

# Physical activity and incidence of vertebral fracture, disc height narrowing, and facet joint osteoarthritis in women and men: The Framingham Spine Health Study

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AL Lorbergs<sup>1,2</sup>, P Suri<sup>3,4</sup>, Y Zhou<sup>5</sup>, A Guermazi<sup>6</sup>, DP Kiel<sup>1,2,9</sup>, E Brochin<sup>1</sup>, C-A Meng<sup>1</sup>, M Jarraya<sup>6,7</sup>, LA Cupples<sup>5,8</sup>, ML Buxsein<sup>2,9</sup>, TG Travison<sup>1,2,9</sup>, EJ Samelson<sup>1,2,9</sup>



<sup>1</sup> Institute for Aging Research, Hebrew SeniorLife <sup>2</sup> Harvard Medical School

<sup>3</sup> VA Puget Sound Health Care System <sup>4</sup> University of Washington School of Medicine

<sup>5</sup> Boston University School of Public Health <sup>6</sup> Boston University School of Medicine

<sup>7</sup> Mercy Catholic Medical Center <sup>8</sup> Framingham Heart Study <sup>9</sup> Beth Israel Deaconess Medical Center



## Rationale

- Facet joint osteoarthritis (FJ OA), disc height narrowing (DHN), and vertebral fracture (VF) are common musculoskeletal conditions associated with significant morbidity among older adults
- Joints, discs, and bones are parts of a system; yet research to-date largely represents these features in isolation rather than as a group
- Physical activity is recommended for musculoskeletal health, however, the effect of physical activity on spine health, considering joints, discs, and bones, is largely unknown

## Objective

To conduct a longitudinal study to determine the association between baseline levels of physical activity and incidence of FJ OA, DHN, VF in a community-based population of women and men

## Methods

### Participants

- 1132 members (622 women, 510 men) of the Framingham Multi-Detector Computed Tomography (MDCT) Study
- Baseline (2002 to 2005) and follow-up (2008 to 2011) MDCT scans
- Physical examination and questionnaires completed at Framingham clinic visits

### Computed Tomography

- Baseline: Images were acquired between the carina of the trachea and the diaphragm, as well as 150mm superiorly from L5/S1 (FOV=35cm, thick=2.5mm, 0mm gap) using an 8-section MDCT (Lightspeed Ultra/Plus, GE Medical Systems)
- Follow-up: Images were acquired from T4 to L1 vertebral levels (FOV=35cm, thick=0.625mm, 0mm gap), and 150mm superiorly from L5/S1 (FOV=35cm, thick=2.5mm, 0mm gap) with a 64-section MDCT (Discovery VCT, GE Medical Systems)

### Spinal Feature Scoring

- A trained radiologist read baseline and follow-up scans side-by-side
- Spinal features were scored on each level from T4-L4 using semi-quantitative (SQ) scores as: 0 = none, 1 = mild, 2 = moderate, 3 = severe
- Incidence was defined as any level graded none or mild (SQ<1) at baseline that progressed to moderate or severe (SQ≥2) at 6y follow up

#### Facet joint osteoarthritis

- Bilateral evaluation of presence and severity of: joint space narrowing, osteophytes, articular process hypertrophy, sclerosis, subarticular erosions, subchondral cysts, and vacuum phenomenon (Suri P et al. *Osteoarthritis Cartilage*, 2013)

#### Disc height narrowing

- Reduction in disc height determined relative to the height of the disc immediately superior (Videman T et al. *Spine*, 1995)

#### Vertebral fracture

- Graded according to the % reduction in anterior, middle, and/or posterior height and area (Genant HK et al. *J Bone Miner Res*, 1993)

### Physical Activity

- At baseline, participants reported activity levels using the Framingham Physical Activity Index (PAI)
- PAI is a weighted score based on the number of hours/day spent sleeping, sedentary, and doing slight, moderate, and heavy levels of activity.

### Statistical Analysis

- Regression used to estimate RR (95% CI) for the association between 6y cumulative incidence (%) of FJ OA, DHN, VF and PAI (quartiles; Q1 = low)
- Models adjusted for baseline age, height, weight, and smoking

Table 1. Participant characteristics at baseline

	Women (N = 622)		Men (N = 510)	
	Mean or %	SD or n	Mean or %	SD or n
Age, y (range, 40-85)	60	8	60	9
Height, in	64	3	69	3
Weight, lbs	160	33	196	33
BMI, kg/m <sup>2</sup>	28	5	29	5
Current smokers, %	9	48	7	45
Physical Activity Index	37	6	38	7

## Results

Figure 1. 6y cumulative incidence of spinal features, N = 1132

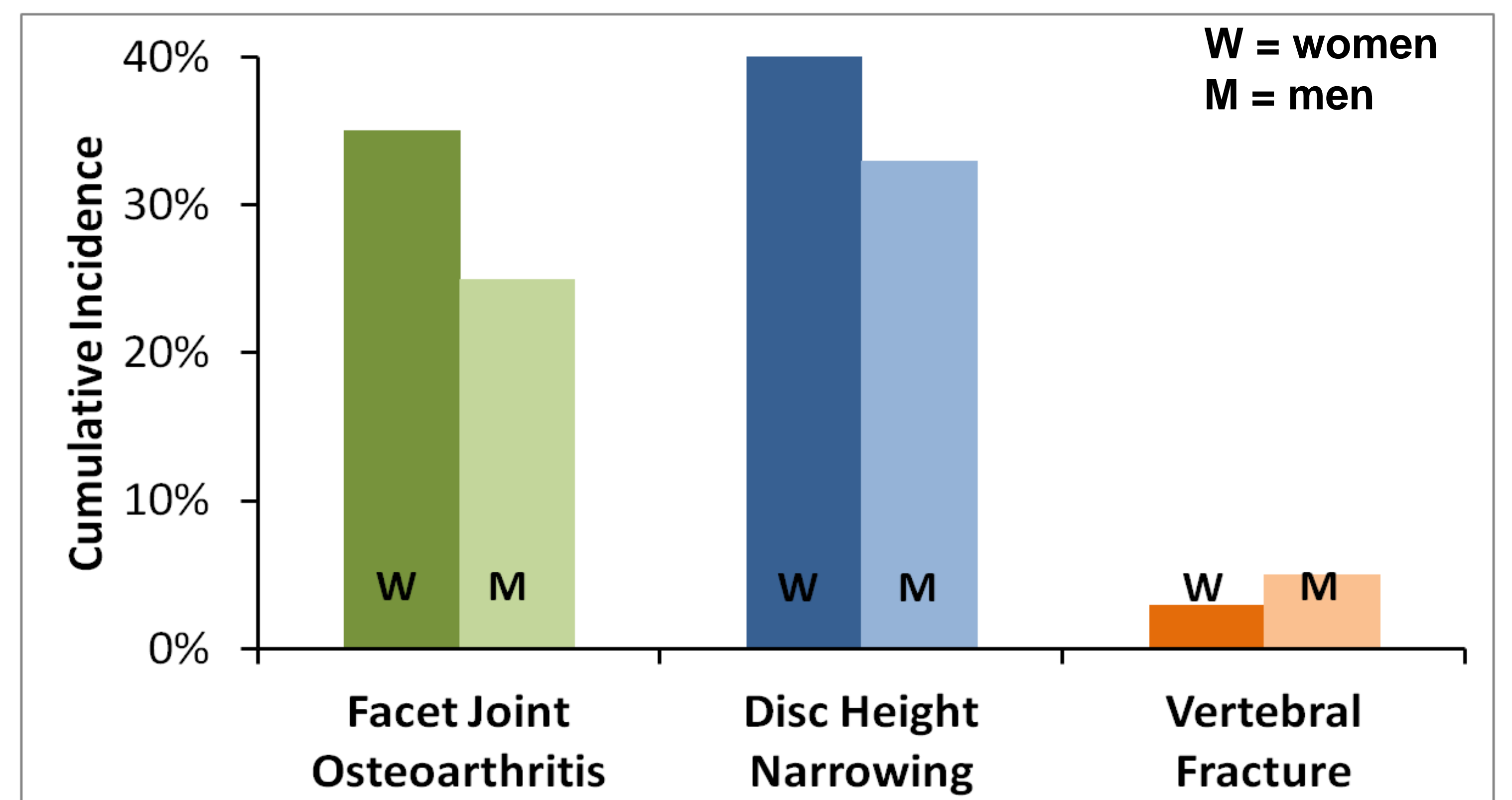
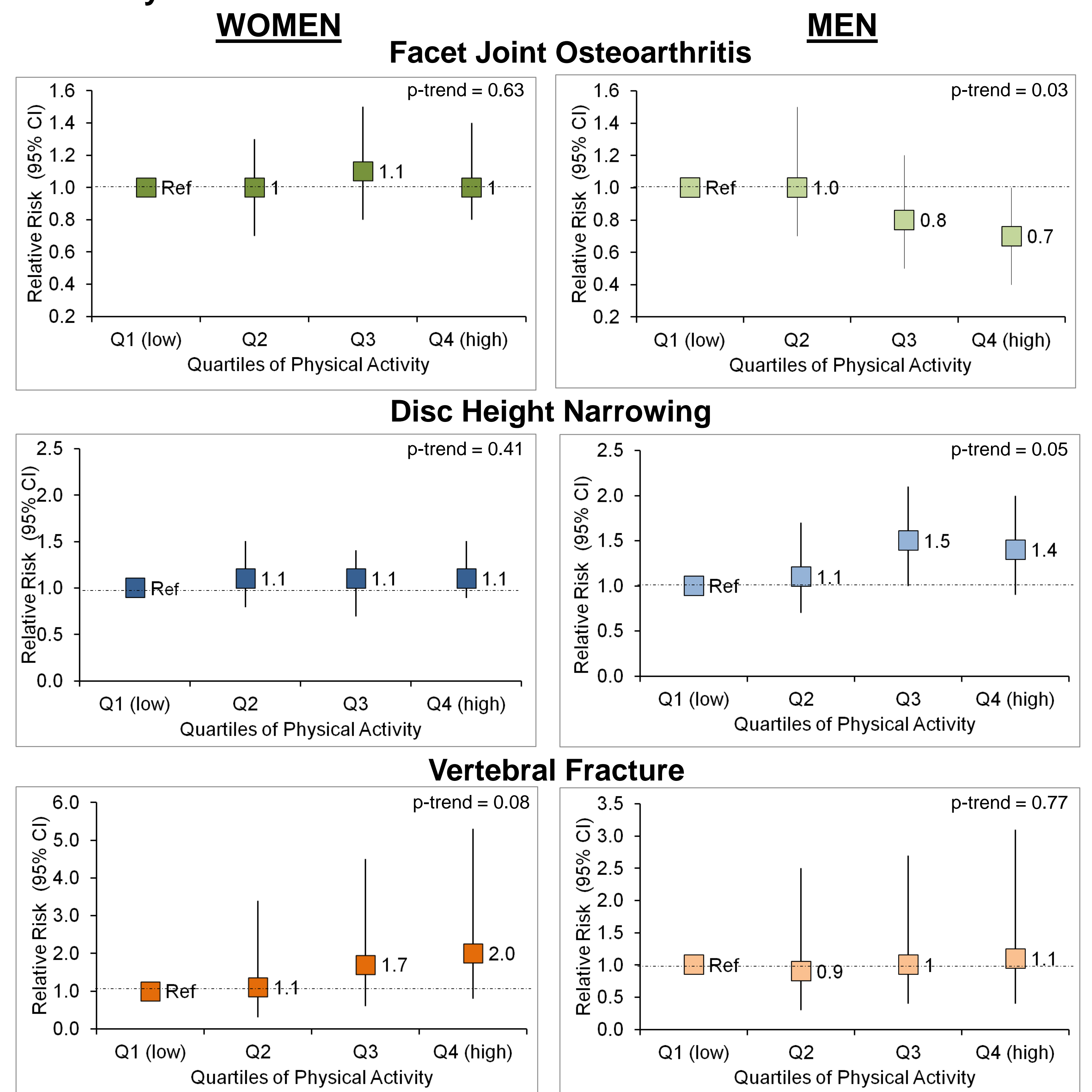


Figure 2. Relative risk of incident spinal features according to physical activity



PAI quartiles, mean (min - max):

Women: Q1: 31 (26-33) Q2: 34 (33-36) Q3: 38 (36-39) Q4: 42 (39-78)

Men: Q1: 31 (26-33) Q2: 35 (33-37) Q3: 39 (37-42) Q4: 46 (42-71)

## Discussion

### Summary

- Increased physical activity had little or no association with incidence of FJ OA, DHN, and VF in women or men
- There was a suggestion of a trend for decreased incidence of FJ OA with higher physical activity in men, but not women

### Strengths and Limitations

- Prospective study including a community-based population of women and men
- CT images used to evaluate facet joints, intervertebral discs, and vertebrae
- Physical activity was self-reported and did not assess type and long term patterns

### Conclusion

- We found that increased levels of physical activity did not significantly increase risk of VF, DHN, or FJ OA, and may possibly protect against FJ OA in men
- Increased physical activity may reduce the risk of FJ OA in men
- Physical activity does not seem to adversely affect spine health in women or men
- Evaluation of specific types of activity and loading patterns is needed to help develop ways to prevent spine disease in older adults