Trinity College Dublin
The University of Dublin

GLOBAL BRAIN HEALTH INSTITUTE

Setting the scene - Overview of Falls

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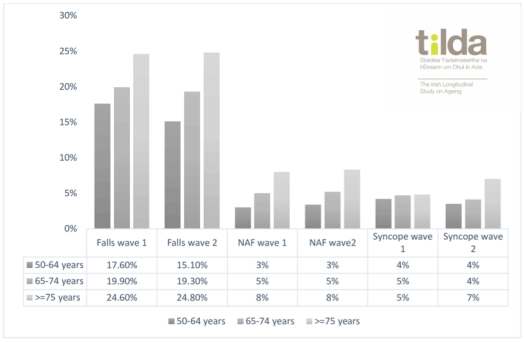
8th International Syncope Training Days, Dublin, 16-17th May 2019

Presentation outline

- Falls in older people *vs.* multimorbidity and frailty
- Non-cardiovascular and cardiovascular causes of falls
- The Comprehensive Geriatric Assessment approach

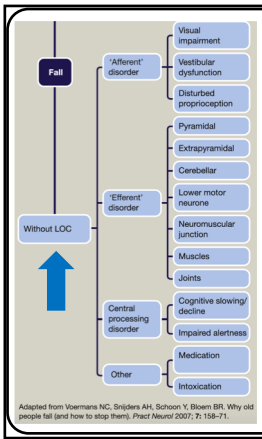
Prevalence and incidence of all falls, non-accidental falls and syncope (TILDA)

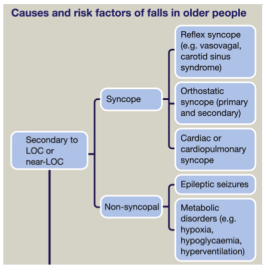


	Falls wave 1	Falls wave 2	NAF wave 1	NAF wave2	Syncope wave 1	Syncope wave 2
50-64 years	17.60%	15.10%	3%	3%	4%	4%
65-74 years	19.90%	19.30%	5%	5%	5%	4%
>=75 years	24.60%	24.80%	8%	8%	5%	7%

50-64 years 65-74 years >=75 years

Bhangu J *et al.* PLOS ONE 2017; 12(7): e0180997





Falls: classification

Kenny RA, Romero-Ortuno R, Cogan L. Medicine 2013

Complexity of syncope in elderly people: a comprehensive geriatric approach

CW Wong *

Hong Kong Med J 2018;24:182–90
DOI: 10.12809/hkmj176945

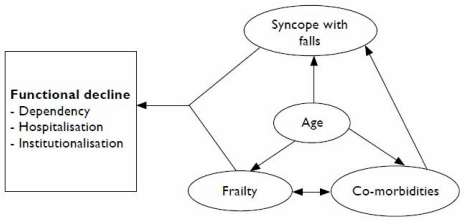
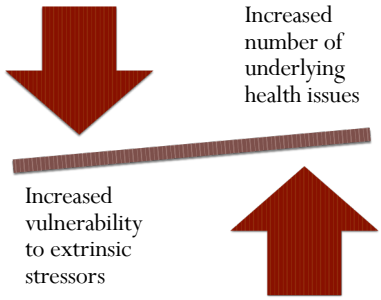
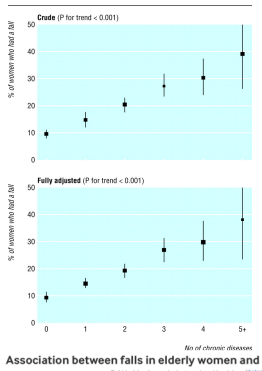


FIG 1. Interaction between syncope, age, frailty, and co-morbidities

Underlying health issues vs. vulnerability to extrinsic stressors: a theoretical perspective



Multimorbidity and falls



Chronic diseases included coronary heart disease, circulatory disease, COPD, eye disease, depression, arthritis

Crude data adjusted for age, each drug taken, BMI, alcohol consumption, Hb concentration and social class

Association between falls in elderly women and chronic diseases and drug use: cross sectional study

Debbie A Lawlor, senior lecturer in epidemiology, Rita Patel, project coordinator, Shah Ebrahim, professor of epidemiology of ageing

BMJ 2003 ; 327 doi: https://doi.org/10.1136/bmj.327.7417.712 (Published 25 September 2003)

bmj.com

Frailty: the clinical concept

- '*A condition or syndrome which results from a multi-system reduction in reserve capacity to the extent that a number of physiological systems are close to, or past, the threshold of symptomatic clinical failure.*
- *As a consequence the frail person is at increased risk of disability and death from minor external stresses*'.

Age and Ageing 1997; 26: 315–318

FOR DEBATE

Unstable disability and the fluctuations of frailty

A. JOHN CAMPBELL, DAVID M. BUCHNER

Department of Medicine, University of Otago Medical School, PO Box 913, Dunedin, New Zealand
Department of Health Services, University of Washington, Seattle, WA, USA

Frailty = vulnerability

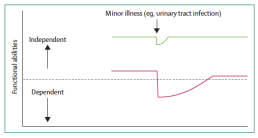


Figure 1: **Vulnerability of frail elderly people to a sudden change in health status after a minor illness**
The green line represents a fit elderly individual who, after a minor stressor event such as an infection, has a small deterioration in function and then returns to homoeostasis. The red line represents a frail elderly individual who, after a similar stressor event, undergoes a larger deterioration, which may manifest as functional dependency, and who does not return to baseline homoeostasis. The horizontal dashed line represents the cutoff between dependent and independent.

Clegg A, Young J, *et al*. Lancet 2013

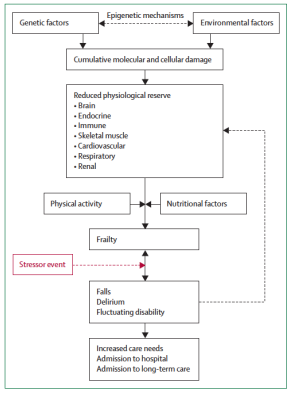
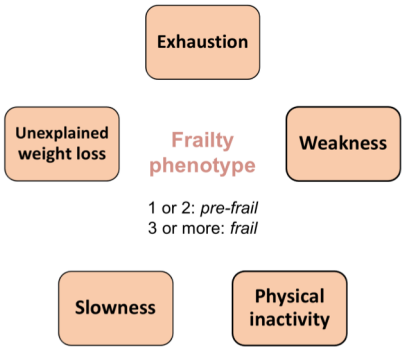
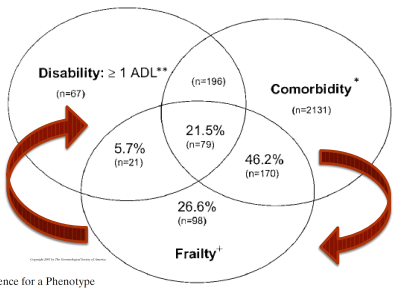


Figure 2: Schematic representation of the pathophysiology of frailty



Fried L *et al*. **Frailty in older adults: evidence for a pheynotype**. *J Gerontol A Biol Sci Med Sci*. 2001; 56:M146-56.

Frailty phenotype *vs*. comorbidities, disability



Frailty in Older Adults: Evidence for a Phenotype

Linda P. Fried,[1] Catherine M. Tangen,[2] Jeremy Walston,[1] Anne B. Newman,[2] Calvin Hirsch,[4] John Gottdiener,[5] Teresa Seeman,[6] Russell Tracy,[7] Willem J. Kop,[8] Gregory Burke,[9] and Mary Ann McBurnie[2] for the Cardiovascular Health Study Collaborative Research Group

Frailty phenotype as an independent predictor of falls

Table 7. Baseline Frailty Status Predicting Falls, Disability, Hospitalizations, and Death in Both Cohorts of CHS With a Maximum Follow-up Time of 7 Years for the First Cohort and 4 Years for the Minority Cohort

	No Frailty (reference)	Hazard Ratios Estimated Over 3 Years		Hazard Ratios Estimated Over 7 Years	
		Intermediate	Frail	Intermediate	Frail
Incident Fall					
Unadjusted	HR* = 1.0	HR = 1.36 CI = (1.18,1.56) $p < .0001$	HR = 2.06 CI = (1.64,2.59) $p < .0001$	HR = 1.28 CI = (1.15,1.43) $p < .0001$	HR = 1.82 CI = (1.50,2.21) $p < .0001$
Covariate Adjusted	HR = 1.0	HR = 1.16 CI = (1.00,1.34) $p = .056$	HR = 1.29 CI = (1.00,1.68) $p = .054$	HR = 1.12 CI = (1.00,1.26) $p = .045$	HR = 1.23 CI = (0.99,1.54) $p = .064$
Worsening Mobility†					
Unadjusted	HR = 1	HR = 1.94 CI = (1.75,2.15) $p < .0001$	HR = 2.68 CI = (2.26,3.18) $p < .0001$	HR = 1.72 CI = (1.58,1.87) $p < .0001$	HR = 2.45 CI = (2.11,2.85) $p < .0001$
Covariate Adjusted	HR = 1	HR = 1.58 CI = (1.41,1.76) $p < .0001$	HR = 1.50 CI = (1.23,1.82) $p < .0001$	HR = 1.41 CI = (1.29,1.54) $p < .0001$	HR = 1.36 CI = (1.15,1.62) $p = .0003$

Journal of Gerontology: MEDICAL SCIENCES
2001, Vol. 56A, No. 3, M146-M156

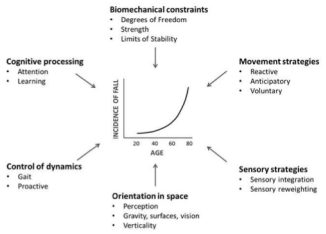
Frailty in Older Adults: Evidence for a Phenotype

Linda P. Fried,[1] Catherine M. Tangen,[2] Jeremy Walston,[1] Anne B. Newman,[2] Calvin Hirsch,[4] John Gottdiener,[5] Teresa Seeman,[6] Russell Tracy,[7] Willem J. Kop,[8] Gregory Burke,[9] and Mary Ann McBurnie[2] for the Cardiovascular Health Study Collaborative Research Group

Balance and postural stability: lessons from complex systems

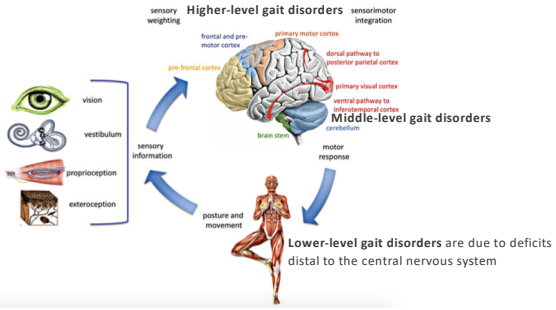
- Walking and maintaining balance are very complex physiological tasks.
- Multiple physiological systems involved in maintaining postural stability.

Resources required for Postural Stability and Orientation



Horak FB, Age and Ageing 2006

Gait disorders: Search for multiple causes



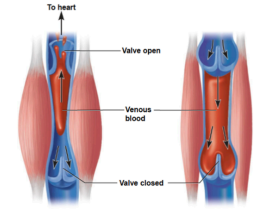
van Dieën J.H., Pijnappels M. (2017) Balance Control in Older Adults. In: Barbieri F., Vitório R. (eds) Locomotion and Posture in Older Adults. Springer

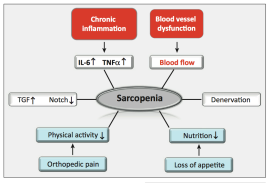
Alexander NB and Goldberg A, Cleveland Clinic Journal of Medicine 2005

SYNCOPEDIA.ORG

The muscle pump

"The second heart"





Trends in Endocrinology and Metabolism June 2013, Vol. 24, No. 6

90 mmHg

Key adjustments

- Constriction of arterioles and of venous capacitance vessels
- Increases in skeletal & abdominal muscle tone

Age and Ageing Advance Access published July 12, 2011

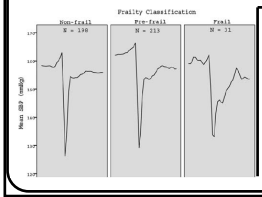
Age and Ageing 2011; **0:** 1–8
doi: 10.1093/ageing/afr076

Orthostatic haemodynamics may be impaired in frailty†

ROMAN ROMERO-ORTUNO[1], LISA COGAN[1], DIARMUID O'SHEA[2], BRIAN A. LAWLOR[1], ROSE ANNE KENNY[1,2]

[1]Technology Research for Independent Living (TRIL) Centre, Trinity College Dublin and Mercer's Institute for Successful Ageing, Hospital 4, Top Floor, St James's Hospital, James's Street, Dublin 8, Ireland
[2]Trinity College Institute of Neuroscience (TCIN), Dublin 2, Ireland
[3]Department of Geriatric Medicine, St Vincent's University Hospital, Elm Park, Dublin 4, Ireland

Address correspondence to: R. Romero-Ortuno. Tel: (+353) 1 428 4527; Fax: (+353) 1 410 3454. Email: romeror@tcd.ie



Frailty, and particularly slow gait speed, was associated with reduced rate of recovery in BP and heart rate recovery following active standing. Impaired BP recovery may represent a marker of physiological frailty.

O'Connell M, Savva G, Finucane C, Romero-Ortuno R, Fan CW, Kenny RA. Impairments in hemodynamic responses to orthostasis associated with frailty: results from TILDA. *Journal of the American Geriatrics Society* 2018 (in press)

Clin Auton Res (2010) 20:39–45
DOI 10.1007/s10286-009-0040-3

RESEARCH ARTICLE

Intolerance to initial orthostasis relates to systolic BP changes in elders

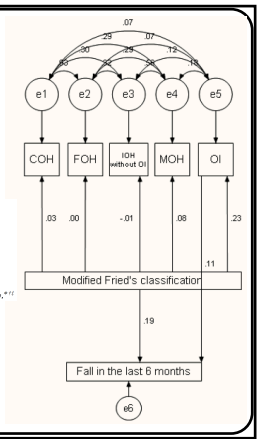
Roman Romero-Ortuno · Lisa Cogan · Chie Wei Fan · Rose Anne Kenny

CLINICAL INVESTIGATIONS

Journal of the American Geriatrics Society 2011;59(4):655-65

Continuous Noninvasive Orthostatic Blood Pressure Measurements and Their Relationship with Orthostatic Intolerance, Falls, and Frailty in Older People

Roman Romero-Ortuno, Lic Med (Barcelona), PhD, MSc,† Lisa Cogan, MBBCh, MSc,*† Tim Foran, MSc, BEng,*† Rose Anne Kenny, MD, MBBCh,*†‡ and Chie Wei Fan, MD, MBBCh,*†‡*



Roman Romero Ortuno, 'Orthostatic Hypotension as a marker of Frailty in Older People', [Thesis], Trinity College Dublin, 2011

Arrhythmia

ORIGINAL ARTICLE

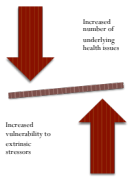
Long-term cardiac monitoring in older adults with unexplained falls and syncope

Jaspreet Bhangu,[1] C Geraldine McMahon,[2] Patricia Hall,[1] Kathleen Bennett,[3] Ciara Rice,[4] Peter Crean,[5] Richard Sutton,[6] Rose-Anne Kenny[1]

Heart 2016;**0**:1–6. doi:10.1136/heartjnl-2015-308706

Twenty per cent of unexplained fallers demonstrate an arrhythmia which is attributable as the cause of their fall. Patients who have cardiac arrhythmia are significantly more likely to experience future falls.

Potential adverse effects of medications contributing to falls in the elderly[2]



Adverse drug effect	Medication(s)*
Agitation	Antidepressants, caffeine, neuroleptics, stimulants
Arrhythmias	Antiarrhythmics
Cognitive impairment, confusion	Benzodiazepines, narcotics, neuroleptics, any drug with anticholinergic effects
Dizziness, orthostatic hypotension	Anticonvulsants, antidepressants, antihypertensives, benzodiazepines, narcotics, neuroleptics
Gait abnormalities, extrapyramidal reactions	Antidepressants, metoclopramide, neuroleptics
Increased ambulation	Diuretics
Postural disturbances (eg, problems with balance)	Anticonvulsants, benzodiazepines, neuroleptics
Sedation, drowsiness	Anticonvulsants, antidepressants, benzodiazepines, narcotics, neuroleptics
Syncope	Beta-blockers, nitrates, vasodilators (eg, alpha$_1$-adrenergic blockers such as doxazosin)
Visual disturbances (eg, blurred vision)	Neuroleptics, any drug with anticholinergic effects

*Not an exhaustive list; many other agents may cause adverse effects specified.
Reproduced with permission from the *Canadian Pharmacists Journal*, 137:6, 2004.

Romero-Ortuno et al. *BMC Geriatrics* 2013, 13:73
http://www.biomedcentral.com/1471-2318/13/73

BMC Geriatrics

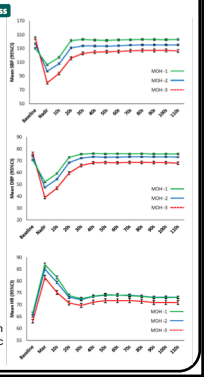
RESEARCH ARTICLE Open Access

Insights into the clinical management of the syndrome of supine hypertension – orthostatic hypotension (SH-OH): The Irish Longitudinal Study on Ageing (TILDA)

Roman Romero-Ortuno*, Matthew DL O'Connell, Ciaran Finucane, Christopher Soraghan, Chie Wei Fan and Rose Anne Kenny

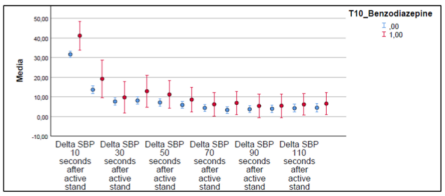
Antidepressants and **beta blockers** were independently associated with MOH-3, and should be used judiciously in older patients with SH-OH. **Hypnotics** and **sedatives** may add to the OI effect of MOH-3.

We proposed a *morphological* classification of orthostatic hypotension (MOH), which is an approach to the definition of three typical orthostatic hemodynamic patterns using non-invasive beat-to-beat monitoring.



Benzodiazepines: early hypotensive effect?

Benzodiazepines users (n=33)
Non-users (n=505)



Orthostatic systolic blood pressure during the active stand test according to benzodiazepines use. SBP, systolic blood pressure.

TRIL Technology Research for Independent Living

Rivasi G, Kenny RA, Romero-Ortuno, 2019 (submitted)

REVIEW

Falls and frailty: lessons from complex systems

Abigail Nowak • Ruth E Hubbard
Geriatric Medicine Research Unit, Dalhousie University and Queen Elizabeth II Health Sciences Centre, 5955 Veterans' Memorial Lane, Halifax, B3H 2E1, Canada
Correspondence to: Ruth E Hubbard. E-mail: Ruth.Hubbard@cdha.nshealth.ca

- *Conceptualization of frailty as a complex system failure might help us understand existing evidence regarding the aetiology and prevention of falls and, most importantly, how it might impact our clinical practice.*

J R Soc Med 2009; **102:** *98–102. DOI 10.1258/jrsm.2009.080274*

Cardiovascular assessment of falls in older people

Clinical Interventions in Aging 2006:1(1) 57–66

Maw Pin Tan[1]
Rose Anne Kenny[2]

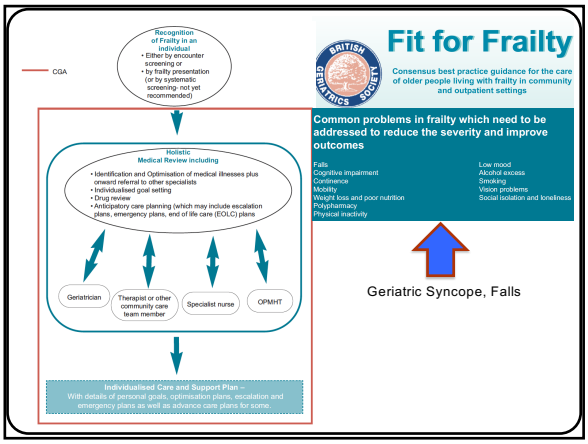
Key challenges:
- Significant overlap between falls and syncope in older persons
- Amnesia for loss of consciousness during unwitnessed syncope
- Falls, frailty and syncope are due to multiple systems dysregulation
- Often unwitnessed, partial histories, cognitive and sensory issues
- Atypical presentations, 'distracting' presentations
- Polypharmacy and variable adherence
- Single culprit unlikely

Suspect primarily cardiac if:
- History (palpitations, SOB)
- Arrhythmia, abnormal ECG
- Known structural, IHD, CCF
- **Recurrent unexplained injurious** falls

Is it cardiac? Assessment of syncope with a scoring system

Roman Romero-Ortuno, Rose Anne Kenny

Heart December 2008 Vol 94 No 12



Multifactorial Assessment

Older People with Falls

NICE 2004 / NICE guideline [CG161] 2013 Falls in older people: assessing risk and prevention

- Identification of falls history
- Assessment of gait, balance and mobility, and muscle weakness
- Assessment of osteoporosis risk
- Assessment of the older person's perceived functional ability and fear relating to falling
- Assessment of visual impairment
- Assessment of cognitive impairment and neurological examination
- Assessment of urinary incontinence
- Assessment of home hazards
- Cardiovascular examination
- medication review

Thank you!