

## A Common Scenario

- Mrs. T is an 80 yo woman, admitted to the hospital for syncope. After an overnight rest with the help of trazadone, she stood up, took her usual medications (metoprolol, lisinopril, furosemide, and isosorbide), ate a good breakfast, read the paper, then went to the toilet and strained to defecate. Upon standing she suddenly crashed to the floor unconscious and was taken to the hospital.

## Falls Epidemiology

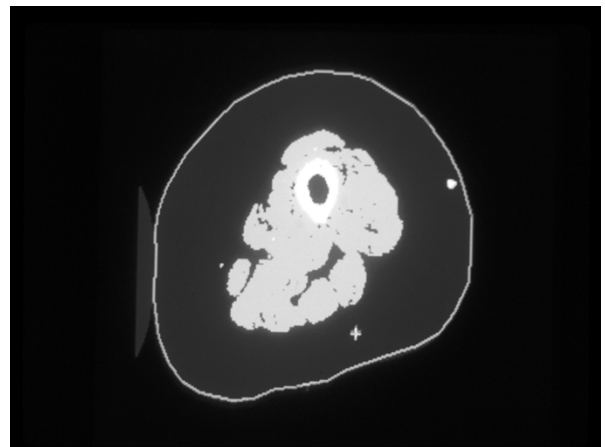
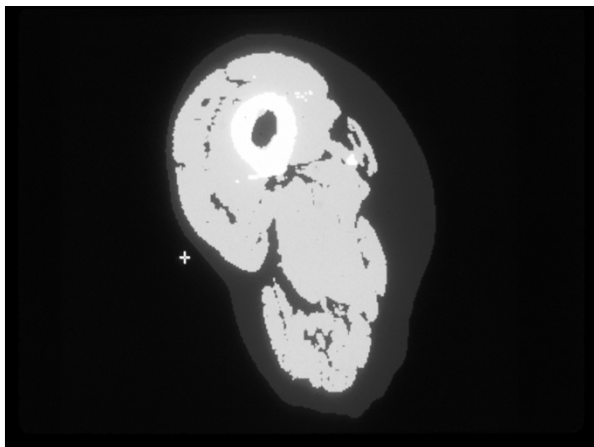
- Common: 30% of community-dwelling elderly, 50% of NH residents fall each year.
- High morbidity, mortality, service use
- Multiple causes & risk factors
- Potentially preventable

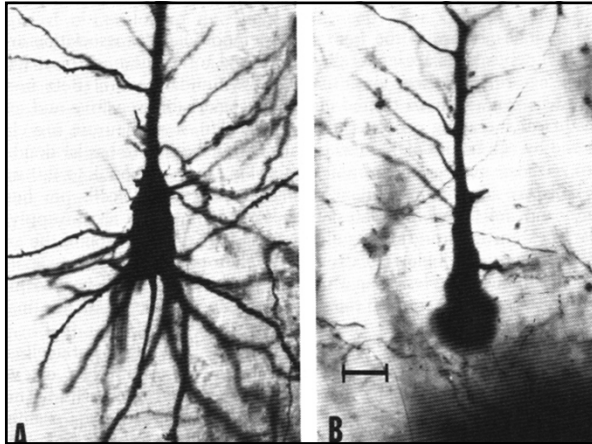
## Epidemiology of Syncope

- Prevalence up to 47% in healthy young
- 23% 10-year prevalence in the NH pop.
- 6-33% 1-year mortality in pts. over 60.
- Up to 40% of cases remain unexplained, despite extensive inpatient evaluations

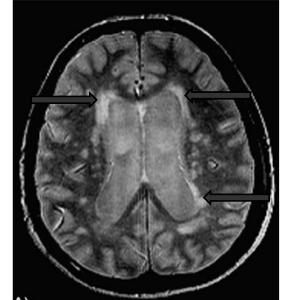
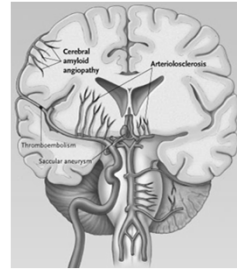
## Pathophysiologic Mechanisms

- Alterations in gait and balance:
  - Muscle weakness
  - Sensory loss
  - Cerebral microvascular disease
  - Peripheral neuropathy
- Reduced cerebral perfusion
  - Abnormal BP regulation
  - Decreased cardiac output, e.g., dehydration





### Cerebral Microangiopathy (WMH): Slow gait, Executive Dysfunction, Depressive Sx.



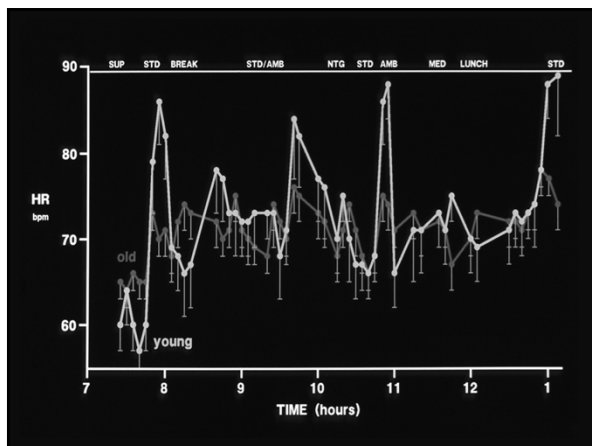
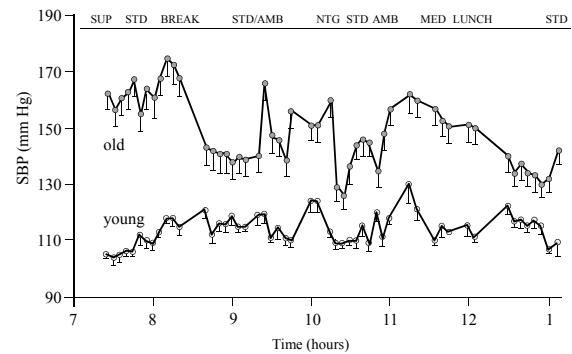
### Abnormalities in BP Regulation

#### Physiologic Mechanisms

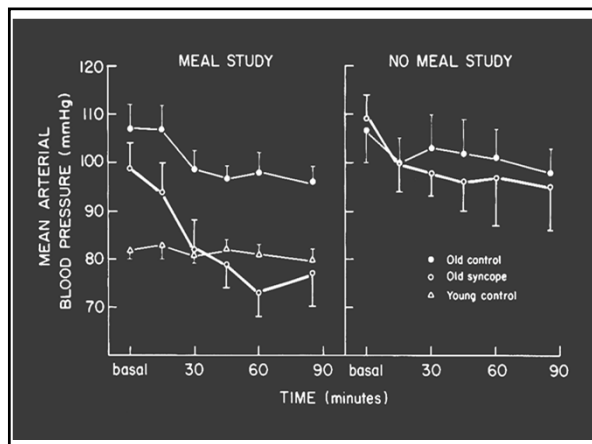
- Reduced baroreflex sensitivity
- Decreased cerebral blood flow
- Reduced renal salt and water conservation
- Decreased diastolic filling
- Vascular stiffness

#### Pathologic Consequences

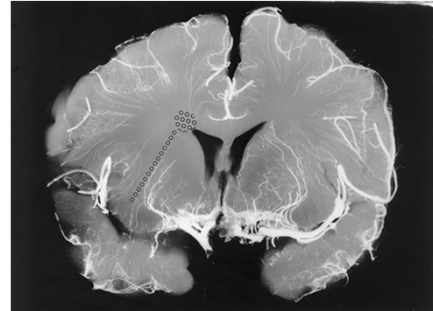
- Syncope
- Orthostatic hypotension
- Postprandial hypotension
- Drug-induced hypotension
- Dehydration
- Carotid sinus syndrome



Elderly patients are at risk of hypotension during common daily activities.

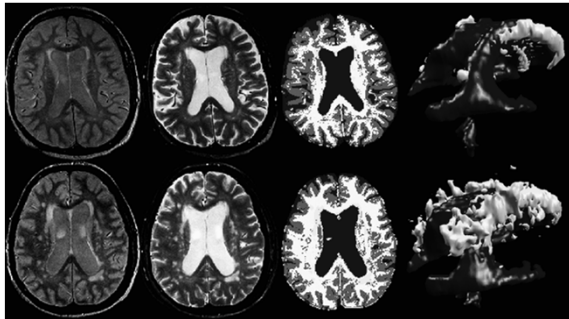


## Watershed Areas of the Brain



Wong, HH et al. Stroke 2001; 32: 1000-1005

## Cerebral Microvascular Disease and Gait



Guttmann et al., *Neurology*, 2000;54:1277-1283

## Disease Related Risk Factors

- Perceptual deficits
  - Cataracts
  - Hearing loss
  - Peripheral neuropathy
  - Vestibular disease
- Orthopedic
  - Arthritis
  - Orthopedic injury
  - Spinal stenosis

## Disease Related Risk Factors (Cont'd)

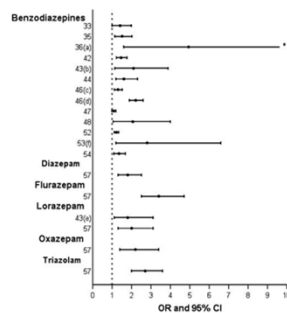
- Cardiovascular
  - Arrhythmia
  - Valvular disease
  - Postural hypotension
  - Postprandial hypotn.
  - Carotid Sinus Syndrome
- Neuromotor
  - Stroke
  - Myopathy
  - Parkinson's Ds.
  - Hydrocephalus
  - Sciatica
  - Depression

## Drugs & Falls: Meta-analysis

Leipzig, Cumming, Tinetti, JAGS, 1999

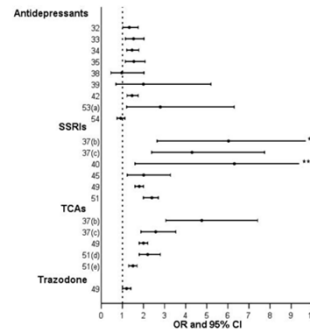
- Psychotropics, any: 1.73 (1.52-1.97)
  - Neuroleptics: 1.50 (1.25-1.79)
  - Sedative/hypnotics: 1.54 (1.40-1.70)
  - Antidepressants: 1.66 (1.40-1.95)
  - Benzodiazepines: 1.48 (1.23-1.77)
- Diuretics: 1.08 (1.02-1.16)
- Anti-arrhythmics (Ia): 1.59 (1.02-2.48)
- Digoxin: 1.22 (1.05-1.42)

## Benzodiazepines and Falls



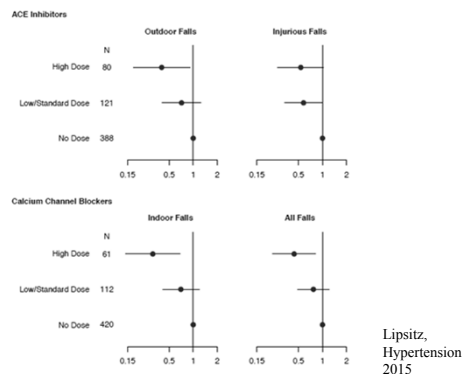
Hartikainen et al, J Geront. 2007

## Antidepressants and Falls



Hartikainen et al, J Geront. 2007

## Odds Ratios for Different Types of Falls According to Anti-HTN Medication and Dose



Lipsitz, Hypertension 2015

## Environmental Hazards

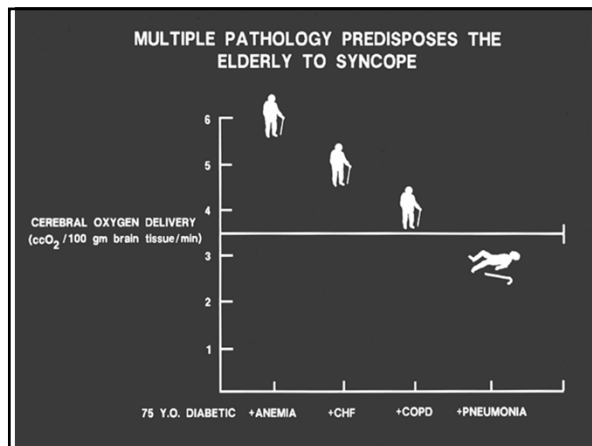
- Poor lighting
- Slippery floors
- Loose rugs, electrical cords
- Moveable furniture
- Stairs
- Poor fitting shoes

## Causes of Falls and Syncope in the Elderly are Multifactorial

- Falls result from the interaction of multiple physiologic changes, pathologic conditions, external hazards, and situational stresses.
- Risk of falling increases with the number of risk factors.
- Falls occur in 10-27% of community-dwelling elders with 0-1 risk factors and 69-78% of those with  $\geq 4$ .

## Causes of Falls and Syncope are Multifactorial

- Therefore, the evaluation of falls and syncope requires a comprehensive assessment to identify multiple risk factors.
- Treatment requires an effort to reduce modifiable risks.



## Evaluation of the Faller: History = DDROPP

- Diseases
- Drugs
- Recovery
- Onset
- Prodrome
- Precipitants

## Evaluation: Physical Exam

- Postural vital signs
- Carotid bruits and upstroke
- Murmurs of AS, MR, or HCM
- Stool hemocult
- Neurologic exam: sensation, motor, reflexes, cerebellar
- Observe activities associated with the event

## “Get Up and Go” Test

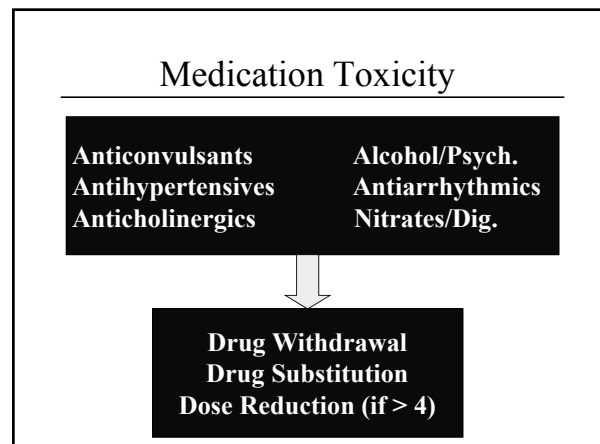
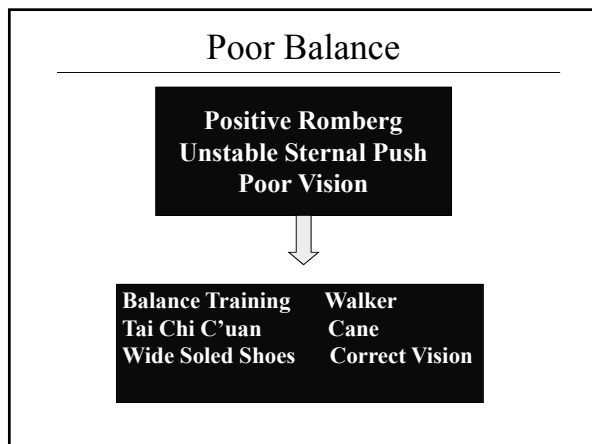
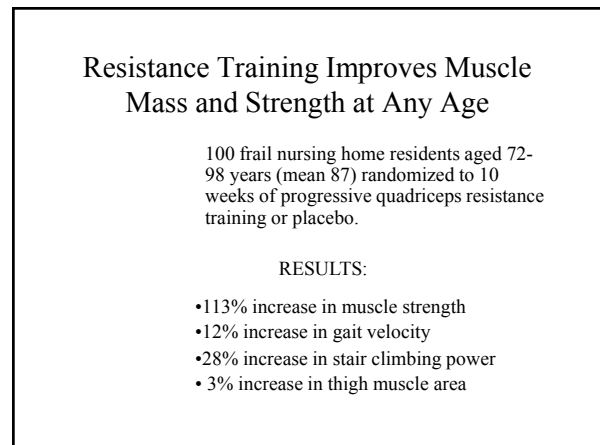
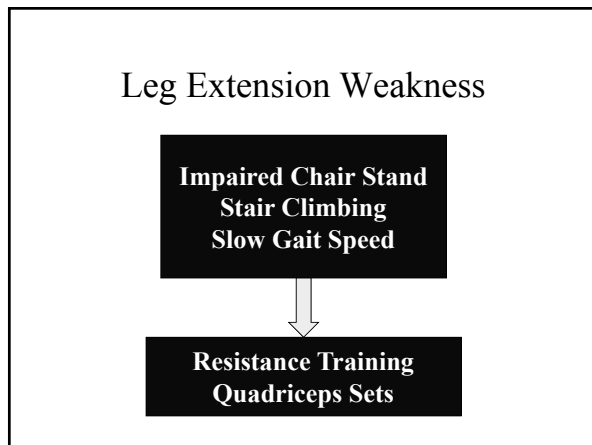
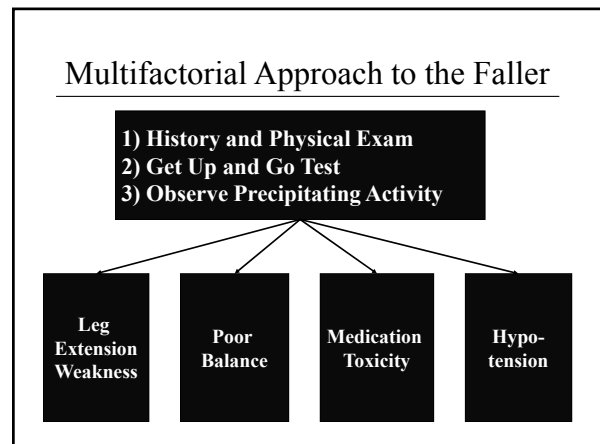
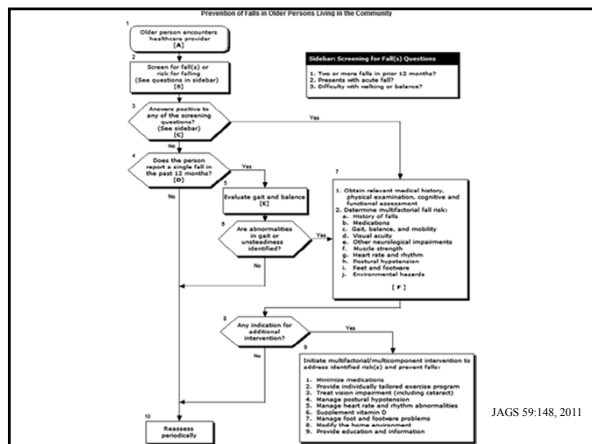
1. Chair stand: get up from chair without using hands
2. Romberg: eyes open and closed, then sternal push
3. 20 foot walk
4. 360 degree turn

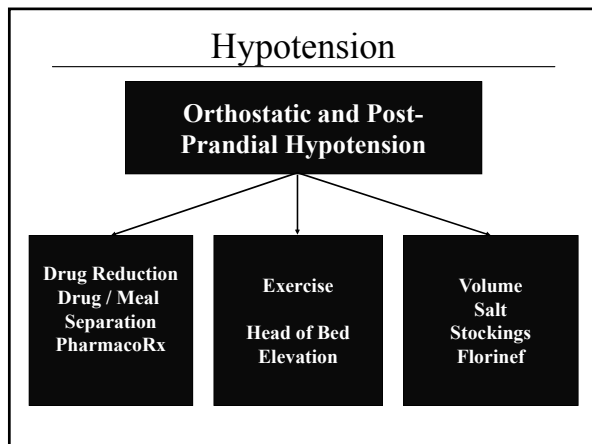
## Gait Observations

- |                          |                         |
|--------------------------|-------------------------|
| • Shuffle: Parkinsons    | • Antalgic: arthritic   |
| • Petit-pas: frontal/CVD | • Spastic: Cerv. Spond. |
| • Hemiparetic: stroke    | • Foot Drop: Peroneal   |
| • Ataxic: cerebellar     | • Sensory: Neuropathy   |

## Laboratory Studies

- CBC, electrolytes, BUN/creatinine, glucose
- Drug levels where appropriate
- Syncope or cardiac sx: EKG
- Suspected arrhythmia: event monitor, CSM, EPS
- Focal neuro. abnormalities: EEG, MRI or CT
- Suspicious systolic murmur: cardiac echo
- Selected patients: tilt studies, autonomic testing

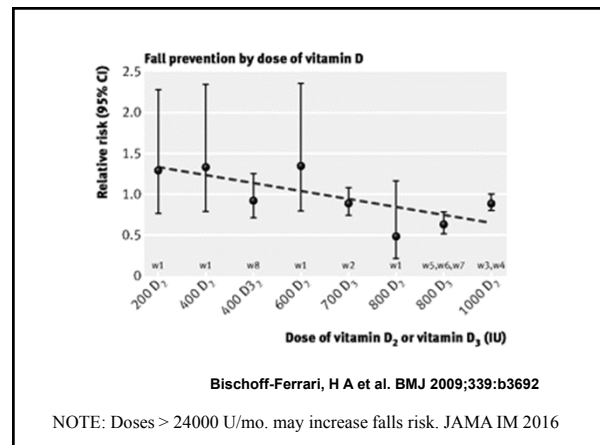
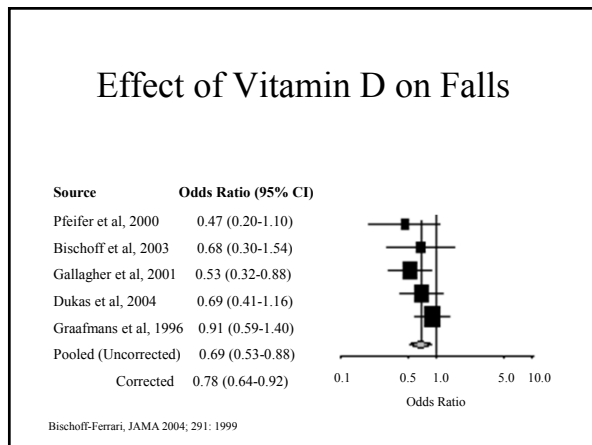




### ***Interventions to Prevent Falls***

<i>Significant Factor from 40 RCTs</i>	<i>Risk Ratio</i>
• Muscle Strengthening & Balance Training	0.80
• Tai Chi Chuan	0.51
• Home Hazard Assessment & Modification	0.64
• Withdrawal of Psychotropic Medications	0.34
• Multidisciplinary, Multifactorial	0.75
– Home/Environment Risk Screening/Intervention	

Cochran Database of Systematic Reviews, 2002, Issue 3



- ## Summary
- Identify and treat all predisposing factors
  - Minimize environmental and situational precipitants.
  - Reduce or eliminate unnecessary medications.
  - Gait training and assistive devices
  - Physical therapy and exercise
  - Treat osteoporosis, 1.2 g Ca, 800 U Vit D