Purpose
• Use deep learning (DL) to improve 10-year fracture risk prediction
• Develop models for four clinical-relevant scenarios:
  1. Opportunistic Screening
  2. Advanced Screening
  3. Full Diagnostic Workup without DXA
  4. Full Workup with DXA

Findings
By combining traditional predictors and DXA images our strongest model achieves a 0.77 AUROC for predicting 10-year hip fracture risk.

Methods
• Limit inputs to fit clinical scenarios
  1. Demographic data
  2. Demographic data + low-energy DXA image
  3. Demographic data + 17 additional data fields (blood markers, disability status, fitness indicators)
  4. All of the above + low and high energy DXA images
• Use DL models to parameterize a Poisson distribution for hazard ratio prediction

Data
• Health, Aging, and Body Composition Study (HealthABC)
  • 3075 patients - 10920 proximal femur DXA scans
  • 70-79 years old, followed up for 15-year period

Conclusions
• Deep learning can improve hip fracture prediction models already containing demographics, bone density, and clinical risk factors
• Deep learning can be applied to DXA images without post acquisition analysis

Neural Network (NN) Models
• 3 Networks that can be trained and used individually or combined
  I. Feed-forward NN for scenarios 1 & 3
  II. Convolutional architecture (DenseNet) for DXA images (scenarios 2 & 4)
  III. Full architecture for combining modalities (scenarios 2 & 4)

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