Falls, Faints, Fragility and Fractures

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Themes for this evening…

• Definitions…
• Scale of problem…
• Costs to individuals…
• To services…and economy…
• Integration and Overlap
• Why do they happen?
  – Falls ?
  – Faints ?
  – Fragility ?
  – Fractures ?
Themes...

- What can we do to prevent them?
- Or minimise the consequences?
- Case by case?
- Whole Systems/Public Health?
- What can you do?
- Evidence sources and types
- Guidelines and Policies?
- Can we turn them into reality?
Definitions...

• **Fall**

• “An incident in which a person suddenly and involuntarily comes to rest upon the ground or other surface lower than their original station.”

• “…with or without loss of consciousness”

• “Except by means of seizure or collision with moving vehicle”
Definitions..

- **Syncope** (i.e. faint) *(Greek “To cut off”)*
- “*A transient loss of consciousness characterised by unresponsiveness and loss of postural tone, with spontaneous recovery not requiring specific resuscitation intervention*”
- “*Caused by transient interruption of cerebral blood flow due to low perfusion pressure*”
As opposed to...

• Pre-syncope “I felt lightheaded/like I was going to faint/blurred vision/legs went weak”

• Fit (epilepsy, seizure, absence attack, grand mal, convulsion)

• Vertigo - illusion of rotatory movement “The room was spinning”

• Dizziness (Catch all term)

• Dysequilibrium - sense of unsteadiness “I felt as if I was going to fall”
Definitions.. Osteoporosis – (i.e. *Porous Bones*)

A disease characterised by **low bone mass** and **microarchitectural deterioration** of bone tissue leading to enhanced bone fragility and a consequent **increase in fracture risk**.

*World Health Organisation (WHO), 1993*
Dual energy X-ray absorptiometry (DXA)
Fracture Risk Doubles With Every SD Decrease in BMD

Relative Risk for Fracture

Bone Density (T-score)
Bone mineral density (BMD) measurements

Surnamae: BLOGGS
Forename: JEAN
Date of Birth: 17/03/1942
Unit No: 12345
Age: 61

**DIAGNOSIS**

<table>
<thead>
<tr>
<th>Site</th>
<th>BMD g/cm²</th>
<th>T-Score</th>
<th>WHO Diagnosis</th>
<th>% of age matched population with lower BMD</th>
<th>% Change since</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spine (L1, L2, L3, L4)</td>
<td>0.601</td>
<td>-3.6</td>
<td>Osteoporosis</td>
<td>2</td>
<td>-2.8% (17/06/2002)</td>
</tr>
<tr>
<td>L Fem Neck</td>
<td>0.513</td>
<td>-3</td>
<td>Osteoporosis</td>
<td>5</td>
<td>-3.8% (17/06/2002)</td>
</tr>
<tr>
<td>L Total Hip</td>
<td>0.628</td>
<td>-2.6</td>
<td>Osteoporosis</td>
<td>6</td>
<td>-0.2% (17/06/2002)</td>
</tr>
</tbody>
</table>

For the sites measured the WHO category is: OSTEOPOROSIS

**FRACTURE RISK**

- 10 year Hip Fracture Risk: 8%
- 10 year Fracture Risk at Any Site (hip, spine, forearm, proximal humerus): 22%

Risk estimated using age and femoral neck T-score only

**Vertebral Deformities**

The lateral DEXA spine image indicates vertebral deformities which if present significantly increase the risk of subsequent vertebral and hip fractures, independently of BMD. This is only a technical evaluation and it is recommended that a radiological interpretation should be obtained.
Factors influencing bone strength

- Mineral density (70% of bone strength)
- Bone quality
  - Trabecular continuity and crosslinks
  - Microfractures
  - Longbone diameter
  - Elasticity
  - Bone turnover / remodelling
Femoral Neck and Osteoporosis

23 y/o female

62 y/o female
Definitions...

• **Fragility (minimal trauma) fracture**

• “a fracture resulting from a fall of less than head height and not from collision with a moving vehicle”

• **(Osteomalacia (Rickets) – bone softening or demineralisation due to calcium/Vit D deficiency)**

• **(Metabolic Bone Disease...)**
Fragility Fractures...vertebral

- Women with vertebral fractures have a 5-fold increased risk of a new vertebral fracture and a 2-fold increased risk of hip fracture
  
  Black et al., J Bone Miner Res 1999
  Melton et al, Osteoporos Int 1999

- One woman in five will suffer from another vertebral fracture within a year
  
  Lindsay et al., JAMA, 2001
Fracture of Proximal Femur (Hip)

70,000 p.a UK
Colles Fracture (Wrist)

91,000 p.a. UK Also...

47,000 Humerus

40,000 Ankle
Overlaps....Integration of Case Finding Investigation and Management...
Bone Fragility

Osteoporosis Agents

FRACTURE

Falls Prevention

Hip Protectors?

Force of Impact

Falls

Prevention

Prevention
Syncope

Falls

Dizziness
How Big a Problem do we have?

• And what are the harms and costs?
• For individuals? (and their families)
• For health and social care?
• For the economy?
Falls – Scale of Problem

- >30% community > 65 yrs...
- >50% F > 85...
- >50% care home residents...
- will fall in 12 months
- 20-40% Ambulance Calls in > 65s
- 7th commonest reason for admission (all ages)
- 37% A&E attenders over 60 yrs
- Incidence increases exponentially with age, F>M
- 65% F and 44% M fall indoors
But...

- Underestimated:
  - Amnesia
  - No ICD Code ("Senility" !!!)
  - Coding Bias
  - No incentive in primary care QOF for GP contract
Falls: Consequences

- Fracture
- Soft Tissue Injury
- Head Injury
- Long Lie
- Loss of Confidence
- Anxiety and Depression
- Constriction of Lifespace
- Hospitalisation
- Carer Stress and Anxiety
- Institutionalisation
- Complaint/Litigation in institutions
- …Costs for health and social economy
Osteoporosis

Human and economic burden
Men get Osteoporosis too!
Osteoporotic Patient Population Risk Stratification Model

- Osteoporotic patients with new fracture/year
- Osteoporotic patients with existing fracture
- Osteoporotic patients with or without fracture
- Post menopausal women
Incidence of osteoporotic fracture in women

Incidence (per 1000) Lifetime risk

- Vertebral 10 - 15 %
- Femoral neck 10 - 15 %
- Colles' 10 - 15 %
- Any of these 30 - 40 %

Socioeconomic Costs of Osteoporotic Fractures in the UK

- There are 200,000 osteoporotic fractures each year which costs the NHS an estimated £1.5 billion\(^1\)

- 1 in 2 women experience a fracture by the age of 70\(^2\)

- 1 in 12 men are at risk of fracturing due to osteoporosis at some time in their life\(^3\)

   Key advances in the effective management of osteoporosis. In Press
Fracture of Proximal Femur (Hip)

- 40% deaths, >50% admissions, >66% bed days from injury in >75s
- Cumulative/age-specific incidence rising...
- 70% in >75s, 87% Female
- XS Mortality 7-20% (ff. 1st 4 months).
- 12 month mortality 30%
- Disability, Dependence
- Cost £4k to £30k per fracture,
Consequences of hip fracture

- Hip fracture is the most devastating clinical end-point of osteoporosis

Adapted from Keene GS et al, 1993.

Long-term morbidity of hip fracture

Ability to:

- Climb stairs
- Dress unaided
- Walk unaided
- Walk half a mile

Before fracture vs. 6 months postfracture

Adapted from Cooney LM, Marottoli RA Fourth International Symposium on Osteoporosis, 1993
Causes of Falls and Faints...

- ...and how that affects your approach to treating them
- ...to individual patients
- ...to public health strategies...
Falls:

• May be a single cause
• But usually interaction of multiple synergistic pathologies
• Interaction of person and environment
• **Biggest lesson of geriatric medicine is to turn apparently “functional” problems into reversible diagnoses**
• So find the causes…
• And do something about them…
• ..Or minimise the consequences..
• Cannot justify “therapeutic nihilism” or ageism
• **Older People Deserve a rigorous diagnosis and treatment plan.**
Approaches to falls?

• Unacceptable terminology…
• “Acopia”
• “Social Admission”
• “Atypical Presentation”
• Or worse… (“crumble, “off legs”, “gomer” etc)

• “Frailty is the failure to organise higher level responses in the face of stress” Rockwood Age Ageing 2004

• A Custodial, risk averse approach which impairs older peoples’ autonomy is ageist and completely unacceptable (community or institutions)
Falls That Count (Campbell 2006)

• Falls that occur during daily activities
• Falls where there is no clear recall
• Falls with loss of consciousness
• Falls with injury, long lie or loss of confidence
• Falls with the potential for intervention
D.A.M.E. Classification (for causes of falls)

- **D**rugs & Alcohol
- **A**ge-related physiological changes
- **M**edical causes
- **E**nvironmental causes
Drugs and Alcohol

• Alcohol - don’t forget!
• Sedative/hypnotics
• Antidepressants
• Diuretics
• Antihypertensives
• Vasodilators
• Antiparkinsonians
• Opiates
• Antiarrhythmics
Drugs, Falls and Older People

• i.e. anything which can increase chance of unsteadiness, drowsiness, low blood pressure faints, slow heart rate

• Older People Far More Susceptible to side effects due to altered:
  • -Pharmacodynamics
  • -Pharmacokinetics

• Multiple long term conditions
• And Multiple Medicines
• Tension with Evidence Based Practice…
• Risk/Benefit Analysis and Prioritisation Crucial
• Stopping drugs can stop falls (but sometimes at a cost…)
• Some drugs (e.g. Fludrocortisone, Calcium and Vitamin D) can stop falls or fainted
Age-related changes

- Gait
- Balance
- Vision
- Postural sway
- Reaction time
- Muscle strength
- Cognitive impairment and poor judgement
- Volume regulation, baroreceptor reflex, cerebral autoregulation...
- Relevant for syncope (faints)
Medical Causes

- Neurological
- Parkinson’s Disease
- Stroke
- Epilepsy
- Dementia
- Neuropathy
- Vertigo
- Cerebellar Syndrome
- Visual field defects
Visual parameters implicated

Visual Acuity  Depth Perception  Contrast Sensitivity
Medical Causes

- Systemic illness
- Non-specific
- Acute
- ...can all present with falls, faints or immobility
- (Or confusion/incontinence)
Medical Causes

- **Cardiovascular syncope:**
  - Vasovagal
  - Postural hypotension
  - Arrhythmia
  - Outflow obstruction
  - Carotid sinus syndrome
  - Myocardial infarction
  - “Drop attacks”
Normal (sinus) heart rhythm

Pacemaker

CSH

Heart Block and Slow Heart Rates
Lifestyle

- **Nutritional;**
- **Vit D, Calcium, B12, Protein Energy**
- **Insufficient Exercise**
- Associated with weak muscles, poor balance and gait, accelerated bone loss
- **Psychosocial**
  - E.g. beliefs, risk taking, family beliefs, fears, adherence to interventions etc
Exercise Works.

Even at extremes of Age

Up to 40% reduction in falls from prog strength balance training plus medication review
Environmental Causes

- Stairs
- Lighting
- Footwear
- Slippery surfaces
- Loose mats
- Access
- Furniture
Causes of Osteoporosis and Fragility Fractures
Main risk factors for Osteoporosis (Cummings SR Lancet 2002)

- Age
- Gender
- Low Body Mass Index
- Premature Menopause
- Long term steroid use
- Previous fragility fracture
- Maternal fragility fracture
- Smoking
- High Alcohol Consumption
- Immobility/Lack of exercise
- Calcium and Vitamin D deficiency
Primary Prevention of Osteoporosis
Follows..

- Screening for high risk patients and common risk factors
- With DXA scanning where indicated
- Adequate Dietary Calcium
- Adequate Vitamin D
- Bone Loading Exercise
- Prophylactic treatment when on long term steroids
- Don’t’ smoke
- Or drink heavily
- Or get too thin..
Treatment Approaches..
Bone remodelling

Affected by PTH, Drugs, Sex Hormones, Bone Loading, Calcium/Vitamin D Status etc
Drug Treatments for OP

**Anti-resorptive**
- Calcium, Vitamin D
  - Adcal, Calcichew D3 Forte
- Bisphosphonates
  - Etidronate (Didronal)
  - Alendronate (Fosamax)
  - Risedronate (Actonel)
  - Ibandronate (Bonviva)
- HRT – no longer used..
- SERMS
  - Raloxifene (Evista)

**Anabolic**
- Strontium Ranelate
  - Protelos
- Teriparatide
  - Forteo
  - **N.b. Also need to Investigate and correct Underlying Metabolic Causes**
Calciuim and Vitamin D

- Recommended Daily Intake...
- Deficiency...
- How you can get enough...
- Vitamin D can reduce falls as well as fractures
- Results from Studies conflicting and depend on population
- Studies of other agents all require adequate Calcium and Vitamin D levels or co-prescription
### Cholecalciferol and calcium in old women (84 yrs) residents of nursing homes (Chapuy et al 1994)

<table>
<thead>
<tr>
<th>Fractures</th>
<th>Rx</th>
<th>Pbo</th>
<th>p</th>
<th>OR (CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip</td>
<td>109</td>
<td>153</td>
<td>&lt;0.01</td>
<td>0.70 (0.62-0.78)</td>
</tr>
<tr>
<td>All non-vertebral</td>
<td>218</td>
<td>284</td>
<td>&lt;0.01</td>
<td>0.70 (0.51-0.91)</td>
</tr>
</tbody>
</table>
Continual increases in total hip BMD with alendronate 10 mg over 10 years

- Alendronate 5 mg
- Discontinuation
- Alendronate 10 mg

Mean % change (±SE)

Year

(6.7%) p<0.001
(3.4%) p<0.001
(2.9%) p<0.05

Adapted from Bone et al 2004

Copy right (c) 2006, David Oliver
Alendronate

Vertebral

47%
RR 0.53
CI 0.41-0.68
P<0.001

Non-vertebral

47%
RR 0.53
CI 0.3-0.9

Hip

51%
RR=0.49
CI= 0.23-0.97
P<0.05


Copy right (c) 2006, David Oliver
Risedronate

Vertebral 1

- 49%
- RR 0.51
- CI=0.35-0.73

Non-vertebral 2

- 39%
- RR 0.61
- CI=0.39-0.94

Hip 3

- 60%
- RR 0.4
- CI=0.2-0.8

References:
2. Harris et al, JAMA 1999;282:1344-1352
Effect of Teriparatide

Patient 1124
Fracture Prevention Trial

Baseline

Follow-Up

Jiang Y et al. JBMR 2002

Female, age 65
Duration of therapy: 637 days (approx 21 mos)

BMD Change:

⇒ Lumbar Spine: +7.4% (group mean = 9.7 ± 7.4%)
⇒ Total Hip: +5.2% (group mean = 2.6 ± 4.9%)
Effects of rhPTH - (Teriparetide)
nonvertebral fractures

Neer et al (2001), NEJM, 344
Strontium Ranelate

- **SOTI trial** *(Meunier 2004)* 1649 F patients (all on Calcium/Vitamin D), mean age 69.
- **41%** ↓ vertebral # 36 months
- No reduction in non-vertebral #

- **TROPOS study** *(Reginster 2005)* 5091 F >70
- **39%** ↓ vertebral #
- **16%** ↓ non vertebral
- Sub-analysis for T Score <-3 at hip, **36%** reduction hip #
- For Over 80s.... **30%** ↓ all # sites.
Actions of Drugs (trials to date \textit{nb} absence of evidence ...)

<table>
<thead>
<tr>
<th></th>
<th>Vertebral #</th>
<th>Hip #</th>
<th>Male OP</th>
<th>Other Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strontium:</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ibandronate:</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Alendronate:</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Risedronate:</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Didronal:</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Raloxifene:</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Teriparetide:</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>
Cost/savings analysis comparing predicted cost with no intervention, with the actual costs with intervention.
IOF, European Womens Institute for Health 2004

- 9 Countries
- Women 50-79 with fragility fracture
- Only 32% women had undergone DXA
- Only 18% were on OP treatment
- UK generally worse...
Percutaneous Vertebroplasty

- Painful spinal fractures
- Injection of cement under X-Ray guidance
- Stabilises vertebra
- Prevents further crushing
- Relieves pain
Vertebroplasty
Safehip has been designed to accommodate the needs of elderly people who suffer from continence problems. It will facilitate the use of both re-useable and disposable shaped continence pads.

Pants: 86% cotton, 10% polyamide, 4% Lycra®

Safehip can be washed safely and repeatedly in domestic and hospital foul linen wash cycles. It is recommended that a 60°C wash is used but it is acceptable to wash at 95°C.

Shells: 100% polypropylene
Policies, Directives and Evidence Based Guidelines...
Modern Standards and Service Models

Older People

National Service Framework for Older People
The NSF Standard 6

- “The aim of this standard is to reduce the number of falls which result in serious injury and ensure effective treatment and rehabilitation for those who have fallen.”

- April 2005: “All local health and social care systems should have established an integrated service for the prevention of falls and fractures.”
Periodic case finding in Primary Care: Ask all patients about falls in past year

- No falls → No intervention
- Recurrent falls
  - Gait/balance problems
    - Fall Evaluation*
      - Patient presents to medical facility after a fall

- Single fall
  - Check for gait/balance problem
    - No problems

Fall Evaluation*

Assessment
- History
- Medications
- Vision
- Gait and balance
- Lower limb joints
- Neurological
- Cardiovascular
- Fear and Function
- Osteoporosis Risk

Multifactorial intervention (as appropriate) *(No time to summarise evidence in this talk!)*
- Gait, balance, exercise - programs
- Medication - modification
- Postural hypotension - treatment
- Environmental hazards - modification
- Cardiovascular disorders - treatment

"By professionals with appropriate skills and experience"
"Local health and social communities should review their practice against these guidelines. Should consider resources necessary to implement, people and processes involved and timelines. Implementation should be as rapid as possible. Local guidelines and pathways should be reviewed in this light. Configuration of falls service may vary but should be clearly linked to bone health"

All healthcare professionals dealing with patients at risk should develop and maintain basic professional competence...
NICE Guidance: 2y Prevention Osteoporotic # in Post-menopausal F

- “Bisphosphonates” *(Alendronate, Risedronate etc)*, for:

- F ≥75 , without DXA scanning ..”
  - F 65 – 74, with confirmed OP “
  - F < 65, if T Score ≤ -3 , or...
  - Confirmed OP + ≥ 1 age-independent risk factor…”

- n.b. doesn’t distinguish agents but summarises evidence and economic data
- BUT Controversial…..
Secondary Prevention of Fracture.

Prevalence of Osteoporosis by Fracture Site (Glasgow Data)

Key:
- Male
- Female

Potentially Treating Many Patients who don’t have OP
NI CE...

- "Raloxifene where bisphosphonates:
  - Contraindicated
  - Not tolerated
  - Not working"

- "Teriparatide only recommended in $F \geq 65$ with:
  - Poor response to bisphosphonates
  - Intolerant to bisphosphonates
  - With $T$ score of $\leq -4$ SD
  - Or $T \leq -3$ SD and multiple fracture or other risk factors"

- NB nothing on men or primary prevention or strontium and cagey about Calcium and Vit D

- NICE Guidance on Primary Prevention out for consultation...
Can we make all this happen in real life?
Services for Falls and Fractures

- Comprehensive?
- Systematic?
- Evidence Based?
- Planned?
- Built in continuous evaluation?
- Integrated?
- Whole systems?
- Population Based?
- Joined up?
- Cross Sector?
- Public Health?

- Serendipitous?
- Historical?
- Driven by enthusiasms or advocates?
- Based entirely in secondary care?
- Not well evidenced?
- Or evaluated?
- Superficial/box ticking?
- Good services for those who receive them (who may not be the right ones)
- Little effect at whole systems level
Estimating Unmet Need...

- 35,000 persons over 65 in Bexley
- Extrapolation from epidemiological studies...
- C 11,600 will fall in one year
- 7000 will sustain some form of injury
- 1300 will have major injuries or fractures
- 166 will have hip fracture
- 1160-2320 may fall twice or more
- 3500 will be over 80
- 500 will be in residential care settings
- c 2000 will seek care in A&E for falls related injuries and 700 admitted
- Local estimates, 9000 older people likely to have osteoporosis
Examples of Whole systems approach to Services

• Glasgow Fracture Liaison Service (Mclellan et al)
• Newcastle Falls and Syncope Service (Kenny et al)
• Hillingdon PCT Osteoporosis Case Finding Project (Sethi et al)
• Stroud PCT (Bayly et al)
Obstacles to implementation

- Scale of Problem – potential overwhelm 2\textsuperscript{nd} or 1\textsuperscript{st} care services
- No Money
- Short term expenditure for medium term benefit
- Competing hierarchy of priorities
- Incentives and penalties?
- National Values/Ageism
- Systems for case finding?
- Joined up working
- Primary Care Role
- IT and Coding

- NB Just announced not in QOF for GP Contract
Arguments to Use

• Massive and growing problem
• Cost in human and service terms high
• Plenty of evidence that treatment and prevention works
• Evidence Based Guidance and Government Targets
• Potential Cost Savings
• Knock on Benefits for other parts of service
• But
• ...might still get nowhere
In Conclusion…

• A huge and growing problem for the public health and for individuals

• An equally growing evidence base that we can do much to prevent or treat

• The need for integration of services for falls, fractures and fragility

• And integration of approaches across public health, primary and secondary care

• But making a real difference requires commitment and investment

• Is it really high on our priority list – and why?
Some resources...

- Oliver et al Editorial BMJ July 2005 (and links)
- NICE Guidelines on Falls, Fractures (OP)
- AGS/BGS falls guidelines
- Cochrane Reviews (Falls, Hip Protectors, Calcium/Vit D)
- RCP Osteoporosis Guidelines
- BGS website
- National Osteoporosis Society
- Help the Aged Resources
- DOH pages on Falls Services
- Older Peoples’ NSF
- European Cardiology Society Syncope Guidelines
- SIGN Hip fracture Guidelines
- BOA “Blue Book”
- D.Oliver@reading.ac.uk
- www.reading.ac.uk/health
- www.reading.ac.uk/agenet