Geriatric Syndrome & Osteoporosis

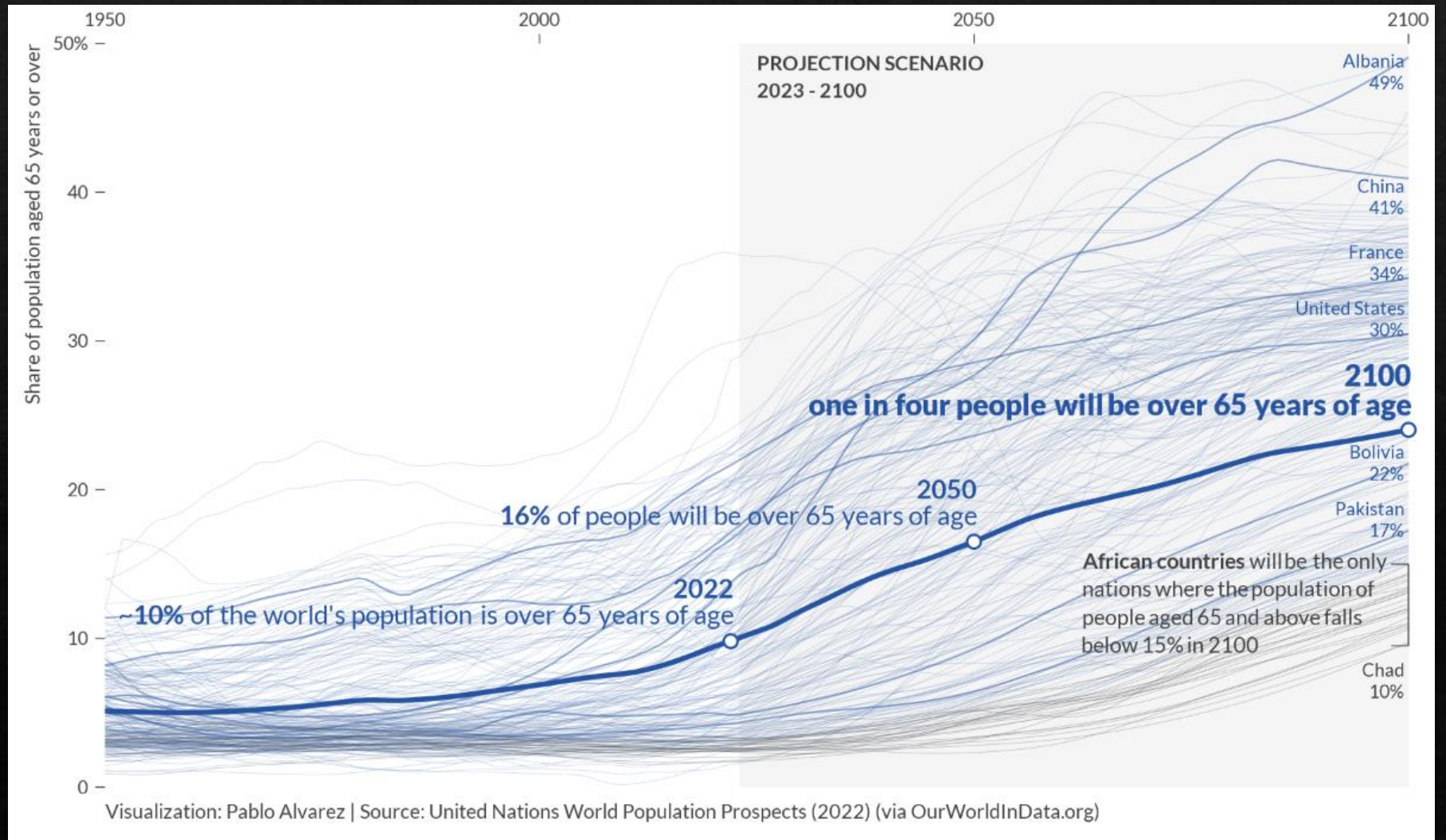
Fatemeh Alsadat Mirzadeh

Geriatric Medicine Specialist

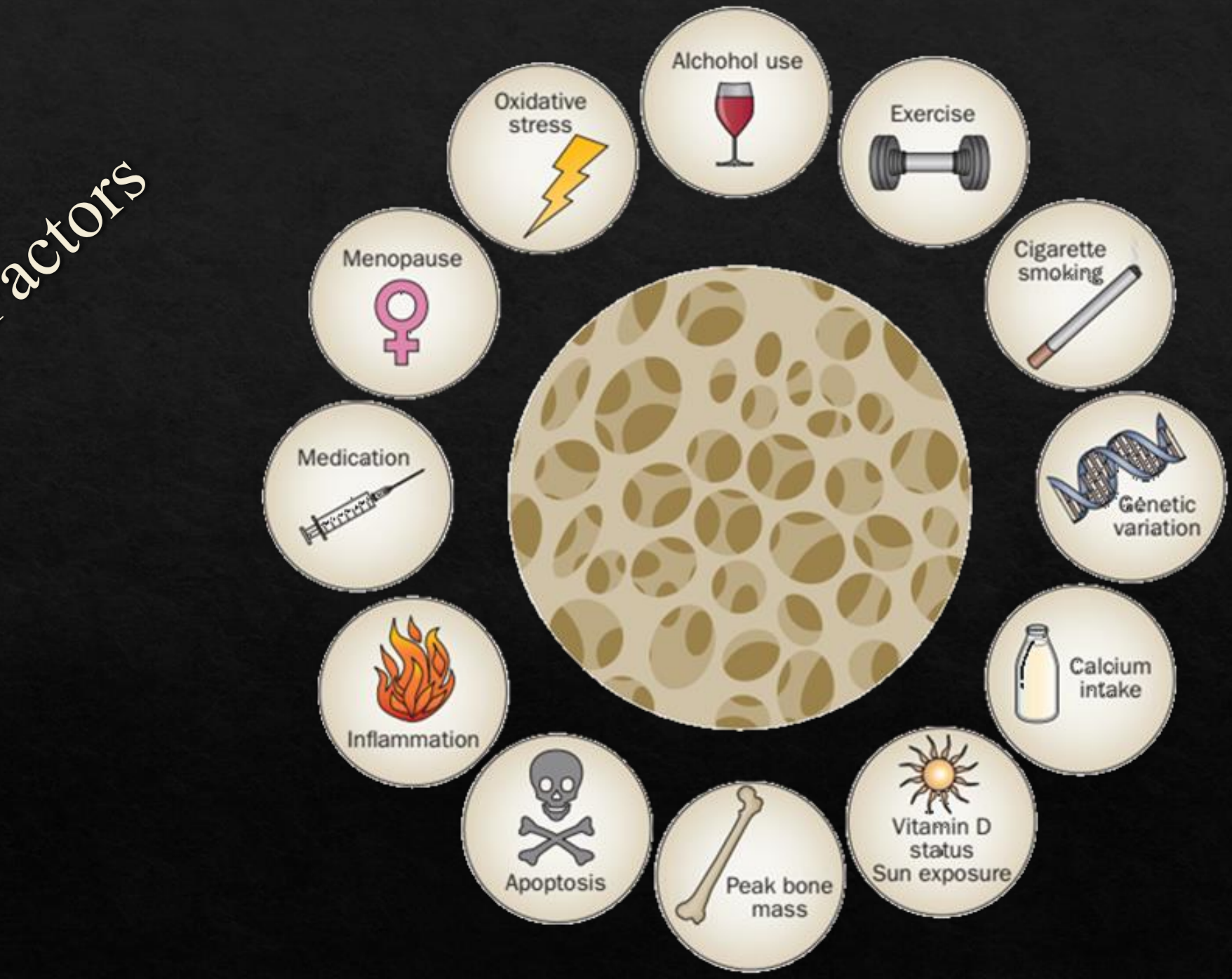
Faculty Member

Tehran University of Medical Sciences

The World's population is aging.



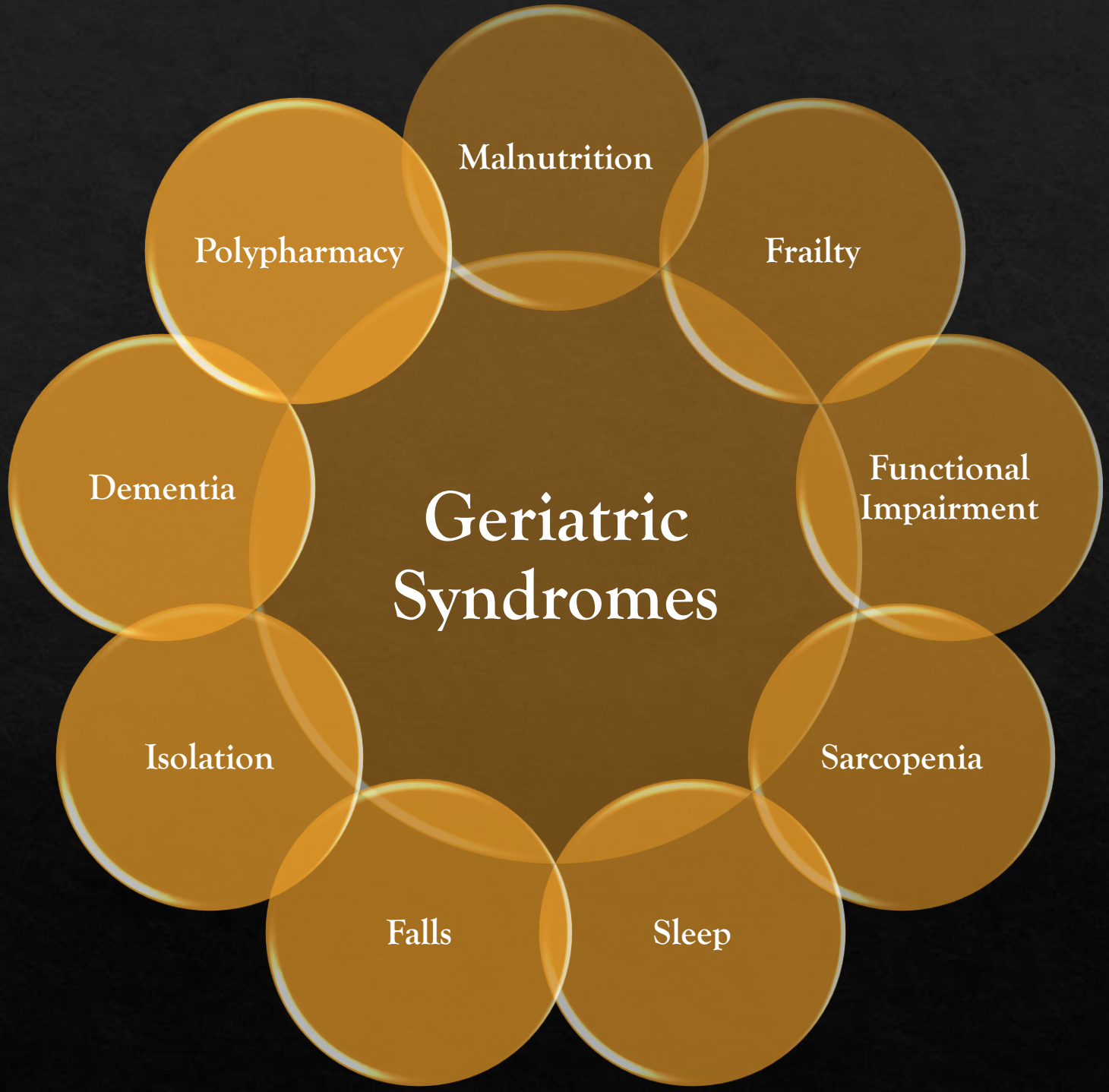
Osteoporosis Risk Factors



OSTEOPOROSIS RISK FACTORS

A • Alcohol Use
C • Corticosteroid Use
C • Calcium Low
E • Estrogen Low
S • Smoking
S • Sedentary Lifestyle

"Access" (leads to) Osteoporosis

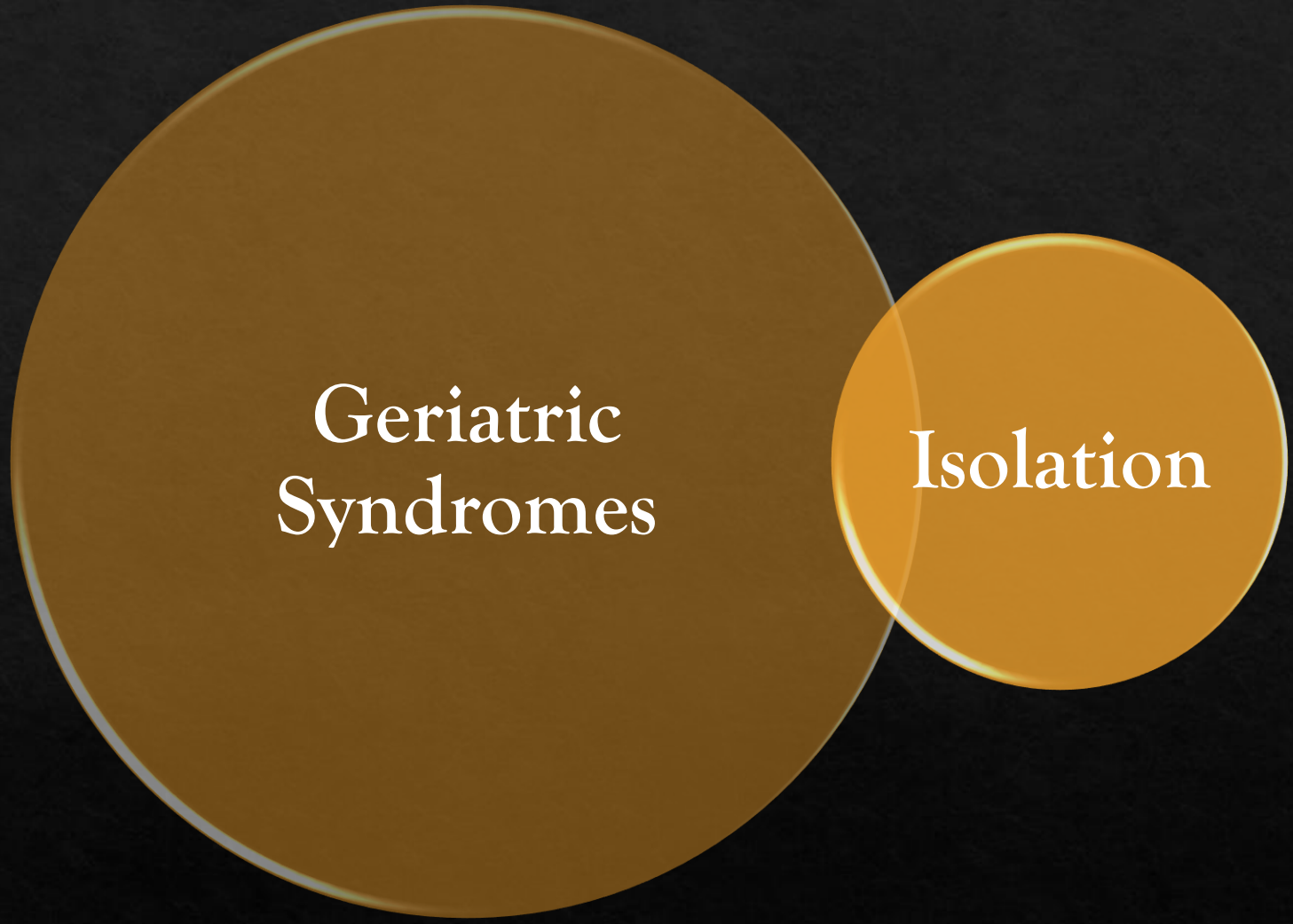

Malnutrition
Polypharmacy
Frailty
Dementia
Functional Impairment
Geriatric Syndromes
Isolation
Sarcopenia
Falls
Sleep

Isolation

- 13,817 new cases of osteoporosis were recorded during follow-up.

- Social isolation and loneliness were independently associated with increased osteoporosis risk:
  - Social isolation index ≥2 → HR 1.18 (95% CI: 1.11–1.25)
  - Loneliness index = 2 → HR 1.25 (95% CI: 1.17–1.34)

Zhou J, Hu X, Zhou S, Liu T, Chen Z. Social isolation, loneliness, and genetic susceptibility in relation to the risk of incident osteoporosis: a prospective cohort study based on the UK biobank. Int J Surg. 2025 Sep 18.


Geriatric
Syndromes
Isolation

Isolation

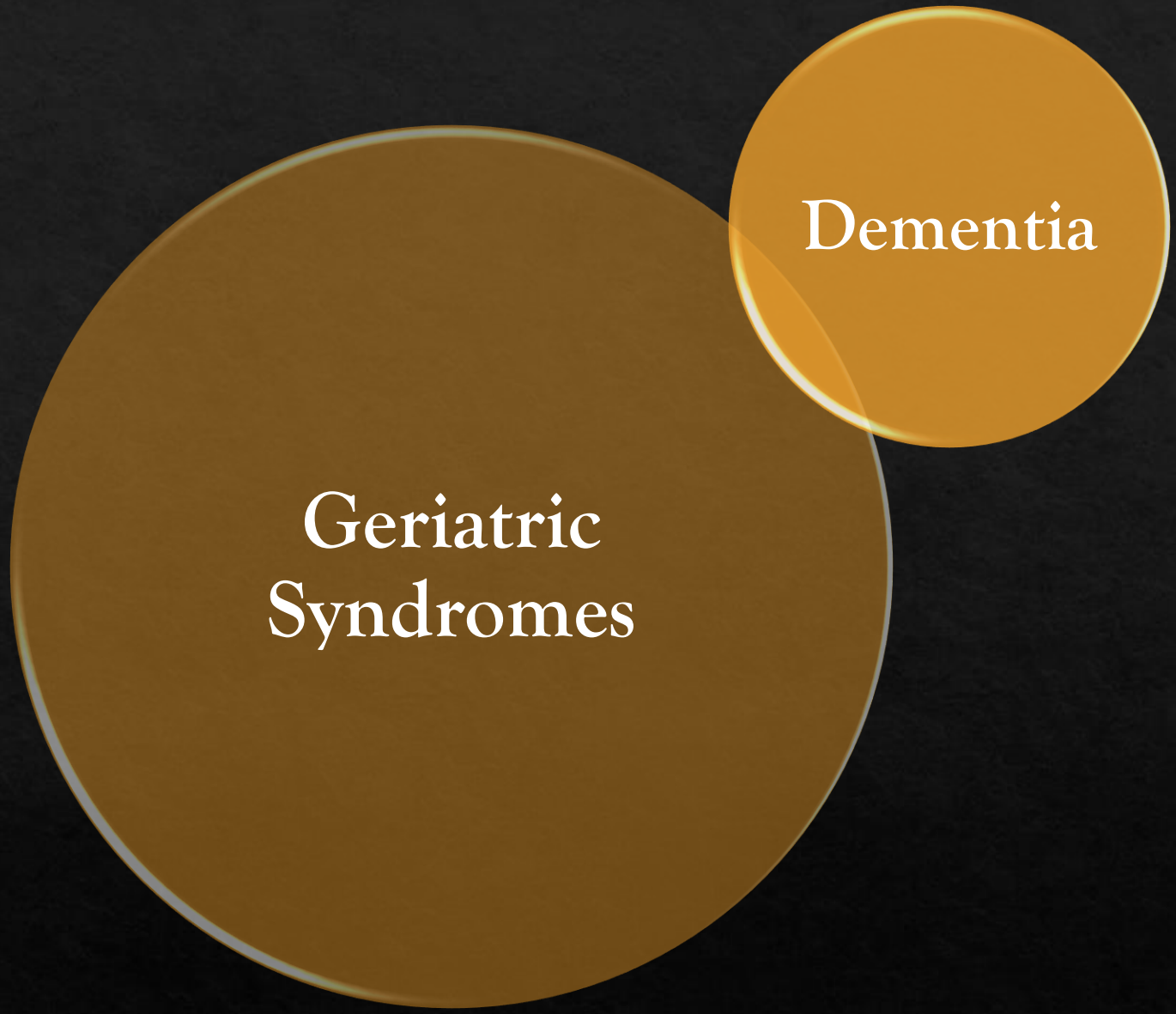
- Each component of isolation and loneliness contributed to risk:
  - Living alone, infrequent social contact, and lack of group activity → 6–10% higher risk
  - Feeling lonely → 19% higher risk
  - Inability to confide → 5% higher risk
- Individuals with both high loneliness and high isolation had a **32% increased risk** of osteoporosis compared to socially connected peers.

Isolation

- Stronger associations observed in:
  - **Men** and **current smokers** (for isolation)
  - **Younger adults (<60)**, **men**, **White ethnicity**, frequent alcohol users, and those **not taking vitamin D** (for loneliness)

Isolation

- Possible pathways:
  - Poor health behaviors (low physical activity, poor diet, smoking)
  - Chronic stress → elevated cortisol → impaired bone metabolism
  - Inflammation → increased osteoclast activity, reduced osteoblast function
  - Reduced access to medical care and support


Dementia
Geriatric
Syndromes

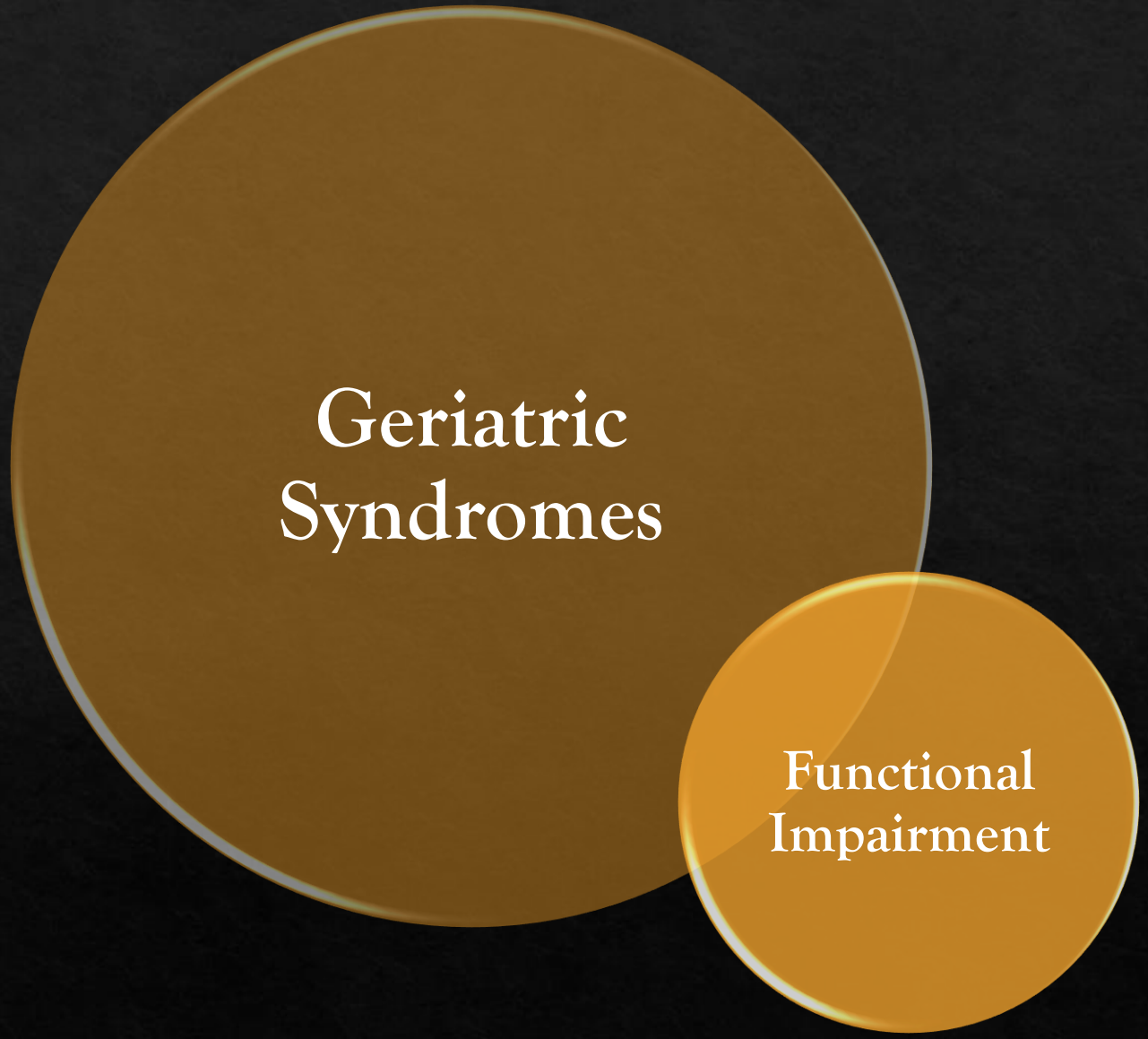
Dementia

- Longitudinal data from 2,361 older adults (Canadian Multicentre Osteoporosis Study).
- Cognitive decline (measured by MMSE) was significantly associated with bone loss in women:
  - Each 1% MMSE decline → 6.5% decrease in femoral neck BMD.
- Women with ≥3-point MMSE decline had a 61% higher risk of osteoporotic fracture.
- No significant association found in men due to limited sample size.

Dementia

- **Estrogen exposure**: Linked to both cognitive decline and bone health.
- **Inflammation and immune dysregulation**: May contribute to both conditions.
- **Bone-derived proteins** (osteopontin, osteocalcin, sclerostin): Elevated in AD and linked to BMD loss.
- **AD-related genes** (APP, BACE1, TREM2, FNDC5/Irisin, SNCA) show effects on bone metabolism and neurodegeneration.

Lary CW, Rosen CJ, Kiel DP. Osteoporosis and Dementia: Establishing a Link. *J Bone Miner Res*. 2021;36(11):2103-2105. doi:10.1002/jbmr.4431


Geriatric
Syndromes
Functional
Impairment

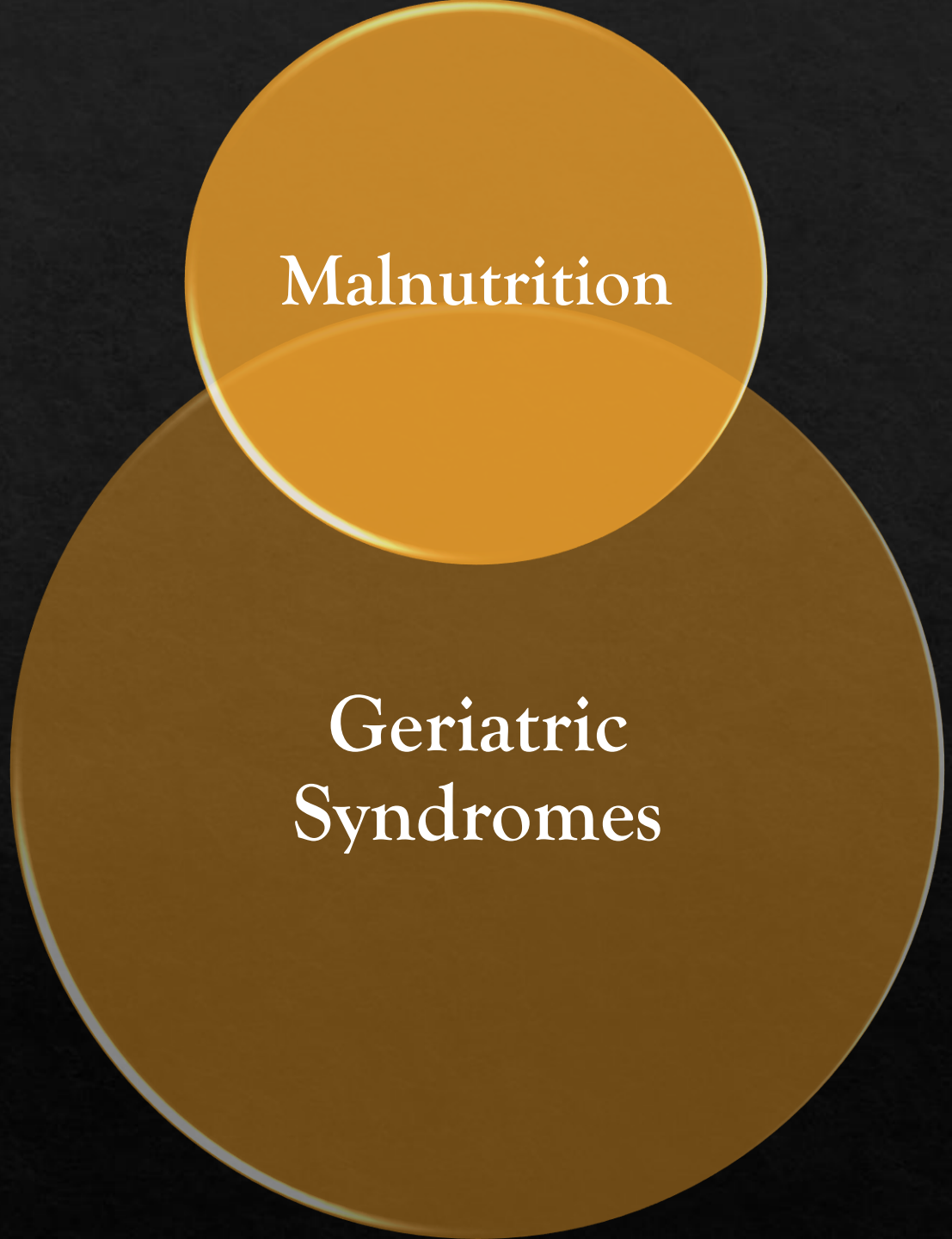
Physical Function Limitation

- Commonly affected tasks: walking, climbing stairs, sitting, bathing, lifting, transferring.
- Limitations persist even after fracture healing; many patients require assistance.
- **Muscle and Bone Loss**
  - Sarcopenia (loss of muscle mass/function) often coexists with OP.
  - Deconditioning from inactivity worsens muscle loss and physical capacity.

Physical Function Limitation

- **Psychosocial Factors**
  - Fear of falling/fracture leads to activity avoidance.
  - Depression and altered body image reduce motivation and social participation.
  - Anxiety and low self-esteem further impair function and independence.

Kerr C, Bottomley C, Shingler S, et al. The importance of physical function to people with osteoporosis. *Osteoporos Int*. 2017;28(5):1597-1607. doi:10.1007/s00198-017-3911-9


Malnutrition
Geriatric
Syndromes

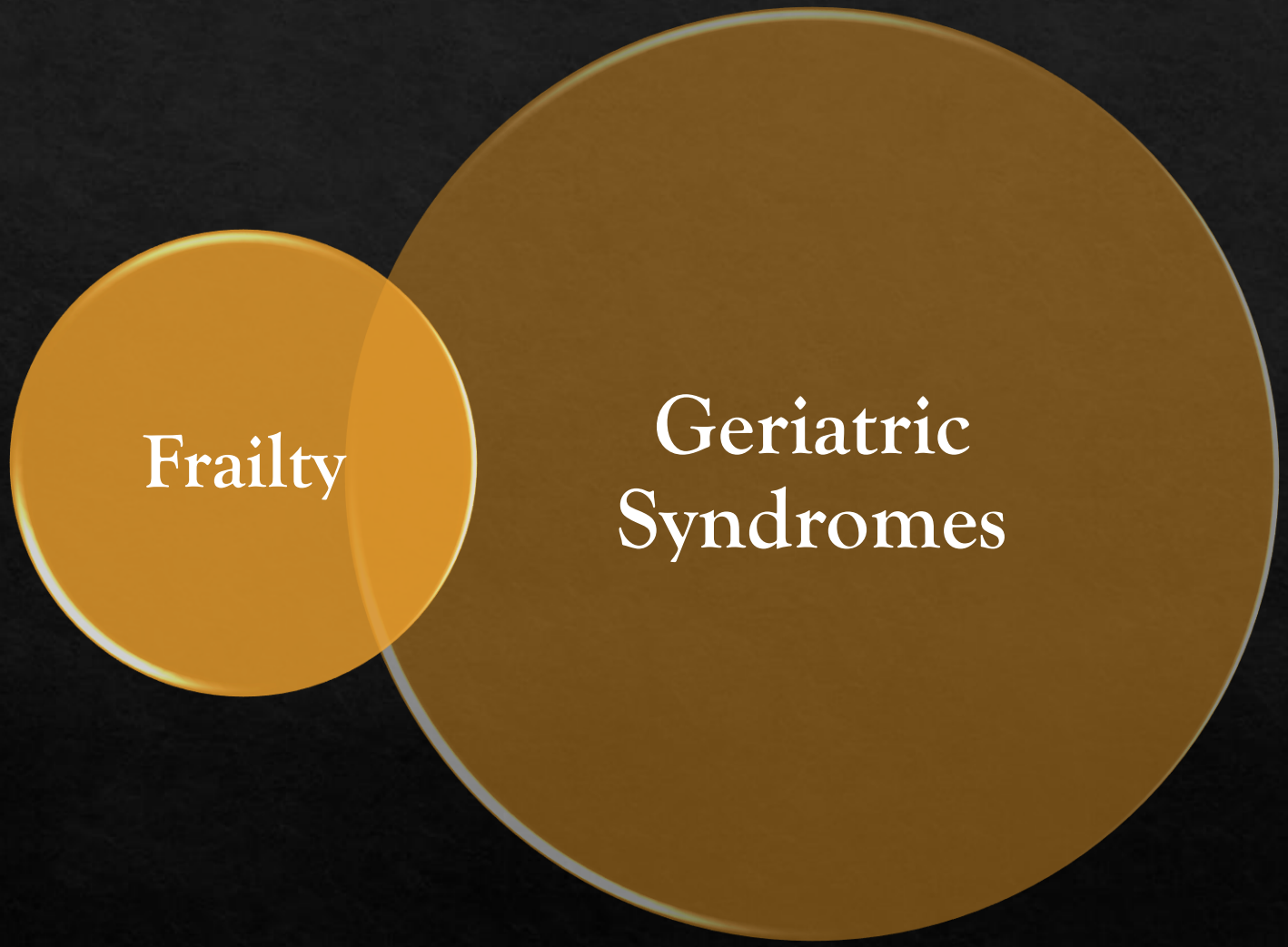
Malnutrition

- Malnutrition affects:
  - 20–50% of older adults in hospitals
  - 35–85% in long-term care facilities
  - 28–40% of community-dwelling elderly
- Higher malnutrition rates are seen in patients with fractures and osteoporosis.

Malnutrition in the elderly and its effects on bone health – A review; N. Siddique, M. O'Donoghue, M. C. Casey and J. B. Walsh; Clinical Nutrition ESPEN 2017 Vol. 21 Pages 31-39

Malnutrition

- Malnutrition leads to:
  - Increased bone loss and fracture risk
  - Impaired healing, muscle weakness, cognitive decline
  - Higher morbidity, mortality, and hospital readmissions
- Sarcopenia and Frailty
- Calcium and Vitamin D
- Dietary Protein


Frailty
Geriatric
Syndromes

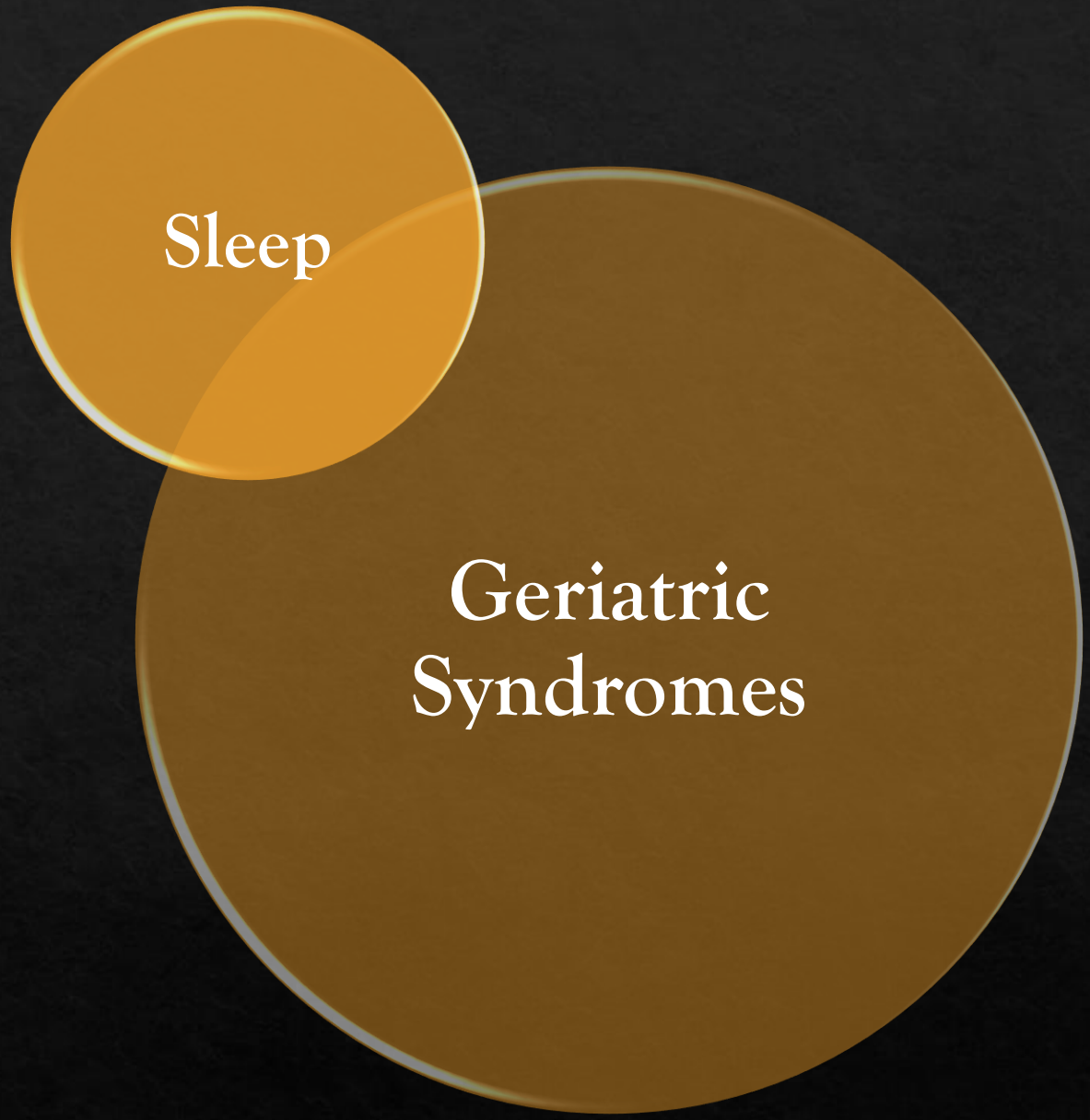
Frailty

- Osteoporosis is significantly associated with frailty:
  - Adjusted odds ratio (OR) = 1.454 (95% CI: 1.142–1.851, P = 0.003)
- Frailty prevalence was higher in:
  - Females, non-Hispanic Blacks, unmarried individuals, those with lower income and education
- Osteoporotic individuals had higher frailty scores across all demographic strata

Frailty

- Bidirectional causal relationship identified:
  - Osteoporosis → Frailty: OR = 2.81 (95% CI: 1.69–4.68, P = 6.82×10^{-5})
  - Frailty → Osteoporosis: OR = 1.01 (95% CI: 1.00–1.01, P = 3.65×10^{-7})
- Results remained significant after adjusting for confounders (BMI, diabetes, cardiovascular disease)

Que, Z., Lin, Y., Chen, D. *et al.* The association between osteoporosis and frailty: a cross-sectional observational study and mendelian randomization analysis. *J Orthop Surg Res* **19**, 398 (2024).


Sleep
Geriatric
Syndromes

Sleep

- **ELSA (UK):** 4,328 participants (mean age 63.8)
- **HRS (US):** 9,132 participants (mean age 65.0)
- Participants with baseline osteoporosis were excluded to focus on incident cases.

Zhang, Xiangxiang, et al. "Trajectories and Osteoporosis Incidence: Findings from Two Prospective Cohort Studies." *Frontiers in Public Health* 13 (2025): 1654798.

Sleep Quality Assessment

- Measured using validated items from the Jenkins Sleep Scale.
- Sleep scores categorized as:
  - Good sleep: lower scores
  - Poor sleep: higher scores
- Sleep trajectory groups:
  - Maintained good sleep
  - Improved sleep quality
  - Worsened sleep quality
  - Persistently poor sleep

Key Findings

- **Baseline Sleep Quality and Osteoporosis Risk**
- Poor sleep quality at baseline was significantly associated with higher osteoporosis risk:
  - **ELSA:** HR = 1.92 (95% CI: 1.57–2.35)
  - **HRS:** HR = 1.41 (95% CI: 1.22–1.62)

Key Findings

- **Sleep Trajectories and Osteoporosis Risk**
- **Persistently poor sleep:**
  - ELSA: HR = 1.89
  - HRS: HR = 1.52
- Improved sleep quality:
  - Still elevated risk compared to stable good sleepers (ELSA: HR = 2.25; HRS: HR = 1.42)
- Worsened sleep quality:
  - Also increased risk (ELSA: HR = 1.54; HRS: HR = 1.34)

Interpretation

- Sleep quality is a dynamic and modifiable risk factor for osteoporosis.
- Even improvements in sleep may not fully reverse risk if poor sleep was present earlier.
- Persistent poor sleep has the strongest association with future bone loss.

- **خانم ۷۱ ساله، بازنشسته امور اداری دانشگاه، در حال حاضر خانه دار و بدون فعالیت بدنی منظم**
- **شرح حال:** بیمار پس از لغزش روی فرش در منزل، بر زمین افتاده و قادر به بلند شدن نیست. از درد شدید در ناحیه لگن سمت راست شاکی است. پا کوتاه و در حالت چرخش به خارج قرار دارد.


Malnutrition
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Our patient
Isolation
Sarcopenia
Falls
Sleep