

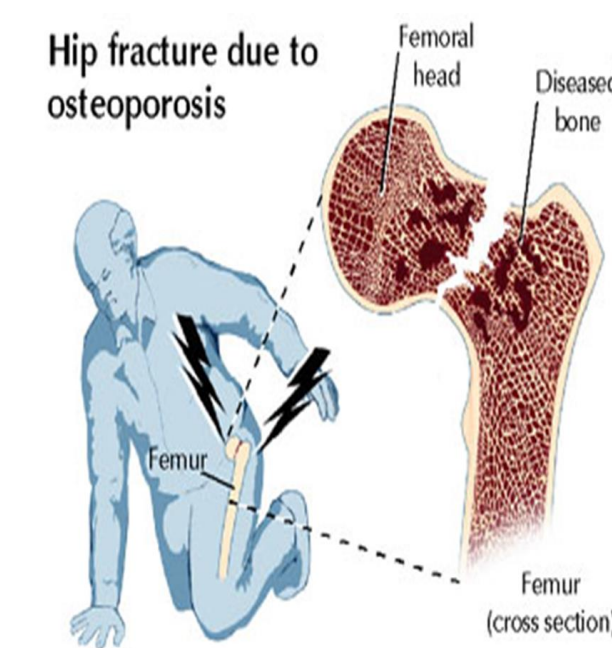
## PURPOSE

To examine impact of usual daily physical activity on bone structure at the hip (Hip Structural Analysis [HSA]) in 430 Midwestern post-menopausal women.

### Magnitude of Osteoporosis Problems:

- 10 million have disease (80% females-20% males)
- Cause in women - decreased bone strength due to menopause and aging
- One in every two women will fracture
- Annual health care costs in U.S.: \$19 billion

After hip fracture: 50% lose independence and 12-24% die within a year of the fracture.



## RATIONALE

- Best predictor of fractures is bone strength - determined by both bone structure and BMD.
- Structure -size, shape, and distribution of bone mass. Past studies on impact of activity on BMD - not on structure. Thus impact of activity on bone may be underestimated.

### Hip Structural Analysis (HSA):

- Structure at hip measured using Dual Energy Absorptiometry (DXA) and Hip Structural Analysis (HSA) software. HSA measures: cross sectional area (CSA) and section modulus (SM) at narrow neck (NN), intertrochanter (IT), and femoral shaft (FS) sites of proximal femur

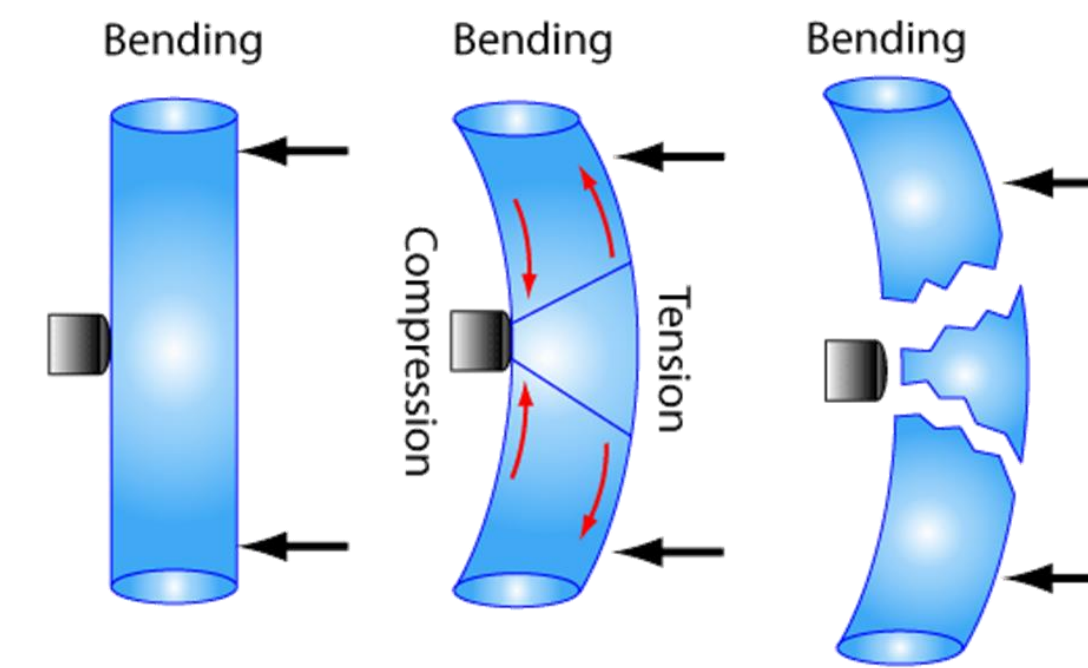
### CSA (cm<sup>2</sup>): total surface area of bone in a cross-sectional slice, excluding marrow and soft tissue:

- Greater CSA = greater cortical thickness. Cortex is solid outer layer of bone. Cortical thickness in post-menopausal women reduced. Studies report increase of in cortical thickening with exercise.



### Section Modulus (cm<sup>3</sup> (SM): indicator of bending strength of bone-ability to withstand bending stress:

- Improved SM = better resistance to bending stress
- Improved CSA = better resistance to compression stress
- Result is reduced fracture risk.



## METHODS

### Sample:

Mean Age	54.5 years
Mean Weight and Height	163 lbs. / 64 inches
Mean % Lean Mass	58.1%
White / Not Hispanic	n=368 89.8%
BMD Categories	
•Normal	n=259 61%
•Osteopenia	n=138 32%
•Osteoporosis	n=29 7%
Activity Level	
•Minimal	n=11 3%
•Moderate	n=180 42%
•Active	n=234 55%

## DESIGN

Descriptive correlational study - secondary analysis of baseline data from women volunteering for a federally funded study: "Prevention of Osteoporosis in Post-menopausal women"

HSA & BMD measures obtained using Dual Energy X-ray Absorptiometry (DXA)



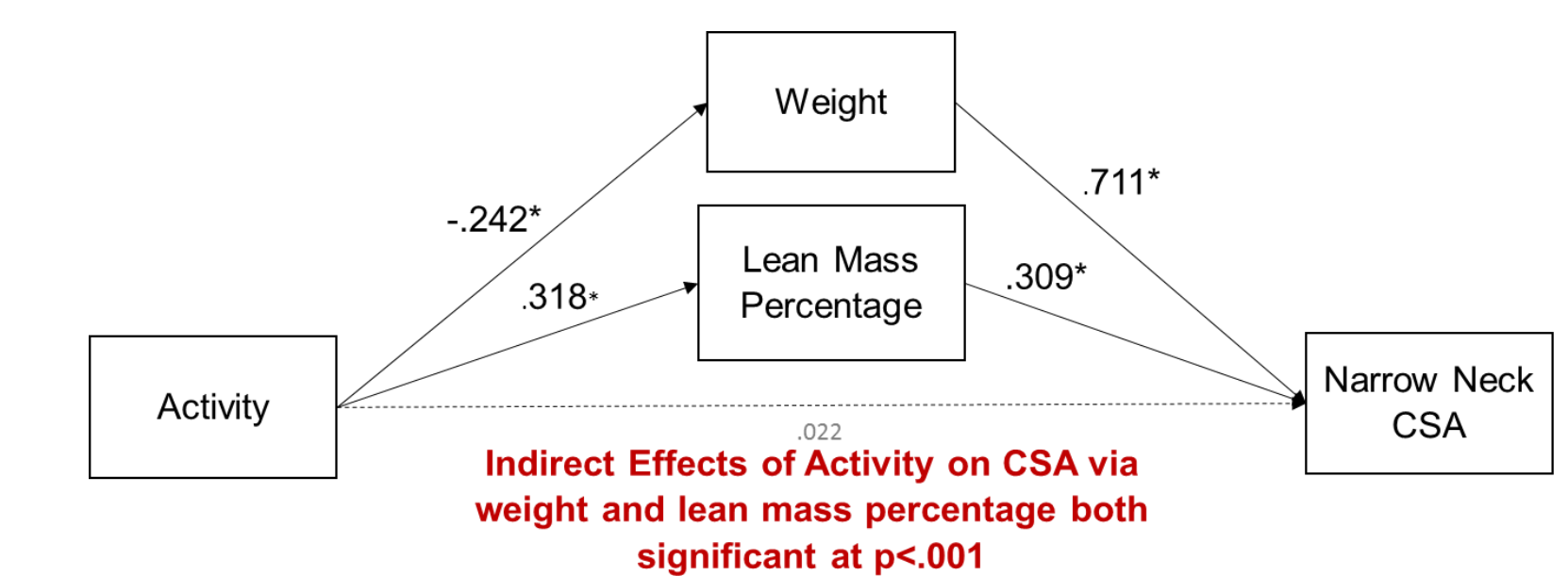
### Physical Activity Profile (HAP):

- Self-reported questionnaire
- Scores correlate with physiologic assessments of activity
- Ranks 94 activities in order of energy to perform
- HAP / Adjusted Activity Score (AAS) - usual physical activity
- 3 categories of AAS
  - Healthy active engage in strenuous leisure activity
  - Moderately active have no limitations at home or work
  - Minimally active only perform grooming and basic household demand.

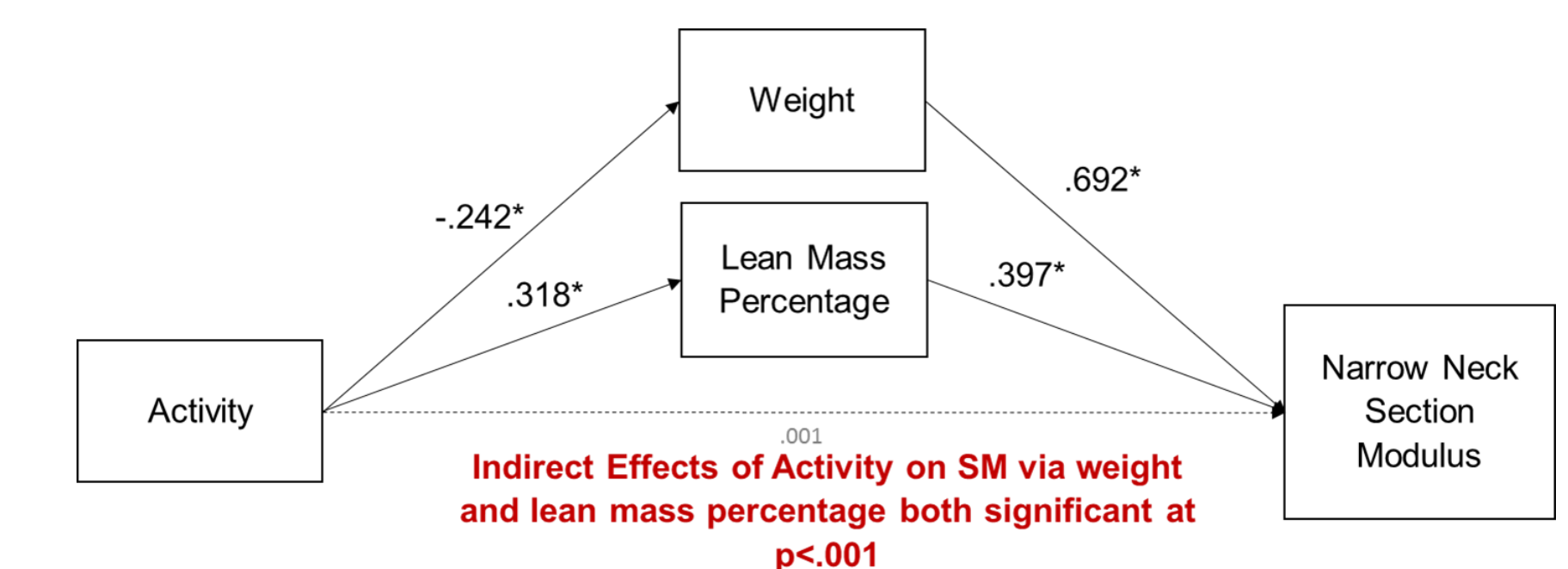
## RESULTS

Usual daily activity (AAS) had a significant indirect effect on Section Modulus (SM) and CSA at all three sites - the narrow neck (NN), intertrochanter (IT), and femoral shaft (FS) sites of the proximal femur (p<.001). Figures 1 and 2 depict path analysis for outcomes of CSA and SM at the neck of the femur – a common site of hip fracture.

**Figure 1.** Proposed path analysis depicting the association between activity, weight, lean mass percentage, and CSA at femoral neck.



**Figure 2.** Proposed path analysis depicting the association between activity, weight, lean mass percentage, and Section Modulus at femoral neck



## CONCLUSIONS and IMPLICATIONS

- In this study of 430 postmenopausal women, usual daily activity (AAS) had a significant indirect effect on Section Modulus and CSA via activity's effect on weight and % lean mass.
- Only 55% of women healthy active and engaging in strenuous leisure activities.
- Average body mass index (BMI) was 27.7. BMI >25 categorized as overweight.
- This sample had a % lean body mass (LBM) of 58.1%. Ideal % LBM ≥ 68%
- > BMI, < % LBM, and < % healthy active in this sample of women a concern for their long-term health. Implication is need to promote increases in activity and a healthier diet.
- For maximum bone health, women should participate in both resistance training and weight bearing activities with high bone-loading forces 3-5 times per week.
- Women who participate in these aggressive bone-loading exercises will require additional demonstrations, training, monitoring, and support.