Mobility and Osteoporosis

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Reduce: immobility, pain and transfers to acute care

Improve quality of life for residents in long-term care
Presenter Disclosure

- Relationships with commercial interests:
  - Grants/Research Support: Amgen, Osteoporosis Canada
  - Speakers Bureau/Honoraria: Advisory Board member for Amgen
  - Employment: McMaster University

Mitigating Potential Bias

- Pharmacological therapy will be presented only as part of clinical recommendations

- Clinical recommendations were determined using the GRADE approach - an evidence-based approach to guideline development

- All pharmacological therapy will be presented in its generic form.
Mobility defined

» Mobility is conventionally synonymous with movement, the transition from point A to B (Gergen & Gergen, 2018)

» (Im)mobility is a strong determinant of physical, mental and social well-being (Grenier et al. 2019)

» Participant quote - Movement to me is very different, turning from side to the other in bed, that’s movement.

Objectives

1. To recognize and assess for potential risk factors for fractures for frail older adults living

2. To identify the impact of fractures on mobility

3. To apply the LTC Fracture Prevention guideline recommendations for frail older adults.
What do we know about fractures in older adults?
How often do fractures happen in long-term and home care?

• In 1 year, 5% of LTC residents will experience any fracture (hip, wrist, spine, humerus, pelvis)
  – 3% will experience a hip fracture
• In 1 year, 3.6% of home care recipients will experience any fracture
  – 1.5% will experience a hip fracture

Table 1

<table>
<thead>
<tr>
<th>One-Year Incident Fractures Location</th>
<th>Number (N) of Fractures</th>
<th>N – 31,732</th>
<th>N – 34,009</th>
<th>Odds Ratio (95% Confidence Interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Care</td>
<td></td>
<td>N = 1026 (1.0)</td>
<td>N = 341 (0.9)</td>
<td>0.93 (0.74-1.17)</td>
</tr>
<tr>
<td>Long-Term Care</td>
<td></td>
<td>N = 1026 (1.0)</td>
<td>N = 341 (0.9)</td>
<td>0.93 (0.74-1.17)</td>
</tr>
<tr>
<td>Hip</td>
<td></td>
<td>44 (0.5)</td>
<td>26 (0.7)</td>
<td>0.60 (0.36-1.00)</td>
</tr>
<tr>
<td>Wrist</td>
<td></td>
<td>35 (0.4)</td>
<td>14 (0.4)</td>
<td>1.00 (0.60-1.60)</td>
</tr>
<tr>
<td>Spine</td>
<td></td>
<td>16 (0.2)</td>
<td>13 (0.4)</td>
<td>1.00 (0.60-1.60)</td>
</tr>
<tr>
<td>Humerus</td>
<td></td>
<td>64 (0.8)</td>
<td>64 (0.9)</td>
<td>1.00 (0.78-1.30)</td>
</tr>
<tr>
<td>Pelvis</td>
<td></td>
<td>117 (1.4)</td>
<td>117 (1.4)</td>
<td>1.00 (0.78-1.30)</td>
</tr>
</tbody>
</table>

The sum of wrist, spine, humerus, and pelvis does not equal the value of other fractures as some people experienced multiple other fractures within the same hospital visit.

*Adjusted for age, sex, cognitive performance scale, walking ability, transfer ability, Changes in Health, End Stage Disease, 3Gs and Symptoms Scale score, medications use, diagnoses Alzheimer’s disease, traumatic brain injury, Parkinson’s disease, diabetes, osteoporosis, multiple sclerosis, depression, chronic obstructive pulmonary disease, emphysema, previous fall, previous fracture, unintentional weight loss.

Table 1 from McArthur et al. 2020. JAMDA 21 (2) 289-290.

**Ten Year Probability of Fracture using BMD**

FRAX® WHO Fracture Risk Assessment Tool

Calculation Tool

Please answer the questions below to calculate the ten year probability of fracture with BMD.

Questionnaire:
1. Age (between 40 and 90 years) or Date of Birth
2. Sex
3. Weight (kg)
4. Height (cm)
5. Previous Fracture
6. Parent Fractured Hip
7. Current Smoking
8. Glucocorticoids
9. Rheumatoid arthritis
10. Secondary oesteoporosis
11. Alcohol 3 or more units/day
12. Femoral neck BMD (g/cm²)

Weight Conversion

Height Conversion

Country: Austria

About the risk factors
## Fracture Risk Factors in Home Care

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Hazard ratio (95% confidence interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing age</td>
<td>1.02 (1.02-1.03)</td>
</tr>
<tr>
<td>Sex (Female)</td>
<td>1.74 (1.66-1.83)</td>
</tr>
<tr>
<td>Cognitive impairment (mild/moderate vs none)</td>
<td>1.27 (1.21-1.34)</td>
</tr>
<tr>
<td>ADL impairment (mild/moderate vs none)</td>
<td>1.10 (1.05-1.16)</td>
</tr>
<tr>
<td>Difficulty with stair climbing</td>
<td>1.06 (1.00-1.18)</td>
</tr>
<tr>
<td>Unsteady gait</td>
<td>1.16 (1.10-1.23)</td>
</tr>
<tr>
<td>Wandering</td>
<td>1.36 (1.28-1.48)</td>
</tr>
<tr>
<td>Alcohol use</td>
<td>1.47 (1.28-1.68)</td>
</tr>
<tr>
<td>Tobacco use</td>
<td>1.37 (1.28-1.48)</td>
</tr>
<tr>
<td>Previous fracture in the last 6 months</td>
<td>1.21 (1.18-1.24)</td>
</tr>
<tr>
<td>Parkinson’s disease</td>
<td>1.31 (1.19-1.45)</td>
</tr>
<tr>
<td>Previous fall in the last 6 months</td>
<td>1.57 (1.49-1.66)</td>
</tr>
<tr>
<td>Any psychotropic medication use</td>
<td>1.18 (1.13-1.23)</td>
</tr>
</tbody>
</table>

Factors unique to home care, not captured in FRAX

McArthur et al. in preparation.

## Biomechanics of falls

Yang et al 2020 JBMR, Robinovitch Lancet 2013
What is the impact of Fracture?

Systematic Review – 28 studies with mobility outcomes

- Mobility 1 to 2 years following hip fracture is significantly worse than for matched control
- Number of people disabled after 2 years was 26 per 100 people with hip fracture for walking 10 feet and 22 per 100 for bed transfers
- People experiencing hip fracture were four times more likely to be unable to ambulate 2 years after fracture

<table>
<thead>
<tr>
<th>Study</th>
<th>Outcome</th>
<th>Follow-up time</th>
<th>Control matched for</th>
<th>Hip Fracture</th>
<th>Control</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boersma 2004 [10]</td>
<td>Unable to walk independently</td>
<td>1 year</td>
<td>age, residence</td>
<td>30 %</td>
<td>7 %</td>
<td>&lt;0001</td>
</tr>
<tr>
<td>Mygattin 2001 [7]</td>
<td>Disabled ambulating 3 m (2)</td>
<td>1 year</td>
<td>age, gender, walking ability</td>
<td>54 % (2)</td>
<td>21 % (2)</td>
<td>&lt;0001</td>
</tr>
<tr>
<td>Joester 1991 [4]</td>
<td>Walk independently across room</td>
<td>6 m (ref)</td>
<td>age, gender, physical function</td>
<td>55 %</td>
<td>39 %</td>
<td></td>
</tr>
<tr>
<td>Poon 2002 [22]</td>
<td>Better community mobility</td>
<td>1 year (2)</td>
<td>age, gender</td>
<td>72 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walden 1993 [13]</td>
<td>Min increase in no. lower body limitations</td>
<td>2 years</td>
<td>age, gender</td>
<td>54 %</td>
<td>37 %</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>Max increase in no. upper body limitations</td>
<td>2 years</td>
<td>age, gender</td>
<td>17 %</td>
<td>17 %</td>
<td>0.719</td>
</tr>
</tbody>
</table>

Mobility recovery – 7 studies

- The bulk of recovery of walking ability occurred within 6 months after fracture.


Mobility recovery

- Between 40 and 60% of study participants recovered their pre-fracture level of mobility

Poor functional outcomes

- Hip fracture survivors are more likely to be functionally dependent and have more difficulties with ADLs 2 years post-fracture.
- 20% - 60% of people independent in self-care pre-fracture, required assistance for various tasks 1 and 2 years after fracture.

LTC: Hip Fractures, mortality and mobility impairment

By 180 days post-hip fracture (N = 60,111):
- 36% died
- 28% new total dependence in mobility*

By 365 days post-hip fracture (N = 52,914)
- 47% died
- 27% total dependence mobility*

* Independent at baseline
Increased mortality was associated with:
- Male sex
- Increasing age (> 90 years)
- White race
- High comorbidity (Charlson score ≥ 5)
- Cognitive impairment
- Mobility dependence
- ADL dependence
- Non-operative management


Reduced health related quality of life (HRQoL; N = 23,655)
- LTC and community dwelling
- For all fracture types, HRQoL decreased immediately following fracture
- Rebounded after the first month, but at 36 months never returned to pre-fracture levels.

Tarride et al. BMC Geriatrics, 2016;16:84
What tools are available to support fracture prevention in LTC?

Recommendations for Fracture Prevention in LTC

- Published in 2015; first of its kind aimed at LTC
- Integration of osteoporosis and falls assessment and management to reduce fractures
- Developed using GRADE approach, considering:
  - Quality of evidence
  - Balance of benefits and harms
  - Values and preferences
  - Resources

Recommendations for Fracture Prevention in LTC

- Directed at interprofessional teams in LTC
- Includes recommendations related to:
  - Pharmacologic therapies for those at high risk for fracture
  - Hip protectors
  - Exercise
  - Multifactorial interventions
  - Calcium and vitamin D
- Goals:
  - Reduce pain, immobility, and hospital transfers
  - Improve quality of life for residents in LTC

Interpreting the Recommendations

<table>
<thead>
<tr>
<th>Implications</th>
<th>Strong Recommendation “we recommend”</th>
<th>Conditional Recommendation “we suggest”</th>
</tr>
</thead>
<tbody>
<tr>
<td>for patients/residents</td>
<td>Most individuals in this situation would want the recommended course of action, and only a small proportion would not</td>
<td>The majority of individuals in this situation would want the suggested course of action, but many would not</td>
</tr>
<tr>
<td>for clinicians</td>
<td>Most individuals should receive the intervention</td>
<td>Clinicians recognize that different choices will be appropriate for each individual and that clinicians must help each individual arrive at a management decision consistent with his/her values and preferences</td>
</tr>
</tbody>
</table>


www.gradeworkinggroup.org
Quick Reference Guide

Worth watching...

Series 5: Personal Support Workers
This series features personal support workers who work in long-term care. It demonstrates how to help residents transfer in and out of bed safely, sit properly in wheelchairs, and how to assist residents to keep their legs strong.

Series 2: Physiotherapists & Physiotherapy Assistants
This series focuses on the role of physiotherapists and physiotherapy assistants for preventing falls and fractures in long-term care by completing balance assessments and communicating with the team, creating exercise programs, and working with residents to keep their senses and muscles strong.

Series 3: Group Exercise Trainers & Exercise Professionals
The series features exercise professionals who help prevent falls and fractures by providing exercises to help prevent falls and fractures. This video provides a comprehensive overview of how to modify exercises for residents who can’t stand, working with residents with dementia or cognitive impairment, and incorporating postural exercises.

Series 4: Restorative Care
The restorative care team can help prevent falls and fractures through practical and effective strategies. The team incorporates simple balance and strength exercises into walking programs and providing postural exercises through range of motion exercises.

https://www.gerascentre.ca/fracture-prevention-toolkit
Functional strength training

Sit to stand exercises

An example of an effective exercise program: randomized control trial in LTC

• Individually prescribed progressive resistance and balance training
  – Group setting (leaders:participants, 1:5)
  – 1 hour 2x/week
• Reduced rate of falls by 55%, and improved physical performance
  – Intervention (n=113) – 1.31 falls per person years or 142 falls
  – Control (n=277) – 2.91 per person years or 277 falls
• Caution:
  – Only included residents with MMSE>15, who were mobile
  – Did not reduce the number/rate of fractures

How is fracture risk assessed?

Meet Mrs. Andrews

87 year old woman just admitted to LTC – six months following the death of her husband; she was unable to care for herself at home
Mrs. Andrews

- History:
  - moderate dementia
  - wrist fracture 8 years ago – from a fall while walking
  - prescribed antidepressant for 2 years; PPI recently prescribed while in hospital
  - Prior fall
  - no osteoporosis diagnosis/ no osteoporosis medications
  - family reported recent weight loss and height change from 5’5” (165 cm) to 5’2”(157 cm) on admission
  - Height loss prompted a lateral thoracolumbar x-ray ordered
    - 2 vertebral fractures found

Mrs. Andrews

- LTC Assessment:
  - Appetite seems good and she is willing to eat food without difficulty
  - No significant dysphagia noted by staff
  - Wandering frequently around the home
  - Able to walk in corridor independently
  - BMI <18
At what level of risk for fractures is Mrs Andrews?

How can you estimate fracture risk?

Fracture Risk Scale For LTC (FRS)

Assessing fracture risk for LTC residents to put strategies into place to prevent fractures


NOTE: Developed and validated with MDS 2.0 in Canada, but items could be derived from MDS 3.0.

Fracture Risk Scale has been developed for Home Care as well
Fracture Risk Scale Scores – Hip Fracture Risk

**Low Risk**
- 55%
- Walk in corridor and BMI > 30
- or
- Unable to walk in corridor and no fall past 30 days

**High Risk**
- 45%
- Walk in corridor and BMI 18-30
- or
- Unable to walk in corridor and BMI <18 with or without a fall
- or
- Walk in corridor and had a fall in last 30 days

**& one of the following:**
- Prior fall
- Prior fracture
- Cognitive impairment (CPS 3-6)
- Tendency to wander
- Age >85


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What is the fracture risk for residents who are immobile?

- **Fracture Risk Scale** - hip fracture risk
  - Inability to walk independently = low risk
  - Inability to walk independently + a fall in last 30 days = high risk
  - May underestimate vertebral fractures and potential for these with transfers or shifting in bed

- **Immobilization** is a risk factor for bone loss and increases risk for osteoporotic fractures

There are many options:

- FRAX
- Clin-Fx
- FRAiL model

... Back to Mrs. Andrews
Mrs. Andrews FRS score

- is able to walk in the corridor (independently)
- has a BMI <18
- had a fall in last 180 days

She is at the highest level of risk

Multifactorial interventions

- Any combination of interventions that are tailored to an individual’s risk to reduce falls
- May include:
  - medication reviews, assessment of environmental hazards, use of assistive devices, exercise, management of urinary incontinence and educational interventions directed to staff

For all residents, we suggest multifactorial interventions that are individually tailored to reduce the risk of falls and fractures
Studies did not measure fractures, quality of life, mobility or pain. Risk of falls informed the recommendation. With multifactorial interventions there may be, per 1000 residents per year:

- 660 fewer falls (1230 fewer to 120 more)
- 55 fewer residents will fall (115 fewer to 10 more)
- 10 fewer hip fractures (14 fewer to 1 more)

Number Need to Treat (NNT)

First Line Drug Therapies to prevent fractures in older persons at High Risk of fractures in long-term care

<table>
<thead>
<tr>
<th>Drug Therapies</th>
<th>Hip Fractures</th>
<th>Vertebral Fractures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Hip fractures prevented per 1000 treated</td>
<td>NNT to prevent one hip fracture</td>
</tr>
<tr>
<td>Alendronate</td>
<td>24 fewer</td>
<td>42</td>
</tr>
<tr>
<td>Risedronate</td>
<td>23 fewer</td>
<td>43</td>
</tr>
<tr>
<td>Zoledronate</td>
<td>22 fewer</td>
<td>45</td>
</tr>
<tr>
<td>Denosumab</td>
<td>22 fewer</td>
<td>45</td>
</tr>
<tr>
<td>Teriparatide</td>
<td>26 fewer</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Confidence interval: (14 – 32 fewer) (15 – 31 fewer) (12 – 29 fewer) (6 – 32 fewer) (40 fewer to 34 more) (15 – 31 fewer) (6 – 32 fewer) (10 fewer to 34 more)

NNT to prevent one hip fracture: 42 (71 – 31) 43 (67 – 32) 45 (83 – 34) 45 (167 – 31) n/a

NNT to prevent one vertebral fracture: 11 (29 – 8) 10 (18 – 8) 8 (16 – 7) 8 (17 – 6) 8 (13 – 6)

1 Quality of evidence was assessed as moderate. Estimated effects assumed baseline risk of hip fx at 6% and vertebral fx at 20%.
2 Primarily with at least 300 mg of calcium, and with/without vitamin D.
3 With calcium and vitamin D.

Cameron ID. Cochrane Database Syst Rev. 2012
What medications are associated with falls and fractures?

Which medications should be considered for deprescribing?

Antipsychotics

- Antipsychotic drug use associated with:
  - Somnolence
  - Extrapyramidal side effects
  - Gait abnormalities
  - Increase postural sway
  - Increased fragility fractures
  - Fracture risk is greatest in the first 30 days of use
  - Haloperidol has the strongest association to fractures

3Jalbert et al. JAMDA 2010; 11:120-17.
6Cox et al. JAMDA 2016; 17: 1089-1093.
7Torstensson et al. Age Ageing 2017; 46:258-64.
**Benzodiazepines**

- Risk of falls is greatest within first 24 hours of initiation\(^1\)
- Associated with:
  - gait and balance impairment\(^2\)
  - 30% - 40% increase in hip fracture risks\(^3-5\)
  - In people with Alzheimer’s Disease, almost 60% more likely to still be in hospital/rehab beyond 4 months.

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\(^3\) Xing et al. Osteoporosis Int 2014;25:105-120
\(^5\) Takkouche et al. Drug Safety 2007;30:171-184
\(^6\) Saarelainen et al JAMDA 2017;18:e15-87

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**Trazodone**

- 5.7% incidence of a fall-related injury requiring hospitalization within 90 days\(^1\)
- New use of low dose trazodone no safer than new use of benzodiazepine\(^1\)
- Compared to atypical antipsychotics, use has similar rates of falls and major osteoporotic fracture and a lower rate of mortality\(^2\)

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\(^1\) Bronskill et al JAGS 2018; 66(10):1963-1971
\(^2\) Watt et al, CMAJ, 2018;190(47):E1176-83.
Anticholinergic Medications
(e.g., clozapine, onanzapine, quetiapine, chlorpromine)

- Associated with functional decline, falls and delirium in nursing home residents\(^1\)
- High-level use of anticholinergic medications associated with 14% greater fracture risk within 30 days than nonuse\(^2\)
- Comorbid conditions and markers of frailty account for increased falls, fractures and BMD loss\(^3\)

\(^1\)Landi et al JAMDA 2014; 15:825-829
\(^2\)Chatterjee et al JAGS, 2016; 64:1492-1497.
\(^3\)Fraser et al Ann Pharmacol 2014 48:954-961

Pearls

- **Fracture Prevention** – key to maintaining mobility
- Determine **risk of fracture** on admission
- **Exercise and multifactorial interventions** may reduce falls, but caution in those at high risk
- **Deprescribing** is important (e.g., anticholinergics)
- **Osteoporosis Medications** reduce fracture risk by 40-60%, provide alternatives to oral bisphosphonates in residents with swallowing difficulties or renal impairment
- Consider a **quality improvement** approach to fracture prevention in your home

\(^1\)Kennedy C et al. Implementation Science. 2012
\(^2\)Papaioannou A et al. CMAJ. 2015
Making life better for older adults by bringing the best research to the frontlines of care as quickly as possible