- Veterans who did not receive an opioid were censored at death or the end of follow-up, whichever came first.

Analyses cont.

- First, we fit a baseline model with the CIH exposure (Y/N) and PTSD diagnoses (Y/N) as the independent variables.
- Next, we adjusted for concurrent use of BZD, gabapentin, MMT or tramadol during the follow-up and for moderate to severe pain at baseline to address residual confounding not captured by the PS score.
- Then added an interaction term between CIH and PTSD, to determine whether the association with opioid initiation differed between Veterans with and without PTSD.
- Adjusted hazard ratio (HR) and 95% CIs were estimated for overall CIH exposure and PTSD diagnoses, respectively, with use of a robust sandwich variance estimator for standard errors.
- Matching was accounted for by treating each matched pair as a cluster.
- Next, we used a GEE to model daily MEQ dose and total days supply (duration) of opioids dispensed, each as a normal distribution, among those who were dispensed opioid.

Table 1. Baseline characteristics of Veterans with back pain or neck pain who obtained first diagnoses for musculoskeletal disorders during fiscal year 2005-2017

Characteristics	Full Cohort†		PS Matched Sample		STD‡	
	Overall (N=1,993,455)	No CIH Visit (N=1,852,553)	No CIH Visit (N=136,148)	≥ 1 CIH Visits (N=136,148)	Full Cohort	PS-Matched
Age (yr), Mean±SD	52.9±17.2	52.1±17.5	45.3±15.0	45.3±14.8	0.520	0.001
Women (N, %)	158013 (7.9)	136231 (7.4)	21232 (15.6)	21232 (15.6)	0.257	0.000
Race/ethnicity						
Non-Hispanic White	1396701 (70.1)	1307867 (70.6)	84485 (62.1)	85740 (63.0)	0.161	0.020
Non-Hispanic Black	339476 (17.0)	310032 (16.7)	31167 (22.9)	28429 (20.9)		
Hispanic	139757 (7.0)	127358 (6.9)	11679 (8.6)	12067 (8.9)		
Others/unknown	117521 (5.9)	107296 (5.8)	8817 (6.5)	9912 (7.3)		
Currently married	1104297 (55.4)	1041896 (56.2)	63031 (46.3)	61360 (45.1)	0.241	0.025
BMI, Mean±SD	29.6±5.7	29.6±5.7	29.4±5.7	29.3±5.7		
Obese (BMI ≥ 30.0)	839772 (42.1)	784477 (42.4)	55207 (40.6)	54008 (39.7)	0.063	0.018
Overweight (BMI 25-29)	758995 (38.1)	706094 (38.1)	51008 (37.5)	51039 (37.5)		
Normal/Underweight (BMI<25)	394688 (19.8)	361982 (19.5)	29933 (22.0)	31101 (22.8)		
Current smoker¶	734039 (36.8)	669529 (36.1)	58884 (43.3)	60813 (44.7)	0.197	0.029
Primary indication MSDs						
Back pain	208446 (10.5)	191144 (10.3)	16337 (12.0)	16461 (12.1)	0.060	0.003
Neck pain	251744 (12.6)	227263 (12.3)	23920 (17.6)	22588 (17.3)	0.140	0.007
Low back pain	773257 (38.8)	711987 (38.4)	61754 (45.4)	59149 (43.4)	0.103	0.039
Non-traumatic joint	1076278 (54.0)	1006740 (54.3)	66274 (48.7)	67564 (49.6)	0.100	0.019
MSD conditions, Mean ±SD§	1.3±0.5	1.3±0.5	1.3±0.6	1.3±0.6	0.104	0.005
Mental health conditions						
PTSD	381783 (19.2)	308158 (16.6)	71069 (52.2)	69205 (50.8)	0.809	0.031
Mood disorders	309749 (15.5)	246677 (13.3)	60276 (44.3)	58771 (43.2)	0.738	0.026
Alcohol use disorders	129250 (6.5)	94141 (5.1)	28371 (20.8)	30971 (22.8)	0.578	0.056
Substance use disorders	138083 (6.9)	97441 (5.3)	34611 (25.4)	36109 (26.5)	0.660	0.031
Inpatient services	49336 (2.5)	33077 (1.8)	9391 (6.9)	12613 (9.3)	0.114	0.031
Years of observation, Mean±SD	5.9±3.5	5.8±3.5	7.2±3.2	7.2±3.3	0.410	0.003
Moderate to severe pain‖	871,437 (43.7)	803,661 (43.4)	70,695 (51.9)	65,574 (48.2)	0.034	0.027

Results

- The average age was 53, with majority where male and Non-Hispanic.
- Non-traumatic joint injuries and low back pain were the leading MSD
- PTSD was the most common mental health diagnosis.
- During the follow-up, 7.1% of the **full** cohort were exposed to CIH, the top three modalities mediation (57.2%), yoga (16.6%) and acupuncture (14.3%).
- Before PS-matching, Veterans with and without CIH differed in 15 of 17 characteristics (STD range: 0.11-0.81). After PS-matching, all characteristics were balanced (STD range: 0.06-0.000).
- In total, 27.5% of Veterans filled ≥ 1 opioid prescriptions during the 2-year follow-up, 20.3% of CIH recipients vs. 28.0% non-recipients.
- Among those dispensed, the average MEQ daily dose was 22.8 mg and total supply was 17.7 days on initial dispensing.
- In the PS-matched sample 25.8% filled ≥ 1 opioid prescriptions, with an average MEQ daily dose of 23.2 mg (23.0 mg with and 23.3 mg without CIH exposure) and total supply of 15.3 days (13.7 days with and 16.4 days without CIH exposure).

Results, time-to-event

Model	Parameters		HR (95% CI)*
1. Baseline model (unadjusted)	*CIH effect*		0.486 (0.480, 0.492)
	PTSD diagnosis		0.934 (0.905, 0.964)
2. Adjusted for co-medication use during follow-up and NRS>+4	*CIH*		0.450 (0.442, 0.458)
	PTSD		0.898 (0.859, 0.939)
3. Adding CIH * PTSD interaction	*CIH effect in:*	*No PTSD*	0.441 (0.429, 0.454)
		PTSD	0.457 (0.445, 0.469)

- Model 1 included only CIH exposure (*Y/N*) during the 2-year follow-up period and PTSD diagnoses (*Y/N*) at baseline as independent variables.

- Model 2, co-medications included BZD, gabapentin, MMT and tramadol dispenses during the follow-up and moderate to severe pain at baseline, defined as a NRS score ≥4.

- Model 3, CIH * PTSD interaction p value = 0.082.

The adjusted mean time to first opioid dispense in the PS-matched sample was 3.82 (95% CI: 3.76-3.87) months **longer** among veterans receiving CIH than their matched counterparts, with no statistically significant CIH by PTSD interaction (p = 0.755).

Results, dose & duration

- Among opioid users, the adjusted average MEQ daily dose among veterans exposed to CIH was 2% lower than those not exposed to CIH (relative effect, 0.98 (95% CI: 0.96-0.99); p value for interaction: 0.802).
  - Similar initiating dose for PTSD and not PTSD

- However, the adjusted CIH effect on total days supply of opioid was higher among veterans with PTSD (relative effect, 0.86 (95%CI: 0.84-0.87)) versus those without PTSD (relative effect, 0.81 (95%CI: 0.80-0.82 0.86 (95%CI: 0.84-0.87)), with a significant CIH by PTSD interaction ($p < 0.001$).
  - CIH lowers the duration, but not as much as among those with PTSD

- The conventional multivariable Cox model in the full cohort, adjusting for all covariates simultaneously, derived comparable results (aHR, 0.47 (95% CI: 0.46-0.49); p value for CIH by PTSD interaction: 0.938)

Conclusions

- Veterans who were exposed to CIH were significantly less likely to start new opioid prescriptions than those who were not exposed in two years of follow-up, conferring to an average 3.8 month delay in opioid treatment.
  - Is this a good thing?
- The lack of statistically significant differences with regard to PTSD diagnoses and the average daily dose of opioid prescriptions deserves further investigation.
- The longer duration for those Veterans with PTSD who initiated opioids also deserves further analyses.
- *The goal is not to eliminate opioids, but to reduce potential harms.*

Limitations

- Don’t know severity of MSD, may vary by PTSD
  - Include multiple MSD dx? Not the same?
  - Chronic versus acute MSD?
  - PTSD treatment?
- Unmeasured confounding
  - Patient preferences, etc.
- Lack of reporting/recording CIH in note
- Lack of modalities and variation over time and place.
- NLP may not identify all modalities, nor did we look for dose, duration, and outcomes

Discussion

- I’d like to hear opinions and impressions from the field of whether our findings make clinical sense, and fit in with your experiences.

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- And many others

Specific Aims of the MSD Cohort Study

- Identify Veterans with MSD, and describe
  - Their socio-demographic and clinical characteristics;
  - Variation in pain screening, severity, and persistence of pain;
  - Duration and recurrence of MSD episodes.
- Assess variation in pain treatment and outcomes, including
  - Differences in time to and in types of treatment;
  - Effect of mental health treatment on pain;
  - Adverse events associated with chronic opioid therapy.
- Estimate the costs of MSD care
  - By patient and facility characteristics;
  - By clinical characteristics;
  - Resulting from adverse events associated with opioid therapy.

Pain research using VA EHR data sources

Sources of pain data.

Source	Percent*	Impression of Data Validity (median score)†
NRS Scores	78	5
ICD-9 Codes for Pain	66	4
CPRS Progress Notes	41	4
Pharmacy	39	5
CPT Codes	38	4
CPRS Problem List	38	3.5
Other (e.g., patient self-report, RAI/MDS)	24	5.5
Clinic Stop Codes	22	4
CPRS Discharge Summary	16	4

Abel, Brandt, Czlapinski, Goulet. Pain research using Veterans Health Administration electronic and administrative data sources. *JRRD*. 2016;53(1):1–12.

Describing Cohort Sociodemographic and Clinical Characteristics

Research Paper

PAIN®

The musculoskeletal diagnosis cohort: examining pain and pain care among veterans

Joseph L. Goulet[a,*], Robert D. Kerns[a], Matthew Bair[b], William C. Becker[a], Penny Brennan[c], Diana J. Burgess[d], Constance M. Carroll[a], Steven Dobscha[e], Mary A. Driscoll[a], Brenda T. Fenton[a], Liana Fraenkel[a], Sally G. Haskell[a], Alicia A. Heapy[a], Diana M. Higgins[f], Rani A. Hoff[a], Ula Hwang[g], Amy C. Justice[a], John D. Piette[h], Patsi Sinnott[i], Laura Wandner[a], Julie A. Womack[a], Cynthia A. Brandt[a]

Pain. 2016;157:1696-1703

Demographic Characteristics

	Year of Entry in to the MSD Cohort											
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
N	1,109,775	516,896	452,199	429,495	399,774	352,668	336,898	315,866	316,601	343,788	346,154	317,649
Age												
under 40	7.6%	7.6%	7.7%	8.4%	10.7%	12.9%	14.7%	17.3%	19.4%	19.8%	20.1%	20.5%
40-49	15.8%	13.7%	13.2%	12.8%	13.1%	12.9%	12.9%	13.2%	13.7%	13.9%	13.5%	13.2%
50-64	32.7%	32.4%	34.5%	36.6%	37.4%	38.0%	38.4%	39.3%	39.2%	40.1%	39.8%	38.8%
65+	43.9%	46.3%	44.6%	42.2%	38.7%	36.3%	34.1%	30.1%	27.7%	26.2%	26.5%	27.5%
Sex												
Women	5.5%	4.9%	5.0%	5.2%	5.7%	6.0%	6.3%	6.7%	7.1%	7.1%	7.4%	7.7%
Race/Ethnicity												
White	74.6%	76.1%	76.3%	76.0%	74.4%	73.8%	73.4%	71.8%	70.6%	70.5%	70.2%	69.6%
Black	16.6%	14.6%	14.0%	13.8%	14.6%	14.9%	15.1%	15.7%	16.2%	16.0%	15.8%	15.8%
Hispanic	4.0%	3.8%	3.7%	4.1%	4.7%	5.1%	5.1%	5.6%	5.8%	5.5%	5.6%	5.9%
Other	2.9%	2.7%	2.6%	2.3%	2.3%	2.4%	2.4%	2.5%	2.5%	2.6%	2.5%	2.5%
Missing	2.0%	2.8%	3.3%	3.8%	3.9%	3.8%	4.0%	4.4%	4.8%	5.4%	5.9%	6.1%

Not cumulative

MSD Diagnoses

	Year of Entry in to the MSD Cohort											
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Non-traumatic joint	15.8%	18.2%	18.5%	18.4%	19.6%	19.9%	20.6%	21.4%	21.9%	22.3%	22.3%	22.5%
Back condition	17.6%	17.0%	16.8%	17.1%	17.6%	17.8%	18.1%	18.2%	18.8%	18.9%	19.0%	18.8%
Osteoarthritis	21.5%	20.4%	19.7%	18.5%	16.0%	13.9%	12.7%	11.2%	10.3%	10.1%	9.5%	9.0%
Fracture	2.0%	2.3%	2.4%	2.3%	2.5%	2.6%	2.6%	2.7%	2.5%	2.3%	2.3%	2.4%
Gout	4.3%	4.8%	4.7%	4.5%	3.9%	3.9%	3.7%	3.4%	3.2%	3.2%	3.3%	3.4%
Neck condition	2.5%	2.4%	2.5%	2.6%	2.9%	2.9%	2.9%	3.1%	3.1%	3.1%	3.1%	3.1%
Fibromyalgia	1.1%	0.9%	0.8%	0.8%	0.7%	0.8%	0.8%	0.7%	0.7%	0.7%	0.7%	0.7%
TMD	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%
>1 MSD	12.2%	11.9%	12.7%	13.5%	14.2%	15.3%	16.4%	17.5%	18.5%	19.2%	19.8%	20.3%

Not cumulative

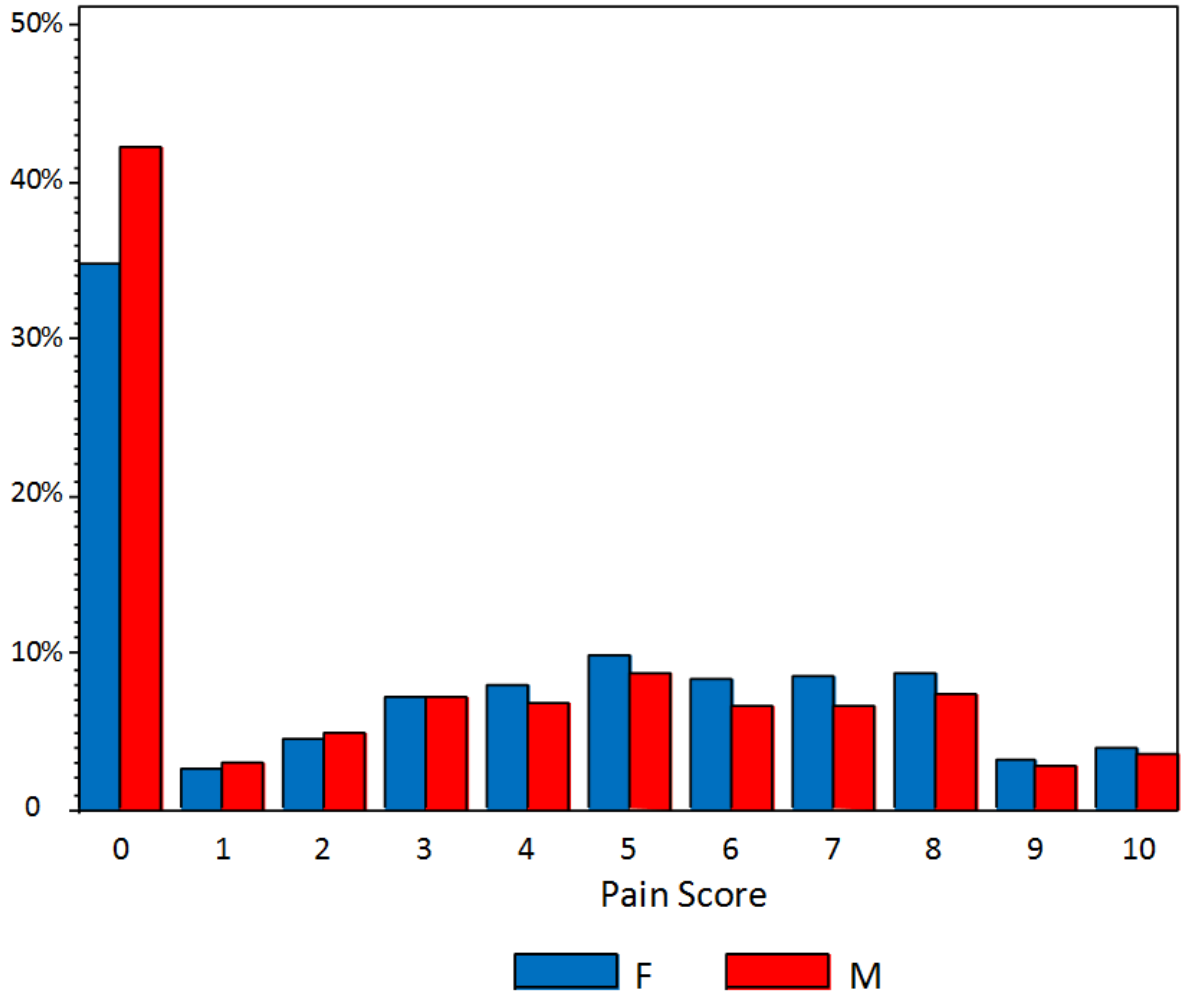
Non-MSD Comorbidity

	Year of Entry in to the MSD Cohort											
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Depressive disorders	13.6%	13.3%	13.5%	14.4%	15.1%	15.3%	15.6%	17.2%	18.6%	19.3%	19.9%	19.9%
PTSD	6.7%	5.2%	5.2%	5.4%	6.4%	7.6%	8.2%	10.2%	11.7%	11.8%	12.1%	12.2%
Alcohol Disorders	6.0%	6.8%	6.4%	6.5%	6.9%	7.1%	7.2%	7.9%	8.4%	8.5%	8.6%	8.6%
Drug Use Disorders	3.0%	3.5%	3.3%	3.3%	3.4%	3.5%	3.5%	3.8%	4.0%	3.9%	3.9%	3.8%
Hypertension	45.3%	48.7%	49.4%	50.7%	50.7%	50.4%	49.8%	48.8%	47.5%	47.0%	46.3%	45.9%
Diabetes	18.6%	19.6%	19.8%	20.2%	20.3%	20.4%	20.0%	19.7%	18.8%	18.6%	18.5%	18.8%
Coronary Artery Dis.	17.3%	19.1%	18.3%	17.9%	17.2%	16.7%	15.9%	14.7%	13.3%	12.7%	12.4%	12.4%
BMI												
Normal	22.4%	22.8%	22.3%	21.9%	22.3%	22.3%	22.2%	21.9%	21.6%	20.7%	20.4%	20.4%
Overweight	39.1%	40.0%	39.8%	39.9%	39.5%	39.1%	38.7%	38.4%	38.2%	37.8%	37.5%	37.2%
Obese	37.2%	36.0%	36.7%	37.1%	37.0%	37.5%	38.1%	38.6%	39.1%	40.5%	41.1%	41.4%

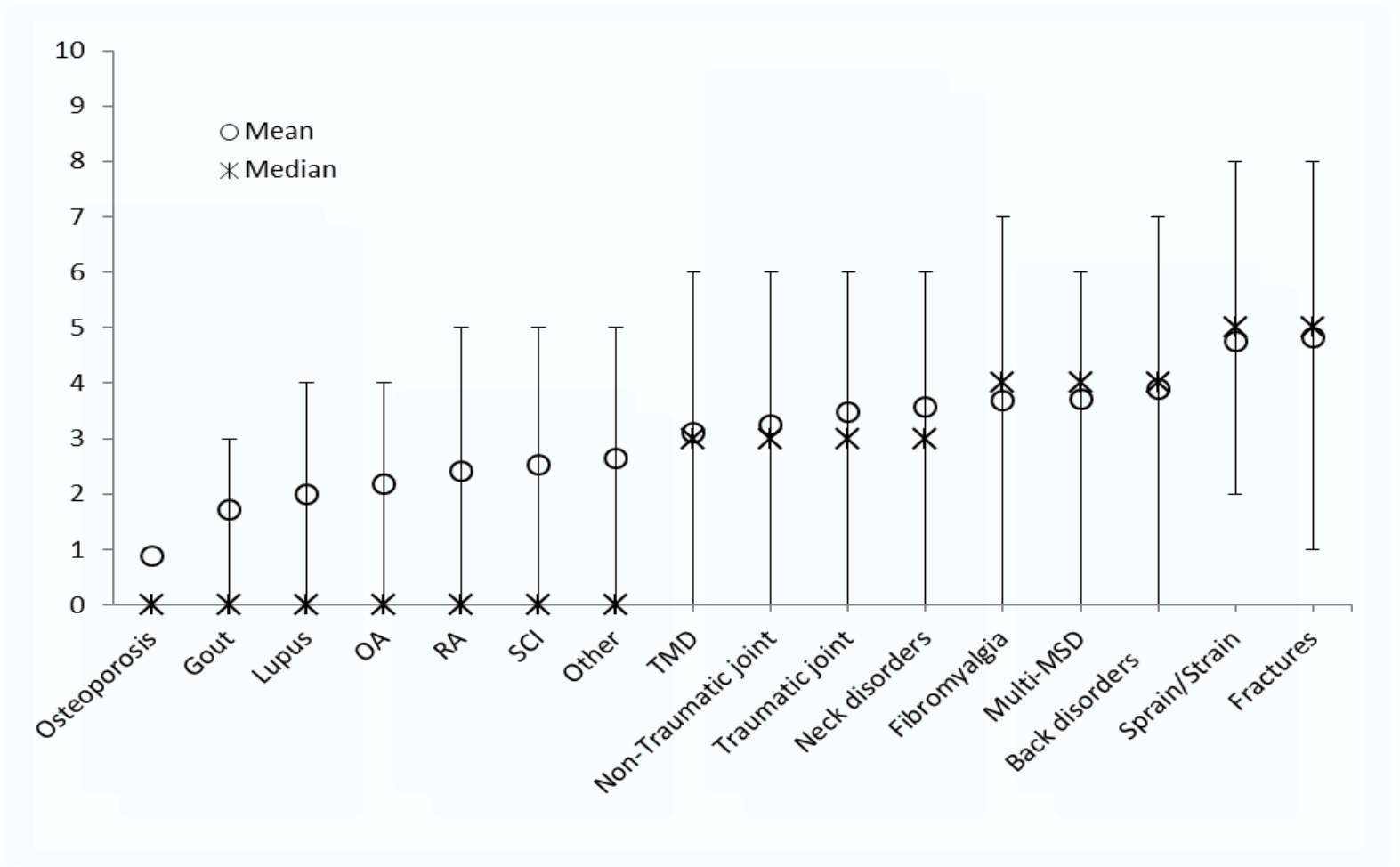
Conclusions

- Over 50% of Veterans receiving VA care 2000-2011 had 1 or more diagnosed MSD.
- That multiple MSD are increasing among younger Veterans deserves particular attention.
- These data demonstrate the potential of the MSD cohort to study complex interactions among demographic and clinical characteristics, including changes over time.

NRS score distribution on the MSD Index Date



Distribution of pain scores, by MSD diagnosis



The circles represent the mean NRS score on the MSD index date for veterans with each diagnosis, the asterisk the median, and the ends of the whiskers represent the 25th percentile (bottom horizontal bar) and the 75th percentile

Assess Variation in Pain Treatment

Arthritis Care & Research

Original Article

Racial and Ethnic Differences in Total Knee Arthroplasty in the Veterans Affairs Healthcare System (2001 – 2013)

Leslie R.M. Hausmann PhD, MS[1,*], Cynthia A. Brandt MD, MPH[2,3], Constance M. Carroll MBA, MPH[3], Brenda T. Fenton PhD, MSc[2,4], Said A. Ibrahim MD, MPH[5], William C. Becker MD[2,3], Diana J. Burgess PhD[6], Laura D. Wandner PhD[7], Matthew J. Bair MD, MS[8] and Joseph L. Goulet PhD, MS[2,3]

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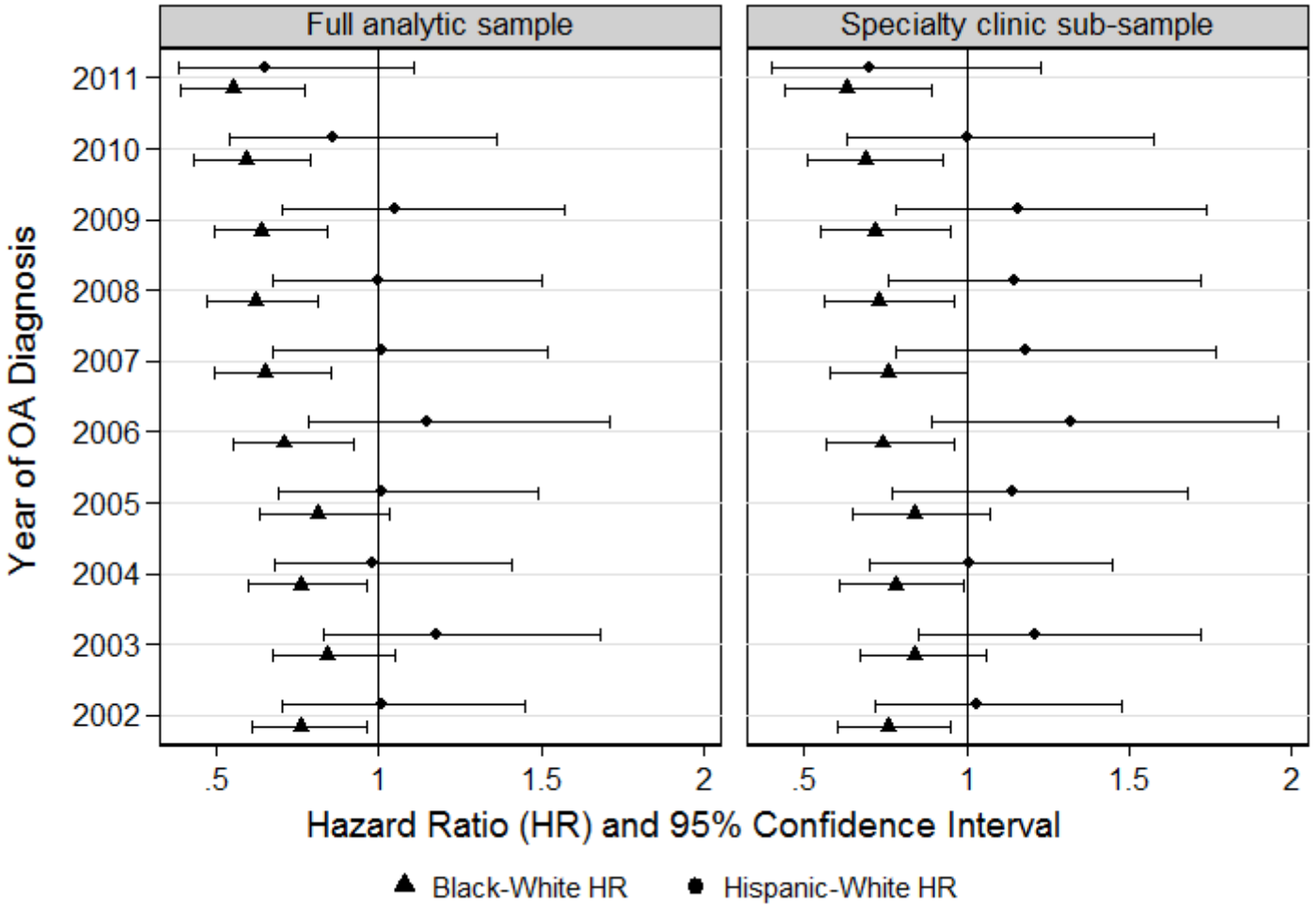
Issue

Arthritis Care & Research

Accepted Article (Accepted, unedited articles published online and citable. The final edited and typeset version of record will appear in future.)

Racial/Ethnic Differences in TKA



Hausmann et al. Arthritis Care and Research, 2016

Other Manuscripts Recently Published/in Submission

- Estimating healthcare mobility in the Veterans Affairs Healthcare System, Wang et al., *BMC Health Services Research*, 2016;16(1):609
- Gender differences among Veterans with musculoskeletal disorders, *D Higgins et al.*
- Association of co-occurring painful medical and mental health conditions in Veterans with temporomandibular disorders, *B Fenton et al.*
- Use of Spinal Cord Stimulators in a Sub-Sample of the Veterans Health Administration's Musculoskeletal Disorders Cohort from 2000-2012, *L Wandner et al.*
- Pain and the Risk for Stroke, *J Sico, et al.*

Grants Informed by MSD

- S Taylor
  - IIR 14-435: The Cost Effectiveness of Complementary and Alternative Treatments to Reduce Pain
- D Burgess
  - IIR 13-030: A proactive walking trial to reduce pain in Black Veterans
- C Brandt, RD Kerns, S Luther
  - NCIH R01: Pain Care Quality and Integrated and Complementary Health Approaches
- J Goulet, Q Zeng
  - IIR under review: Association of Complementary and Integrative Health (CIH) Interventions with Opioid Use and Related Risks among Veterans with Musculoskeletal Disorders (MSD) and PTSD

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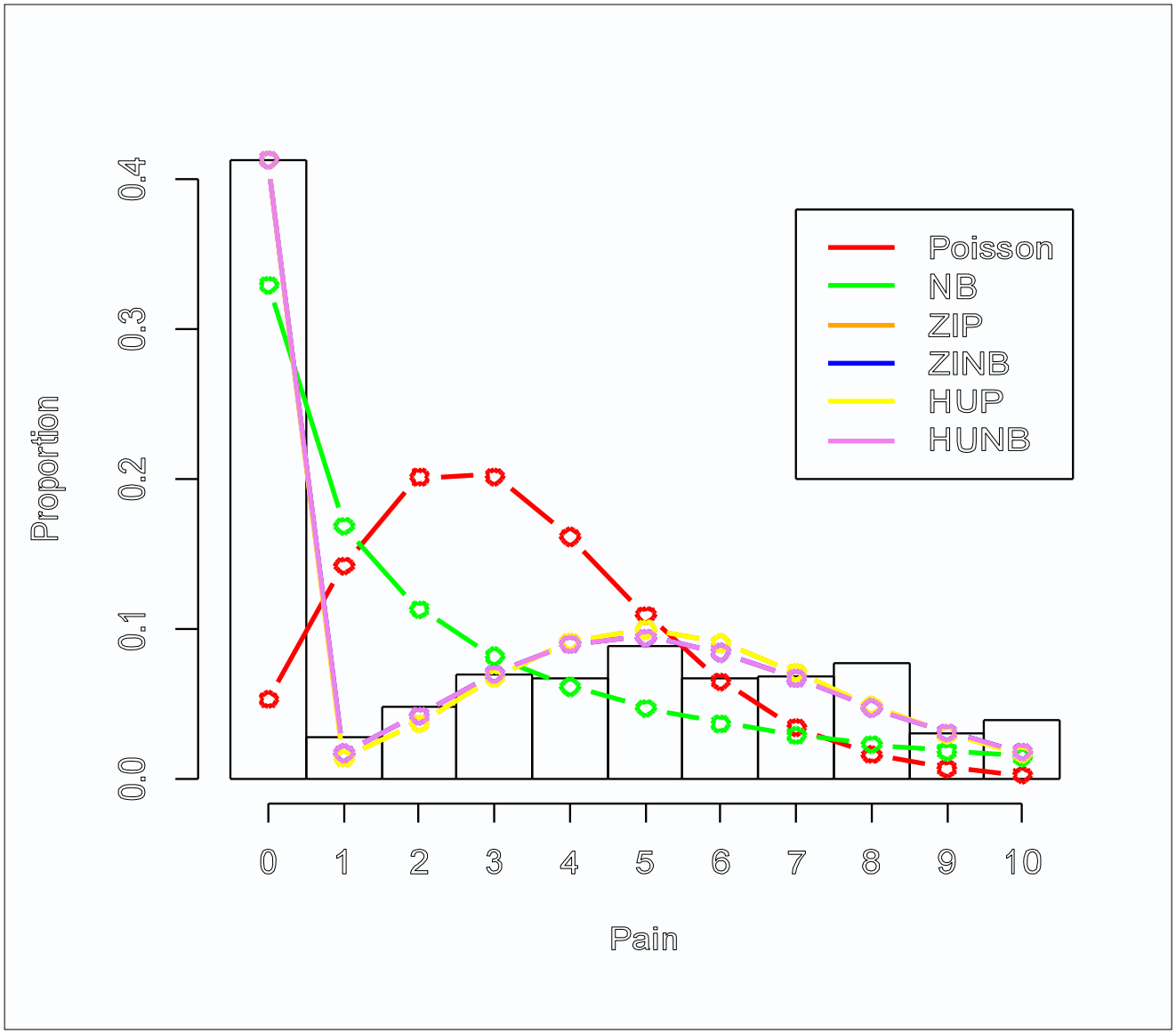
Evan Carey, VHA Denver
Hamada Altalib, VACHS
Hong Yu, Central Western MA
Jason Sico, VACHS
Jodie Trafton, Palo Alto
John Burns, Rush U
John Piette, Ann Arbor
Joseph Goulet, VACHS (PI)
Julie Womack, VACHS
Karen Wang, VACHS
Karl Lorenz, Greater LA
Laura Blakley, VACHS
Laura Wandner, Walter Reed
Leslie Hausmann, VA Pittsburgh
Liana Fraenkel, VACHS
Lindsey Dorflinger, Walter Reed
Lori Bastian, VACHS

Mark Ilgen, Ann Arbor
Mary Driscoll, VACHS
Matthew Bair, Indianapolis VAMC
Patricia Rosenberger, VACHS (deceased)
Patricia Sinnott, Palo Alto
Penny Brennan, Palo Alto
Perry Miller, VACHS
Priscilla Wang, VACHS
Qing Zeng, VA Washington, DC
Rani Hoff, VACHS
Robert Kerns, VACHS
Robin Masheb, VACHS
Sally Haskell, VACHS
Sarah Krein, VA Ann Arbor
Sarra Nazem, VA Denver
Silvia Ronzitti, VACHS
Steven Dobscha, VA Portland
Ula Hwang, Bronx VA
William Becker, VACHS

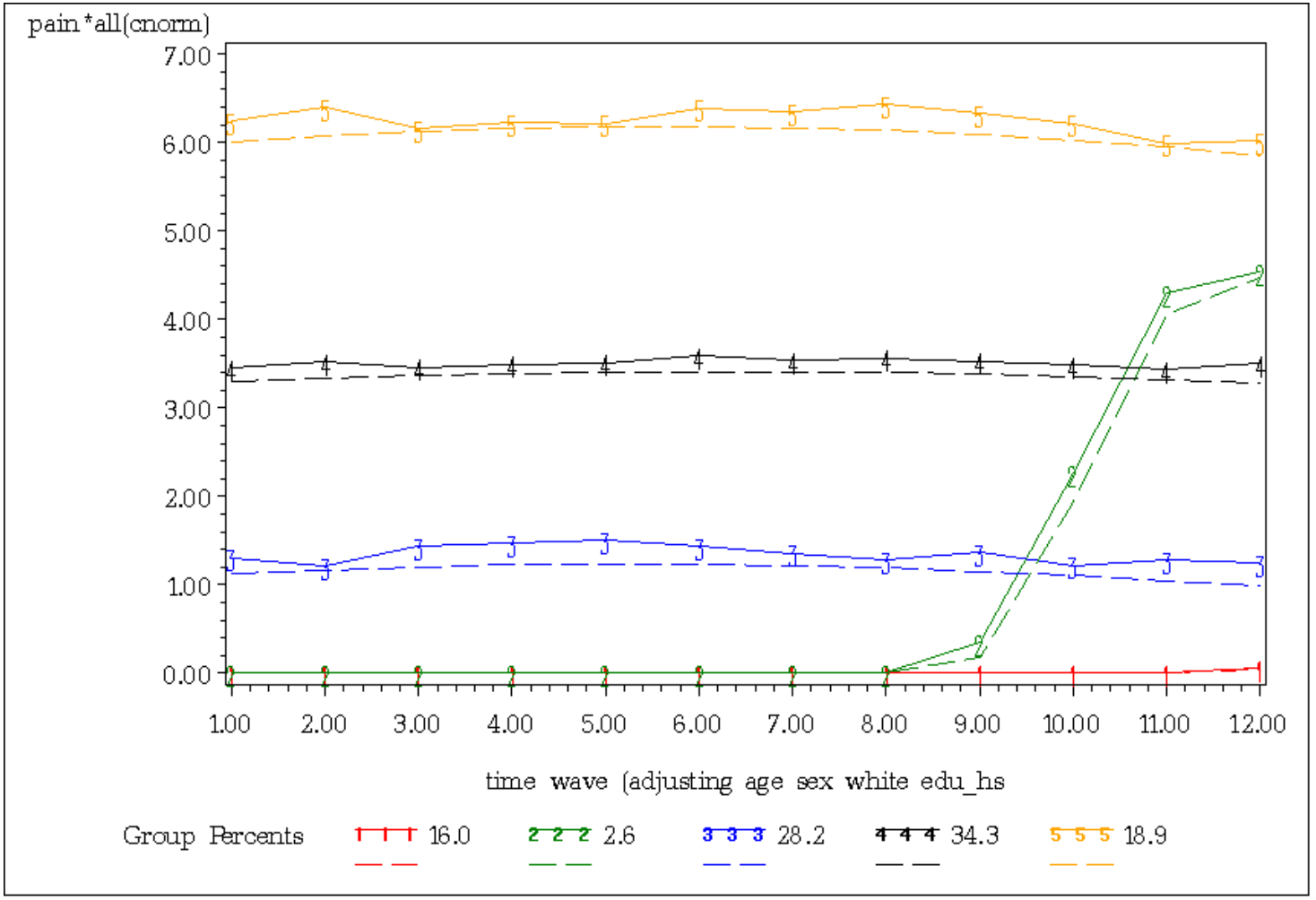
More information

Distribution of pain on MSD index date

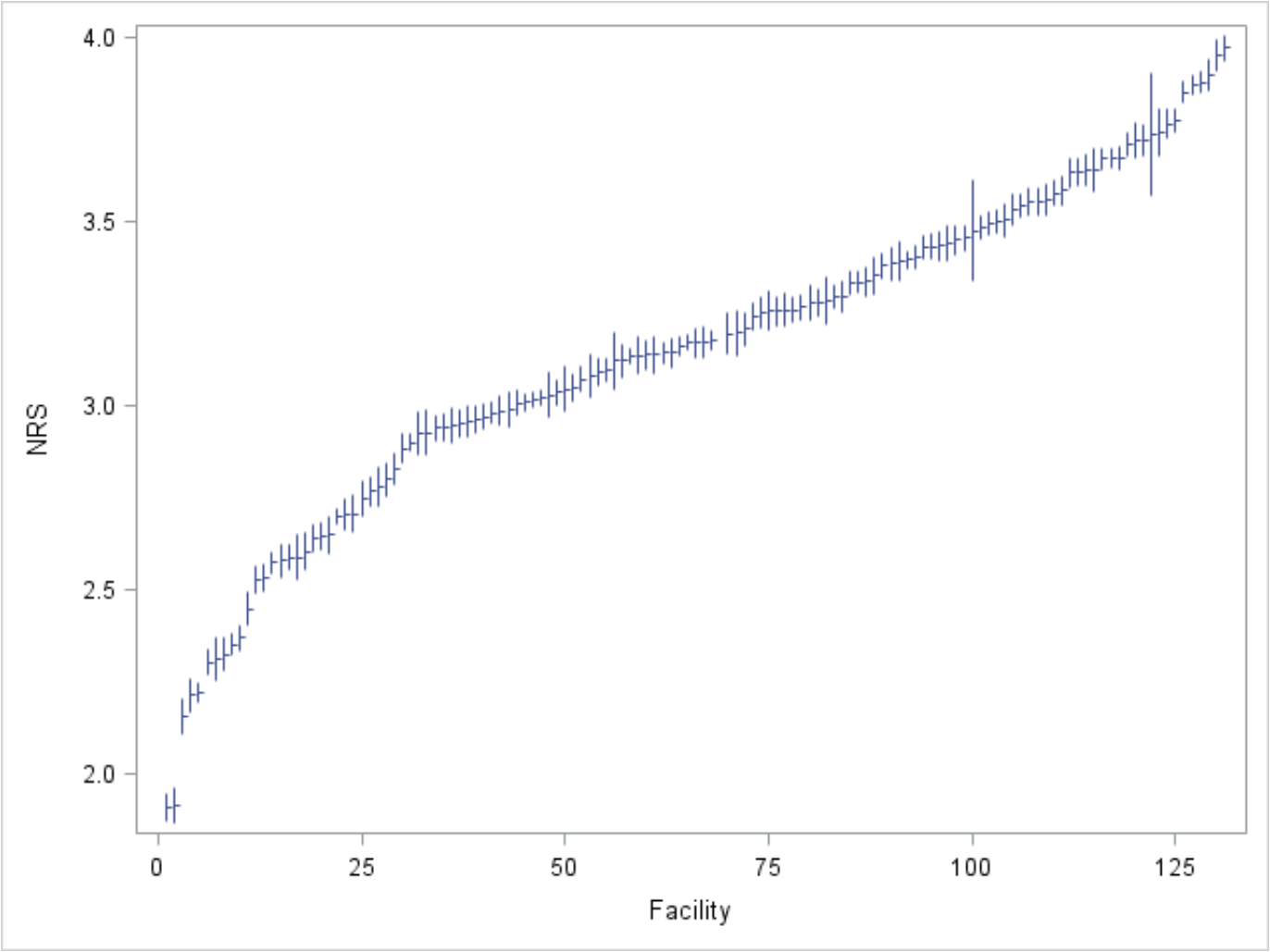


Goulet et al. Statistical models for the analysis of pain intensity numeric rating scale data. *In press*, *J Pain*

Course of Pain



Variation in Pain NRS, by VHA Facility



Unpublished data