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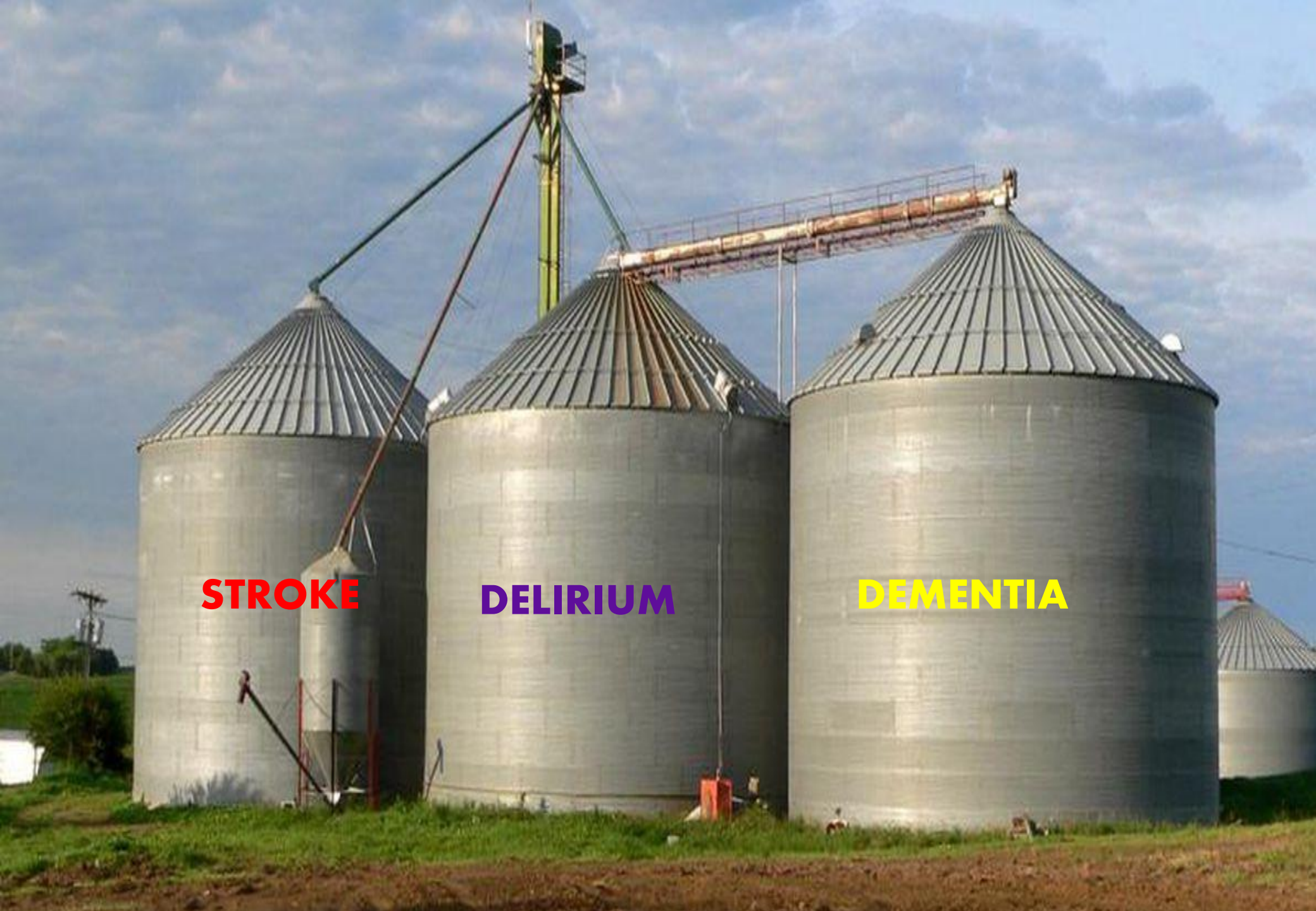
Physical & cognitive frailty in stroke

Terry Quinn



Terry.quinn@glasgow.ac.uk

[@DrTerryQuinn](https://twitter.com/DrTerryQuinn)

The image shows three large, cylindrical metal grain silos with conical roofs, arranged in a row. A metal conveyor system with a long horizontal section and angled sections connects the tops of the silos. The silos are situated in a grassy field under a blue sky with scattered clouds. The word 'STROKE' is overlaid in red on the left silo.

STROKE

DELIRIUM

DEMENTIA



University
of Glasgow

The F word (Frailty)

Terry Quinn



Terry.quinn@glasgow.ac.uk

[@DrTerryQuinn](https://twitter.com/DrTerryQuinn)



- **What is frailty** **in stroke**
- **Why is it important** **in stroke**
- **How to assess for frailty** **in stroke**
- **How to treat frailty** **in stroke**



Geriatrics, from geras, old age, and iatrikos, relating to the physician,

is a term I would suggest ...
to cover the same field in old age
that is covered by the term
pediatrics in childhood,

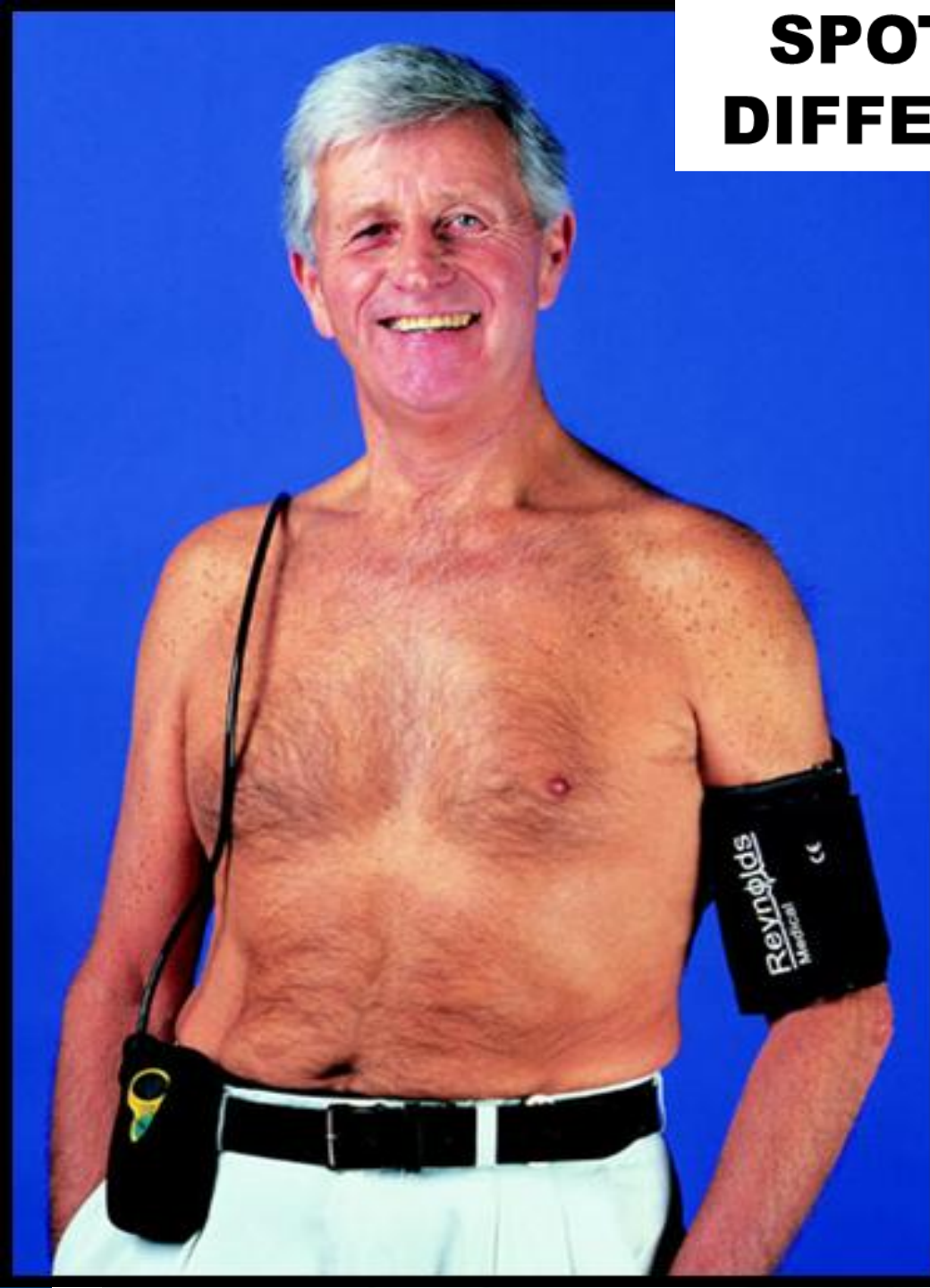
to emphasize the necessity of
considering senility and its disease
apart from maturity and to assign it
a separate place in medicine

IL Nascher, Geriatrics.
New York Medical Journal 1909

SPOT THE DIFFERENCE



SPOT THE DIFFERENCE



Clinically recognizable state of increased vulnerability resulting from **ageing-associated decline** in reserve and function across multiple physiological systems such that the ability to cope with every day or acute stressors is compromised

Xue 2011

state of vulnerability to poor resolution of homoeostasis after a stressor event as a consequence of cumulative decline in physiological systems **during a lifetime**. This depletes homoeostatic reserves until minor stressor events trigger disproportionate changes in health status

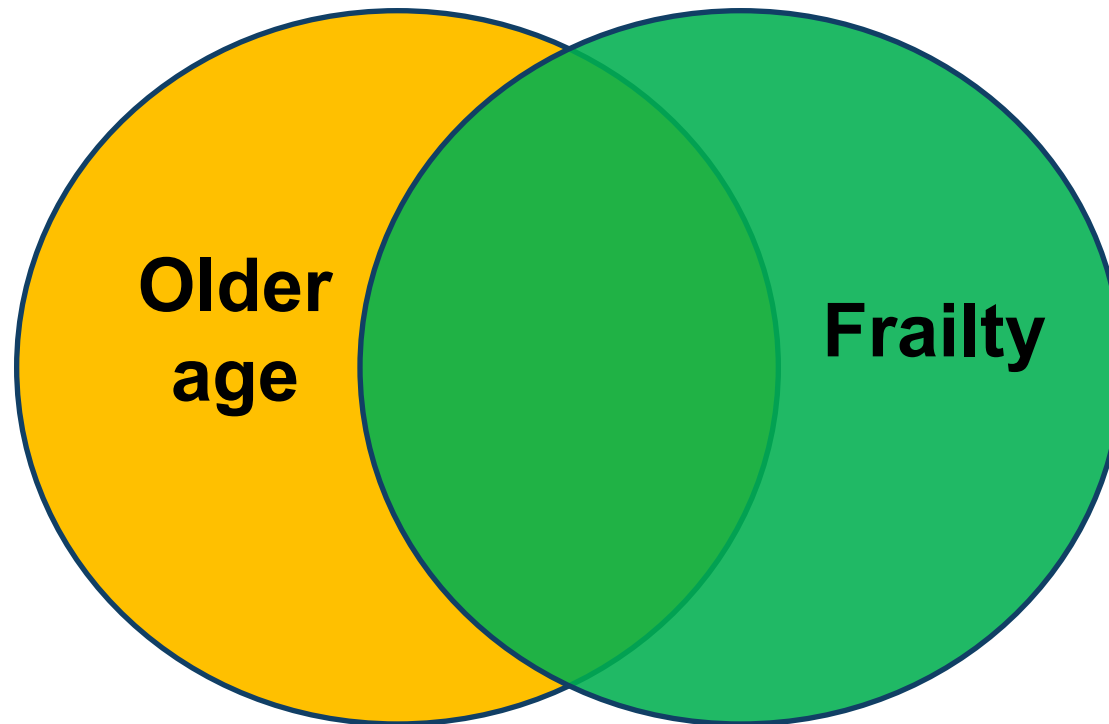
Clegg 2013

Frailty is a distinctive state of health related to the **ageing process**, characterised by a complex mix of physical, mental health and social care needs. The body's in-built reserves are eroded, vulnerable to sudden changes in health triggered by seemingly small events

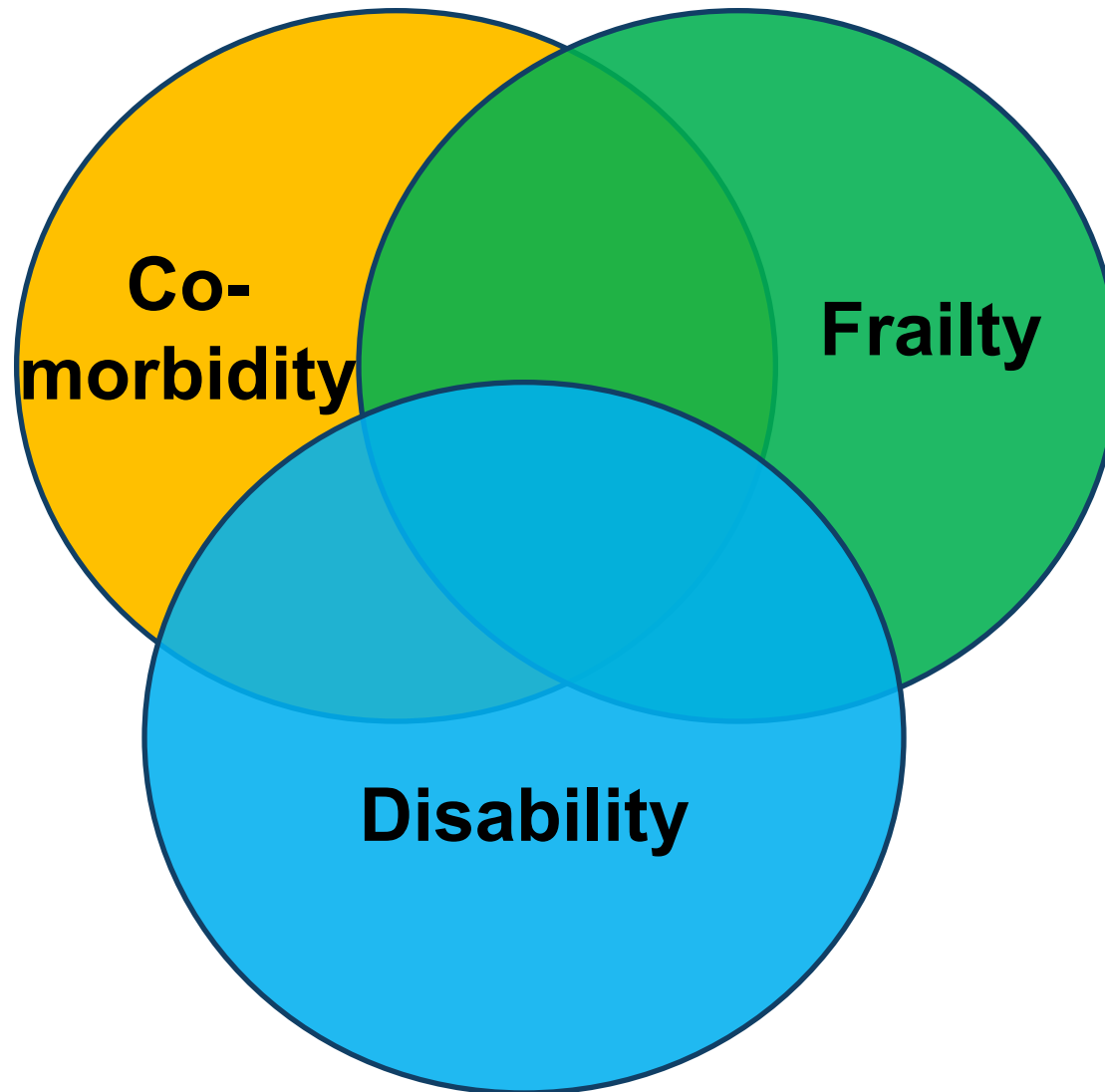
NHS Right Care 2016

Frailty is a distinctive health state related to the **ageing process** in which multiple body systems gradually lose their in-built reserves"

BGS 2014



Approx. 10% of people aged over 65 living with frailty
Approx. 25-50% people aged over 85 living with frailty





THE LANCET Healthy Longevity

✦ LeapSpace ↗

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REVIEW · [Volume 7, Issue 5](#), 100853, May 2026 · [Open Access](#)

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Stroke in older adults: exploring the intersections of comorbidity, disability, and frailty

[Terence J Quinn, Prof](#) ^a  · [Nicholas Evans, PhD](#)^c · [Patricia Fearon, MBChB](#)^d · [Katie I Gallacher, PhD](#)^b



A photograph of an elderly man with white hair and a serious expression, lying in a hospital bed. He is wearing a green hospital gown. His right hand is resting on his chin, and a clear IV drip chamber with a blue tube is attached to his wrist. The background shows a white pillow and a blurred medical monitor.

Old age – it doesn't come alone

TIA

Previous stroke

Hypertension

Atrial fibrillation

Gout

Hearing impairment

Disordered gait and balance

Asthma



61% of stroke survivors in Scotland are also living with **3 or more of any comorbidity**.

This is an estimated **79,000** people.

Please choose one option below.

H&CDs and related conditions /risk factors

- ☐ Atrial fibrillation
- ☐ Coronary heart disease
- ☐ Dementia
- ☐ Diabetes
- ☐ Heart failure
- ☐ Hypertension
- ☐ Peripheral vascular disease

Multiple comorbidities

- ☐ 1 or more other H&CD comorbidity
- ☐ 1 or more of any comorbidity
- ☒ 3 or more of any comorbidity

Nation

- ☐ the UK
- ☐ England
- ☒ Scotland
- ☐ Northern Ireland
- ☐ Wales



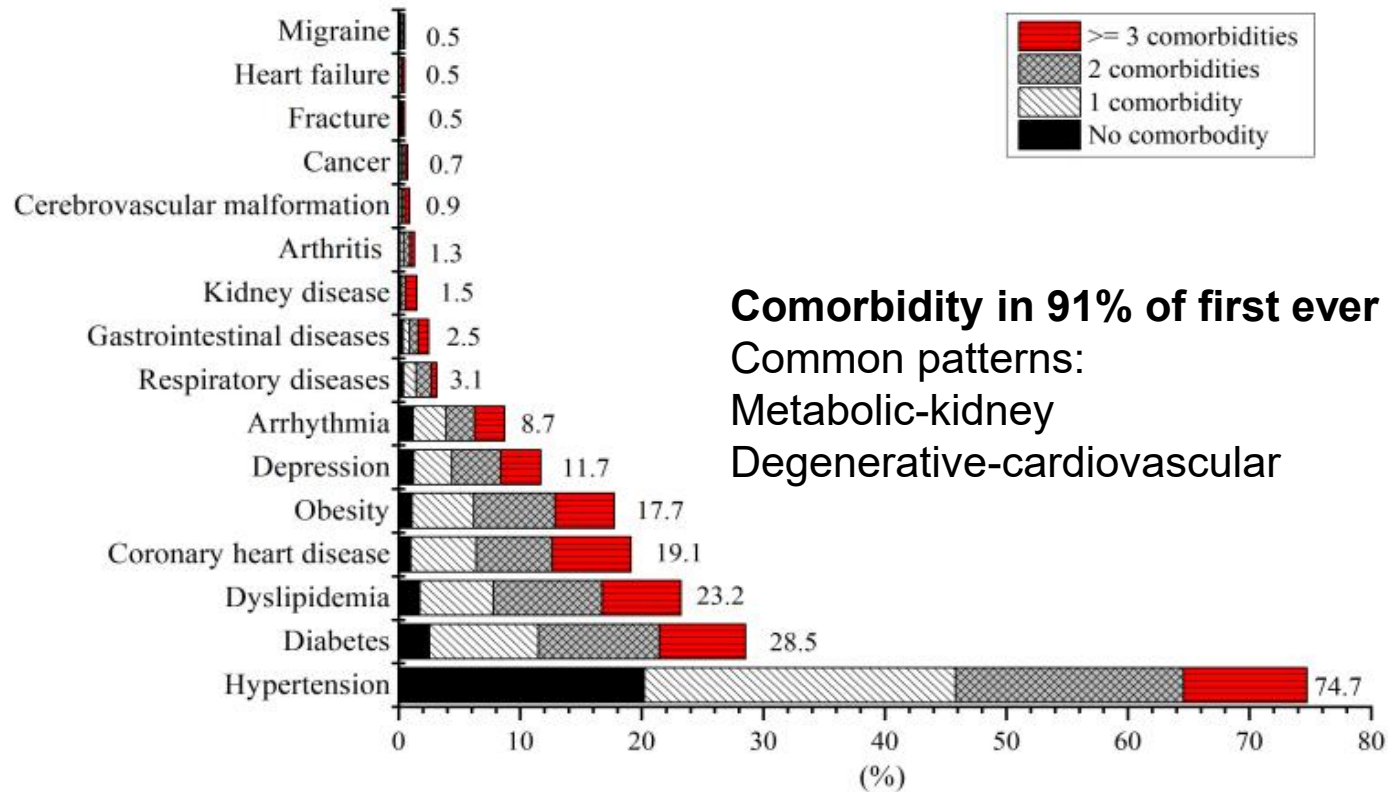


FIGURE 1

Prevalence (per 100 patient population) and co-occurrence of chronic diseases among patients with first-ever acute ischemic stroke ($n = 2,151$). Comorbidity refers to chronic diseases other than the specific condition and stroke.

Clinically recognizable state of increased **vulnerability** resulting from **ageing-associated decline** in **reserve** and function across multiple physiological systems such that the ability to cope with every day or acute stressors is compromised

Xue 2011

state of **vulnerability** to poor resolution of homoeostasis after a stressor event as a consequence of cumulative decline in physiological systems **during a lifetime**. This **depletes homoeostatic reserves** until minor stressor events trigger disproportionate changes in health status

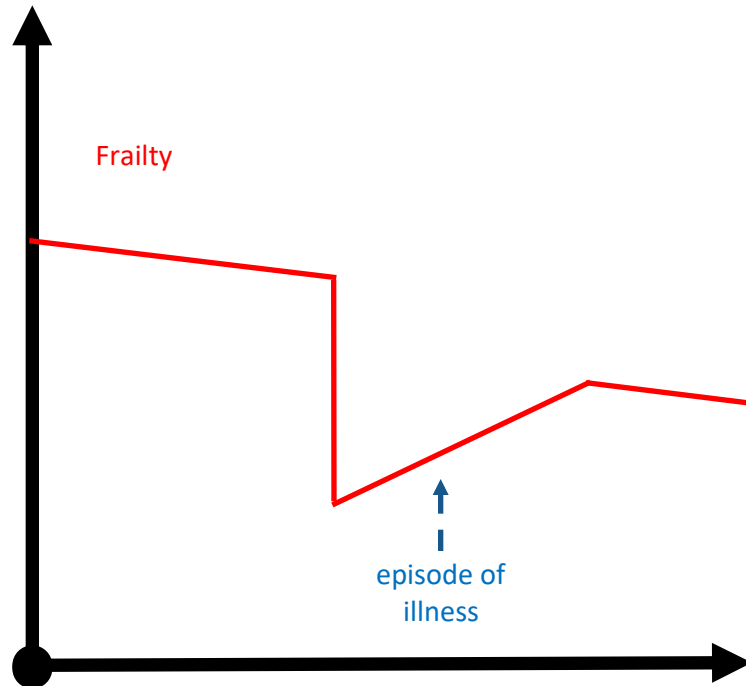
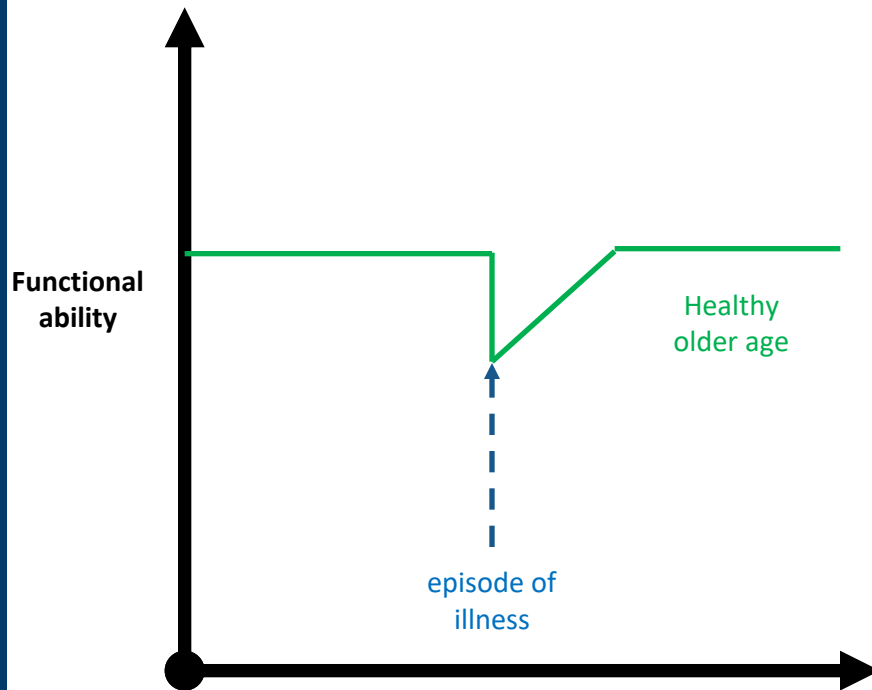
Clegg 2013

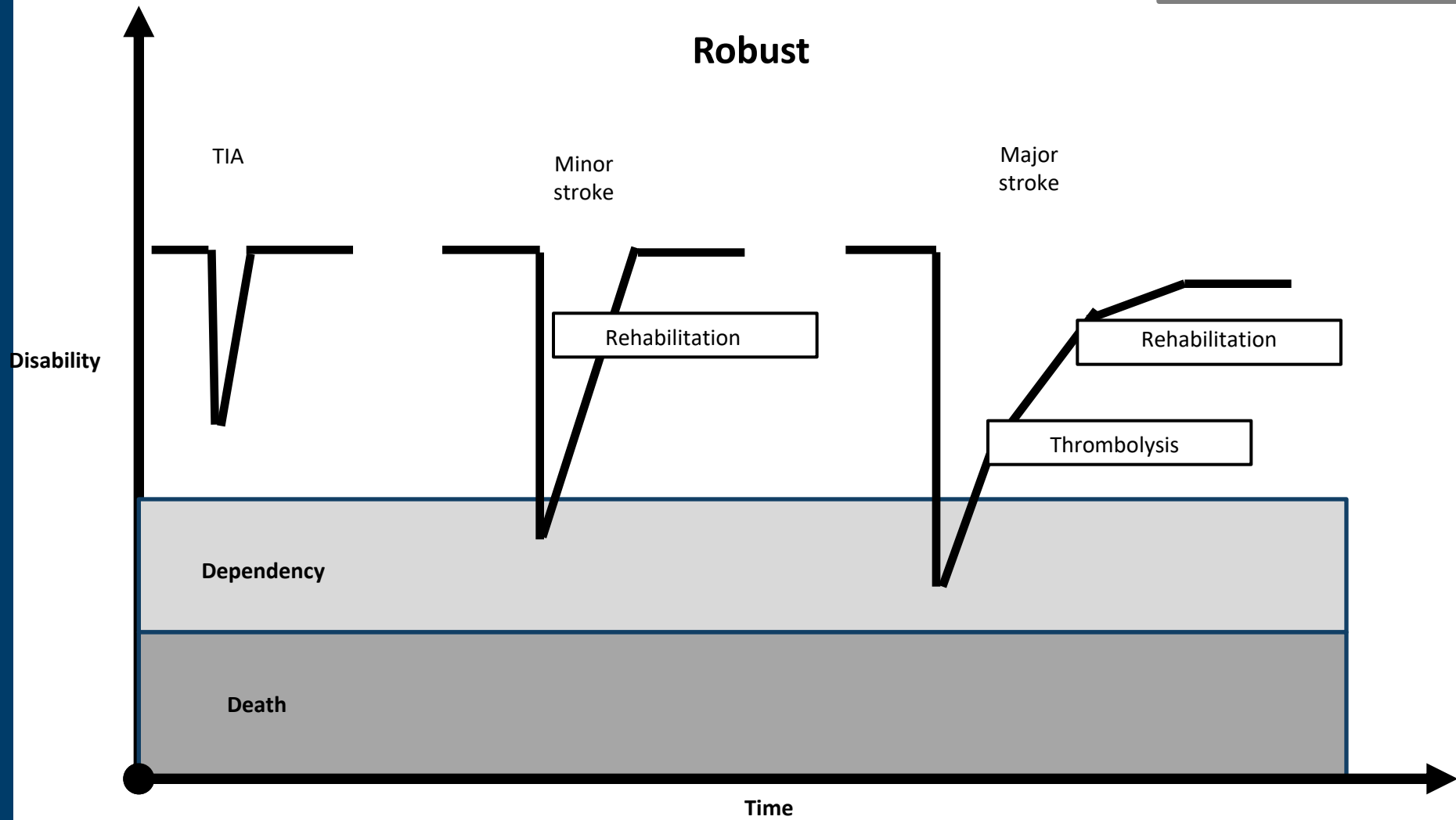
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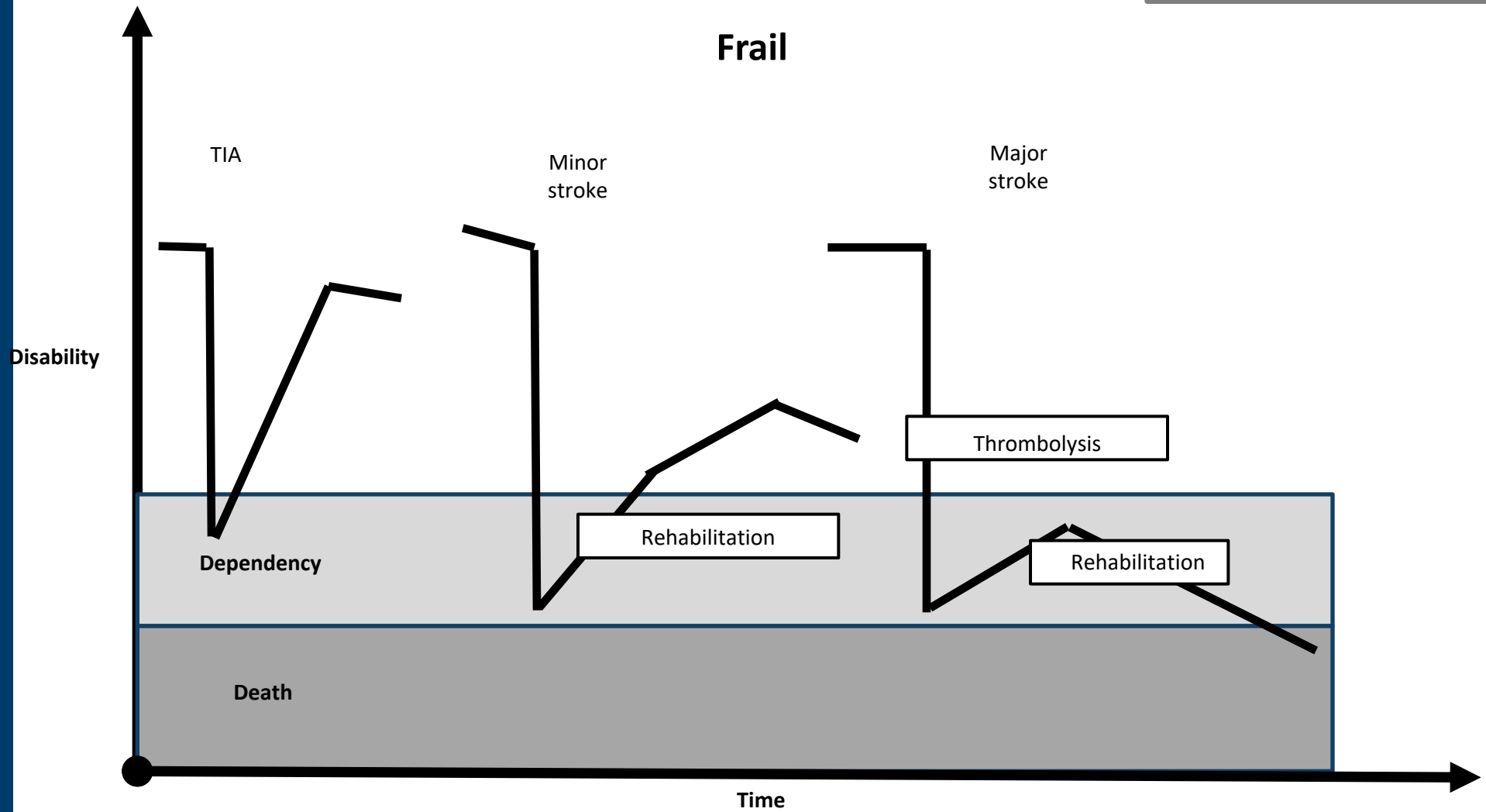
NHS Right Care 2016

Frailty is a distinctive health state related to the **ageing process** in which multiple body systems gradually lose their **in-built reserves**"

BGS 2014









Frailty as cumulative burden

The more things go wrong the more likely the system will fail

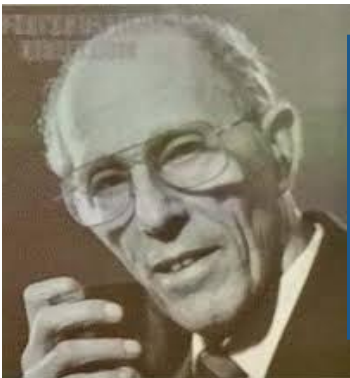
Frailty index



Frailty as a syndrome with recognisable features

Frailty can be clinically assessed and quantified

Frailty phenotype



Frailty is recognised in the manifestation of ill health

Final common pathways that follow all physiological insults

Frailty syndromes (Geriatric Giants)



Frailty as cumulative burden

The more things go wrong the more likely the system will fail

Frailty index

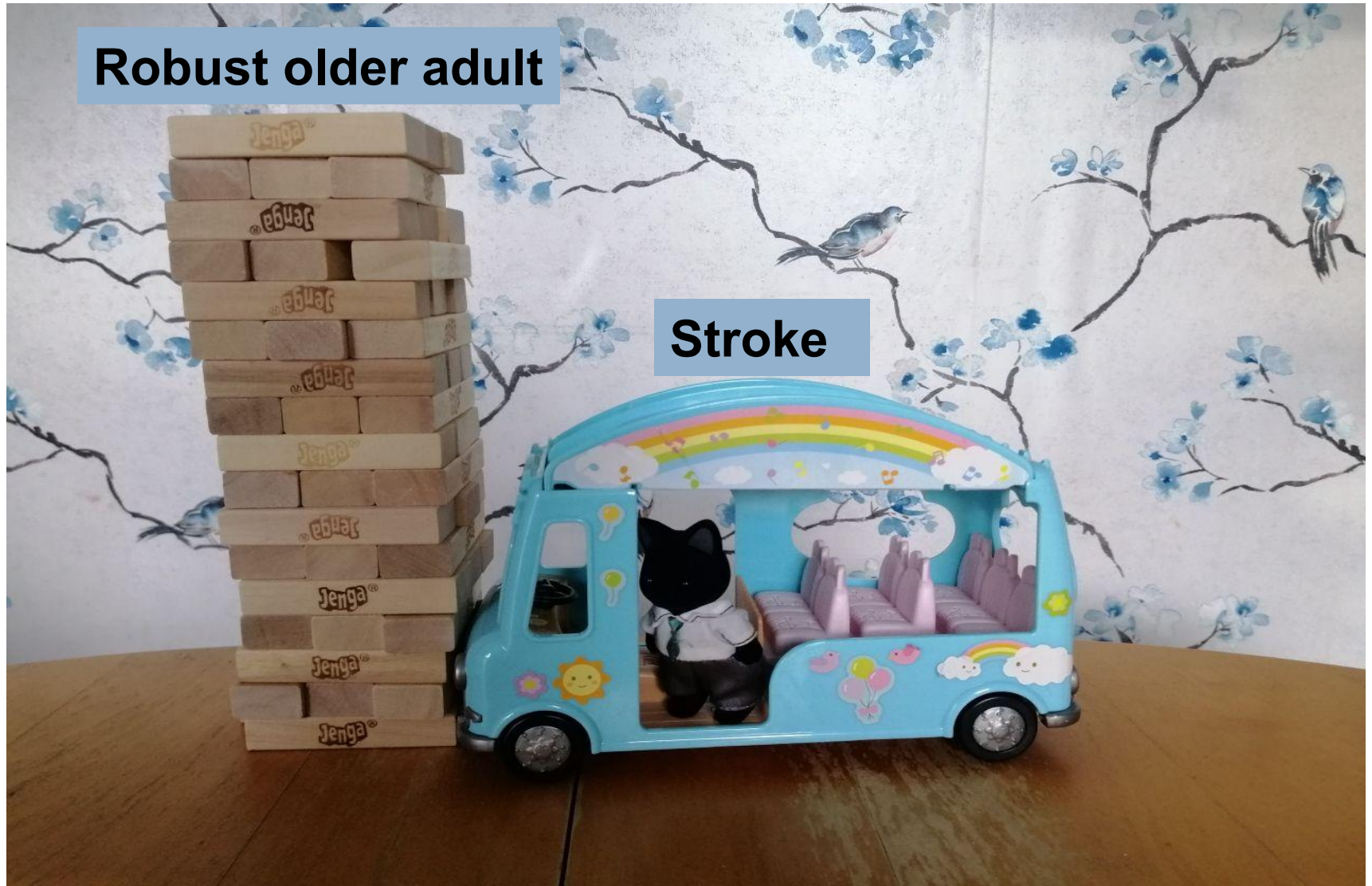
Robust older adult

Stroke



Robust older adult

Stroke



Frail older adult

Anaemia

Heart failure

Falls

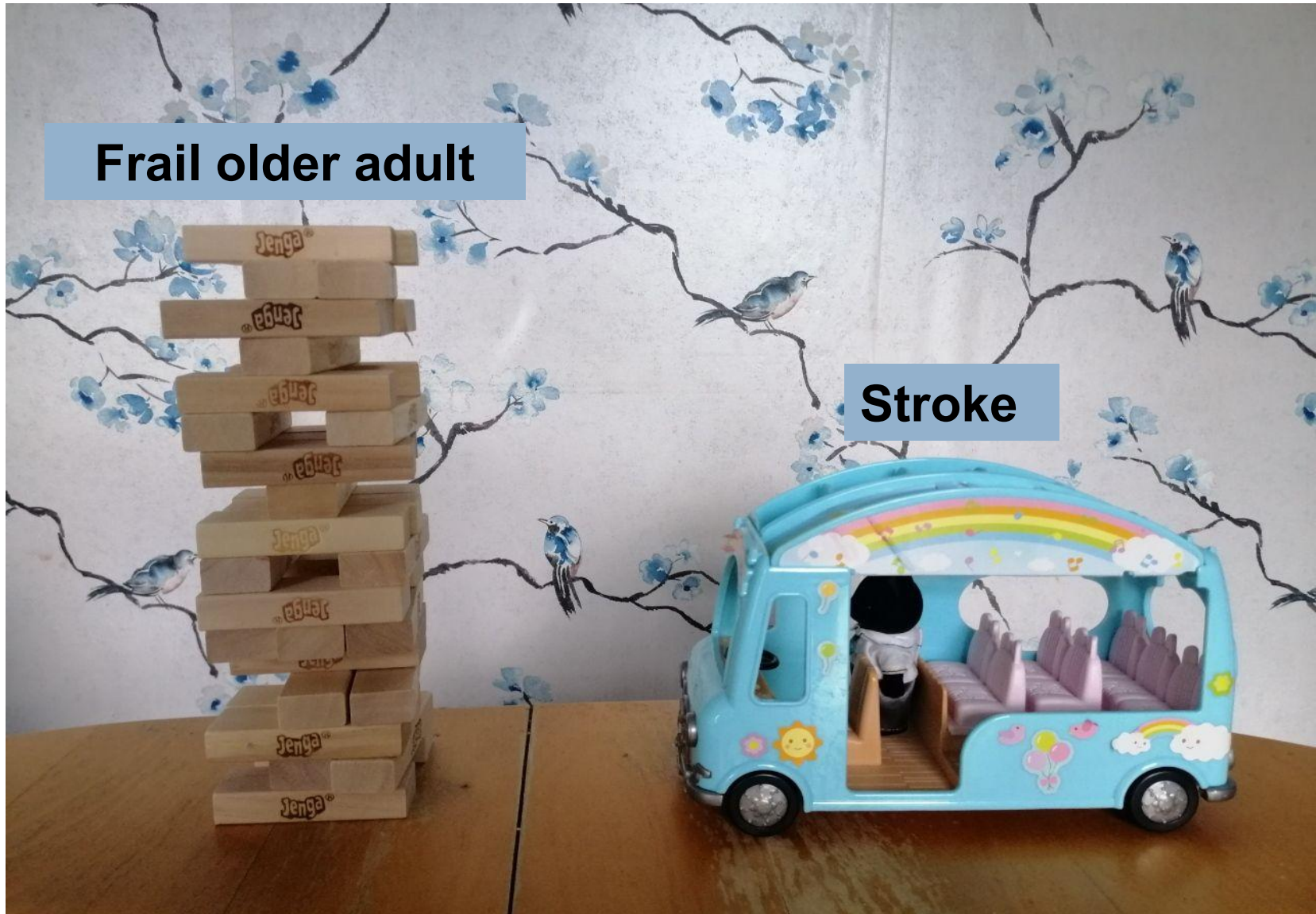
Postural hypotension

Depression



Frail older adult

Stroke





Advanced frailty



Atrial fibrillation

Visual impairment

Anaemia

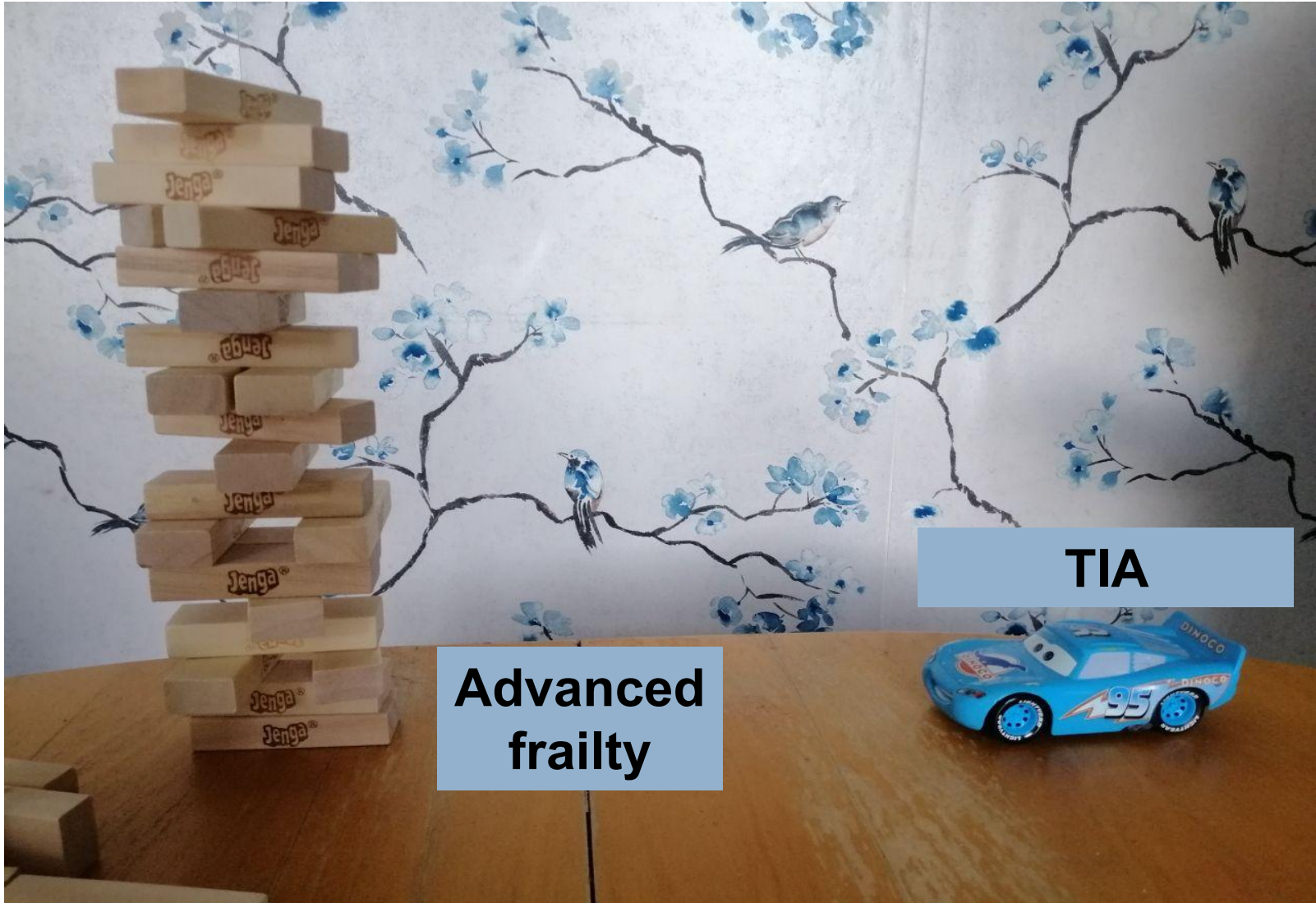
Heart failure

Falls

Postural hypotension

Depression

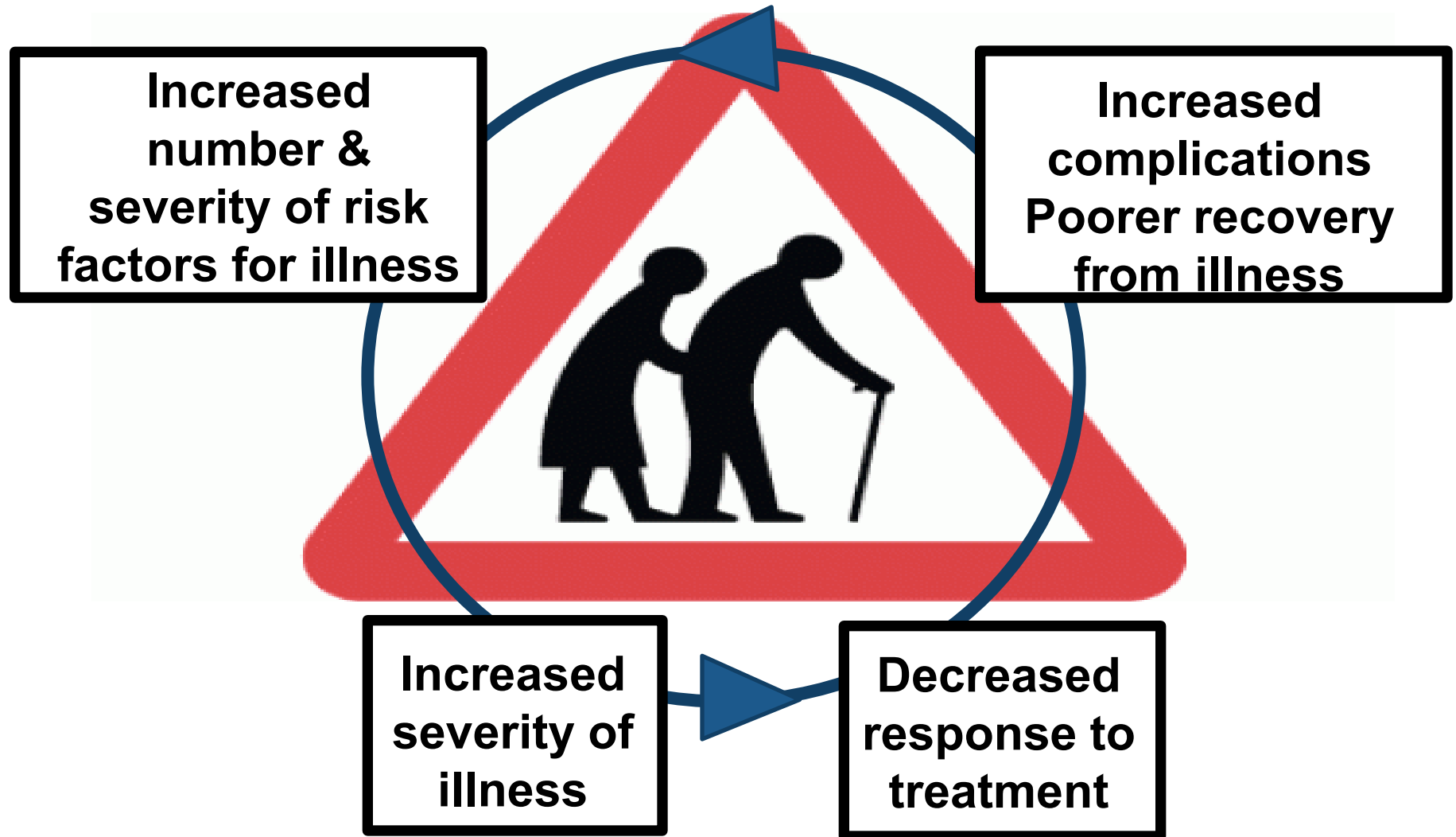
Mild cognitive impairment

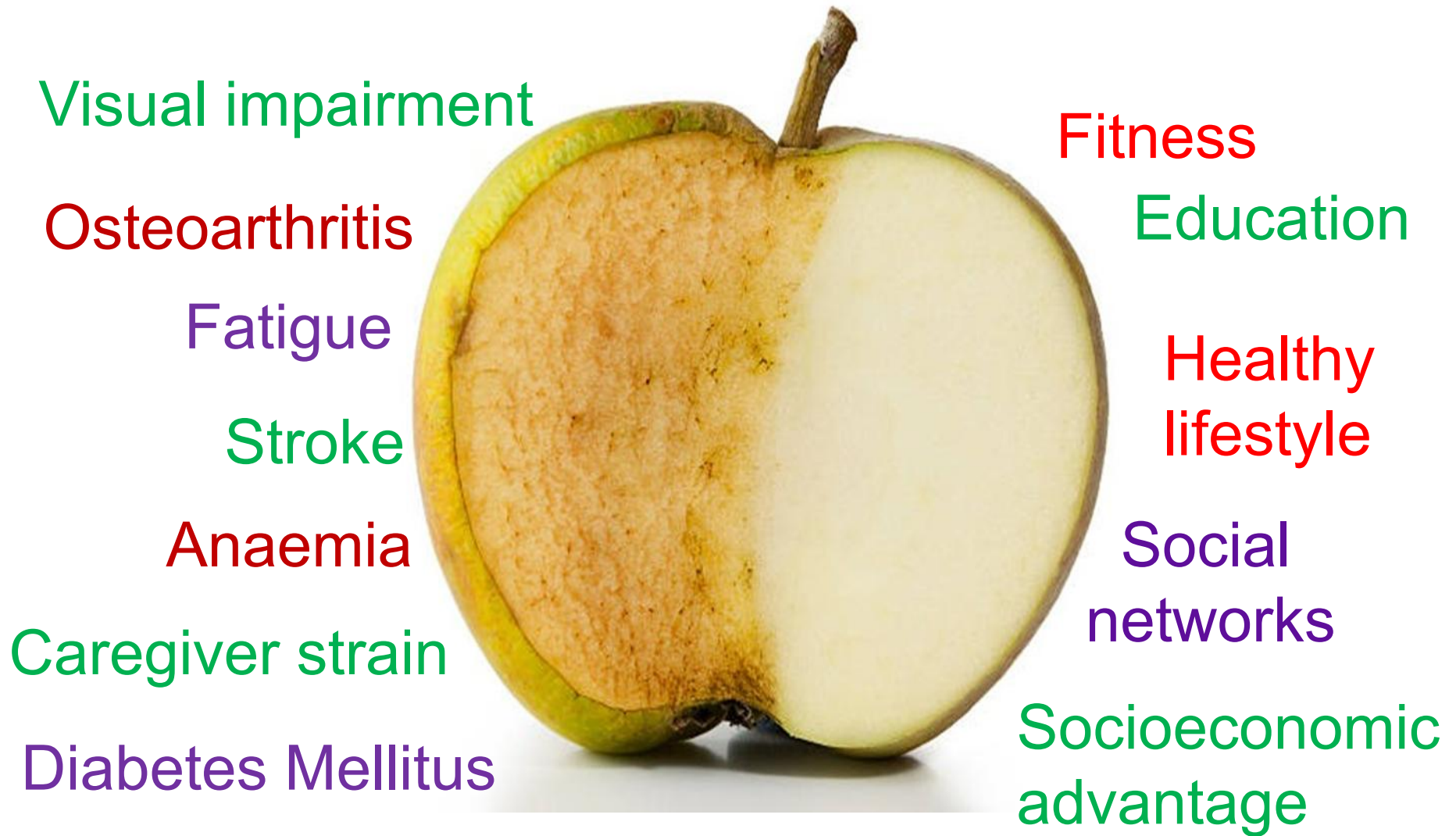


TIA

**Advanced
frailty**









Frailty as cumulative burden

The more things go wrong the more likely the system will fail

Frailty index



Frailty as a syndrome with recognisable features

Frailty can be clinically assessed and quantified

Frailty phenotype



Weight loss



Exhaustion

Slowness

Inactivity



Weakness



Frailty as cumulative burden

The more things go wrong the more likely the system will fail

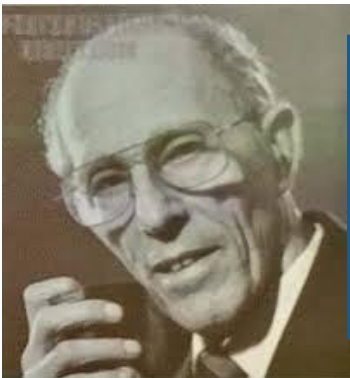
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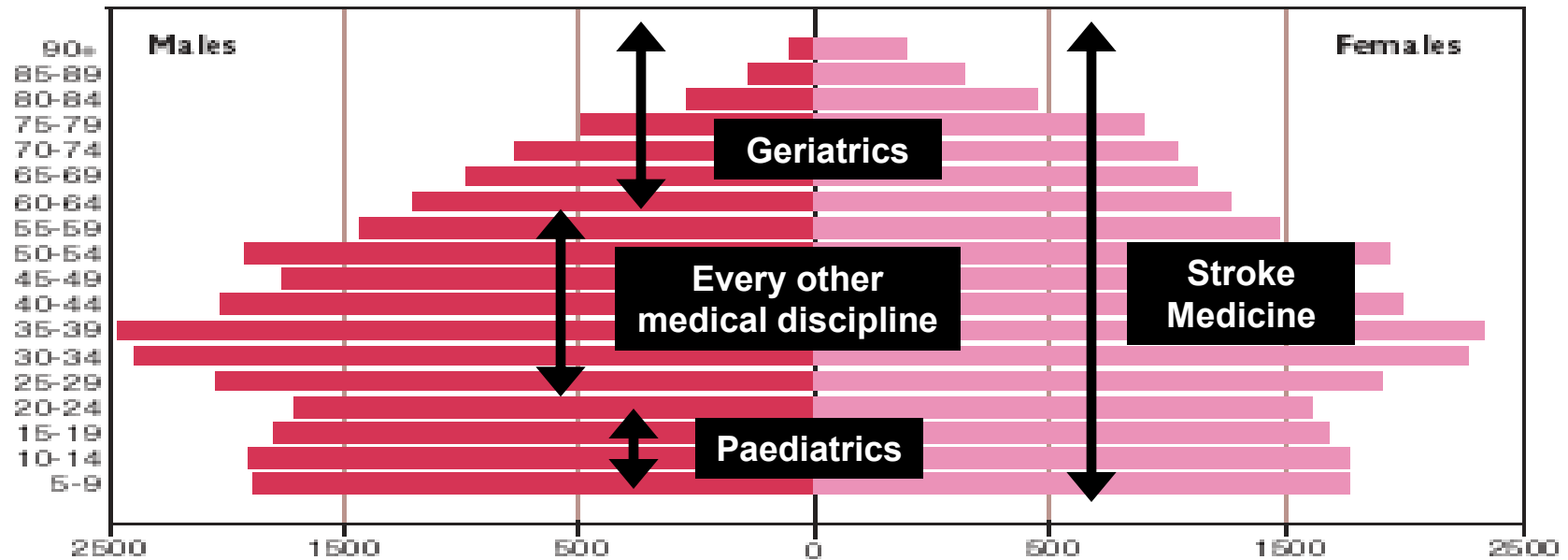
Final common pathways that follow all physiological insults

Frailty syndromes (Geriatric Giants)

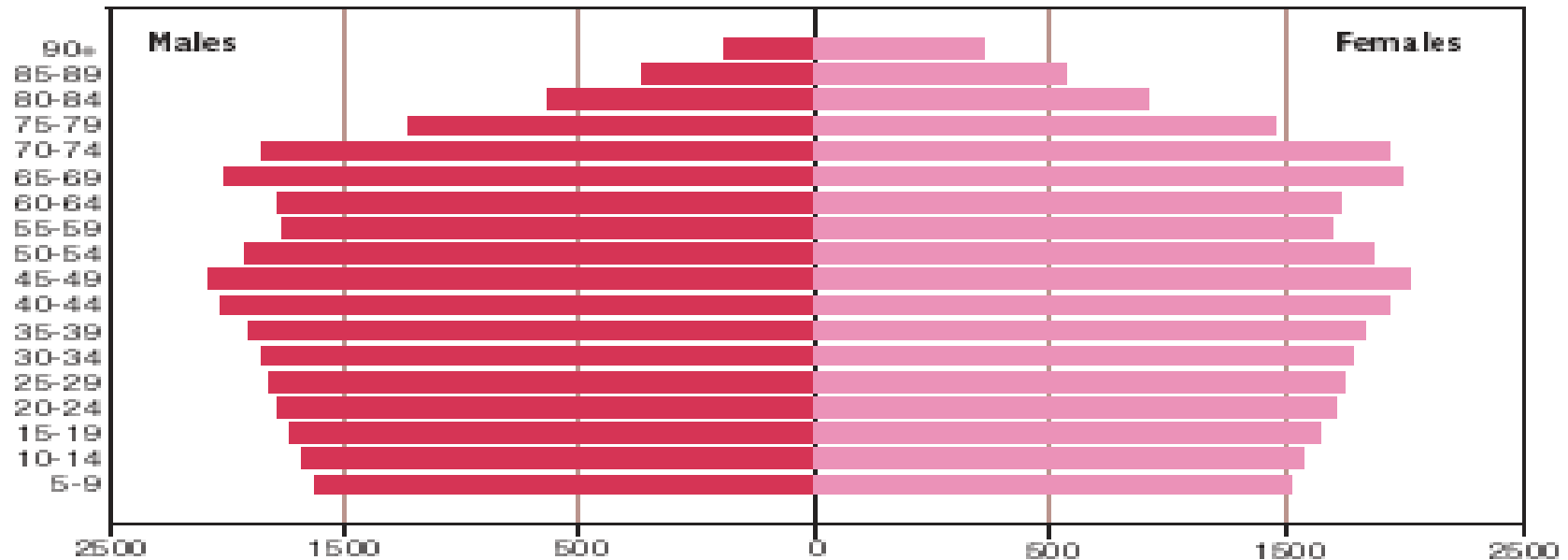


- **What is frailty**
- **Why is it important**
- **How to assess for frailty**
- **How to treat frailty**

2000 (thousands)



2036 (thousands)

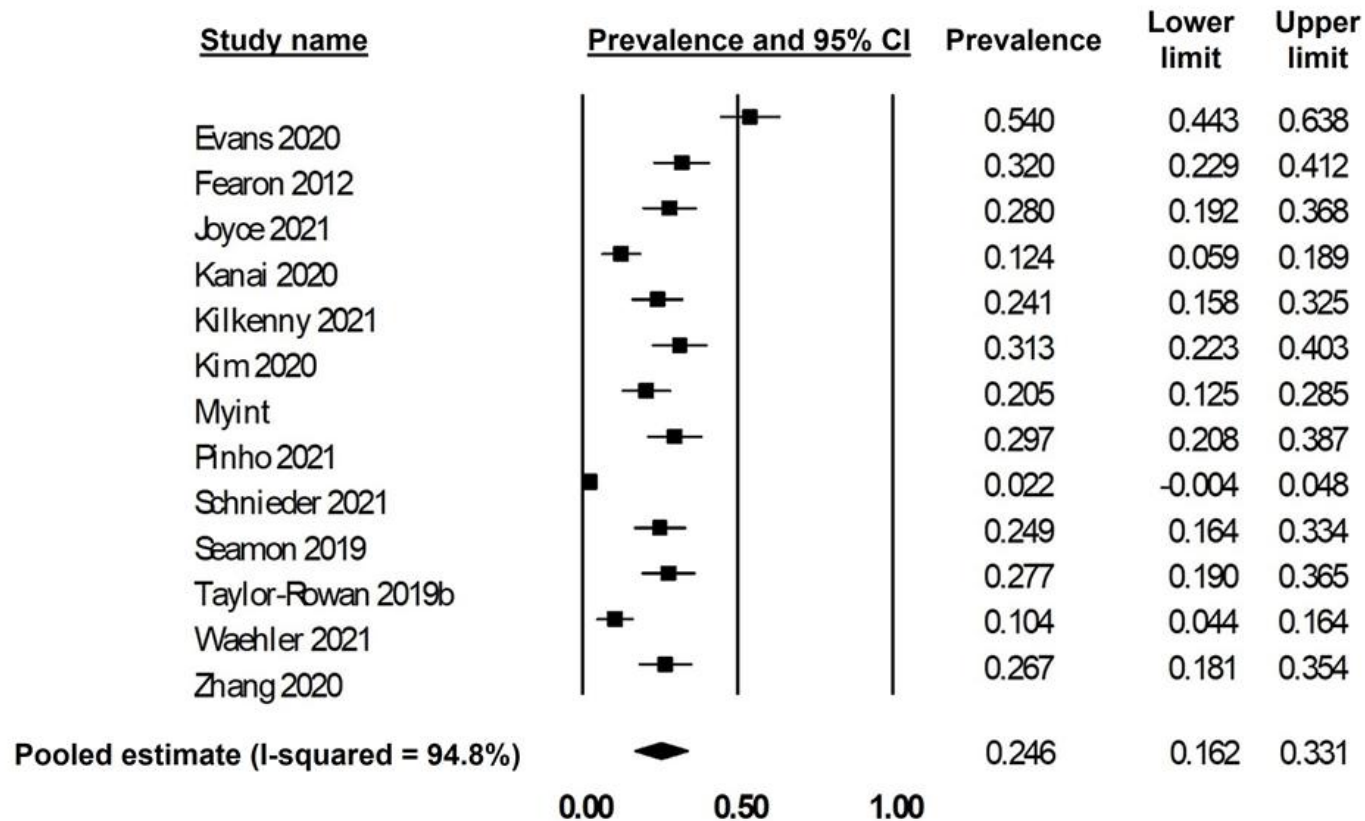


Study	Country	Sample Size	Frailty prevalence
Evans 2020	UK	433	54%
Fearon 2012	UK	231	38%
Imaoka 2018	Japan	217	15%
Joyce 2021	UK	175	28%
Kanai 2020	Japan	234	12%
Kilkenny 2021	Australia	12019	24%
Kim 2020	USA	240	15%
NorCoast 2021	Norway	815	11%
Pinho 2021	Germany	489	29.7%
Seamon 2019	USA	7258	25%
Taylor-Rowan 2019	UK	546	28%
Zhang 2020	Australia	2098	27%



Study	Country	Sample Size	Frailty prevalence	Pre-frailty prevalence
Evans 2020	UK	433	54%	
Fearon 2012	UK	231	38%	
Imaoka 2018	Japan	217	15%	
Joyce 2021	UK	175	28%	
Kanai 2020	Japan	234	12%	55%
Kilkenny 2021	Australia	12019	24%	49%
Kim 2020	USA	240	15%	45%
NorCoast 2021	Norway	815	11%	57%
Pinho 2021	Germany	489	29.7%	68%
Seamon 2019	USA	7258	25%	36%
Taylor-Rowan 2019	UK	546	28%	51%
Zhang 2020	Australia	2098	27%	48%

**Burton et al
Age & Ageing 2021**



Heterogeneity between groups: $p=0.000$

1 in 4 people presenting with stroke are living with frailty

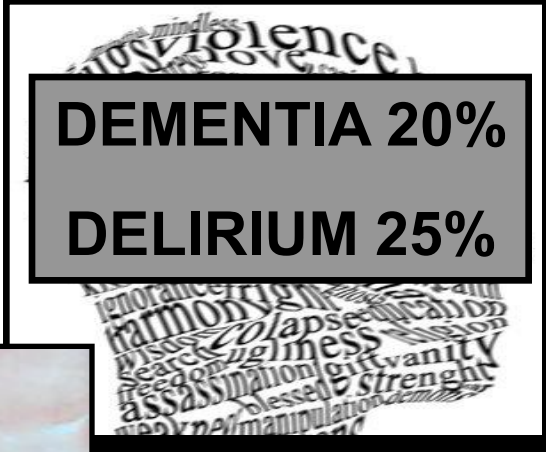
- **545 consecutive patients to a HASU**
- **Frailty index**
- **151 (28%) frank frailty**
- **276 (51%) pre-frail**
- **Fried Phenotype**
- **Questionnaire approach**
- **28% frail**



Falls 41%

Denissen et al
Cochrane 2019

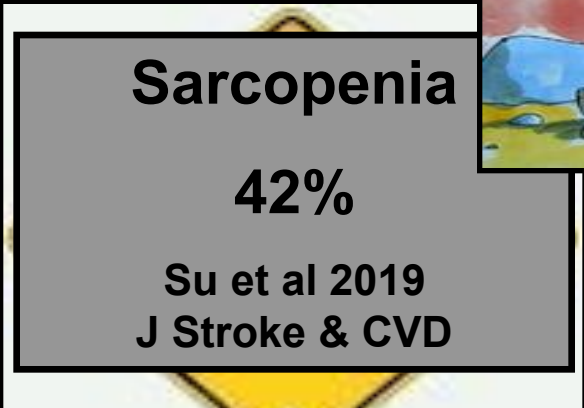
Instability



DEMENTIA 20%

DELIRIUM 25%

**Intellectual
impairment**

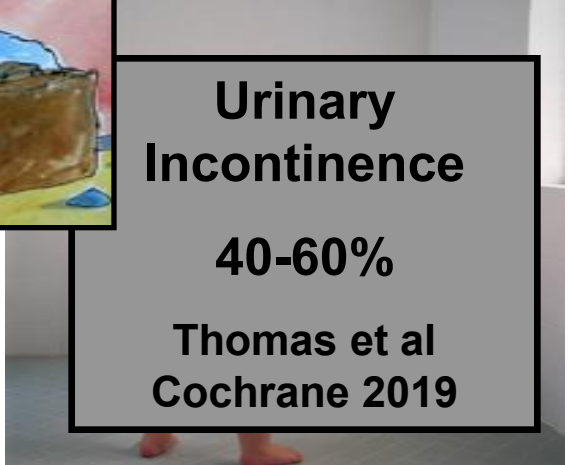


Sarcopenia

42%

Su et al 2019
J Stroke & CVD

Immobility



**Urinary
Incontinence**

40-60%

Thomas et al
Cochrane 2019

Incontinence



Community dwelling older adults
Frailty 10.7% (95%CI:10.5-10.9)

Collard 2012



Hospitalised older adults
Frailty 47.4% (95%CI:43.7-51.1)

Doody 2022



Care-home resident adults
Frailty 52.3% (95%CI:37.9-66.5)

Kojima 2015



Community dwelling older adults
Frailty 17.4% (95%CI:14.4-20.7)

Siriwardhana 2018

Age and Ageing

Issues

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 Comments (0)

Clinical frailty independently predicts early mortality after ischaemic stroke

Nicholas R Evans , Jasmine Wall, Benjamin To, Stephen J Wallis, Roman Romero-Ortuno, Elizabeth A Warburton

Age and Ageing, afaa004, <https://doi.org/10.1093/ageing/afaa004>

Published: 17 January 2020 **Article history** ▼

- N=433 consecutive ischaemic stroke Addenbrookes
- One month mortality in frailty 17% (5% if non-frail)
- One point increase in frailty associated with one point decrease in post-tPA NIHSS

- **Mechanical thrombectomy (Belfast)**
- **2014-2018**
- **175 patients**
- **49 (28%) frail**

Disability (mRS) at three months		
	OR (95%CI)	P
Age (years)	1.02 (0.99 to 1.1)	0.24
Sex	1.11 (0.49 to 2.52)	0.80
Baseline NIHSS	1.10 (1.03 to 1.16)	0.002
IV thrombolysis	0.91 (0.41 to 2.02)	0.81
Frailty (yes or no)	3.04 (1.10 to 8.44)	0.003

- **Mechanical thrombectomy (Belfast)**
- **2014-2018**
- **175 patients**
- **49 (28%) frail**

	Frail (n=49)	Non-Frail (n=126)	P
Door to imaging	17 (13-29)	21 (13-30)	0.16
Imaging to groin	37 (30-83)	39 (27-61)	0.004
Groin to recanalisation	38 (26-60)	36 (25-59)	0.93
IV thrombolysis (%)	19 (39%)	55 (44%)	0.58
Recanalisation (%)	37 (76%)	107 (87%)	0.65

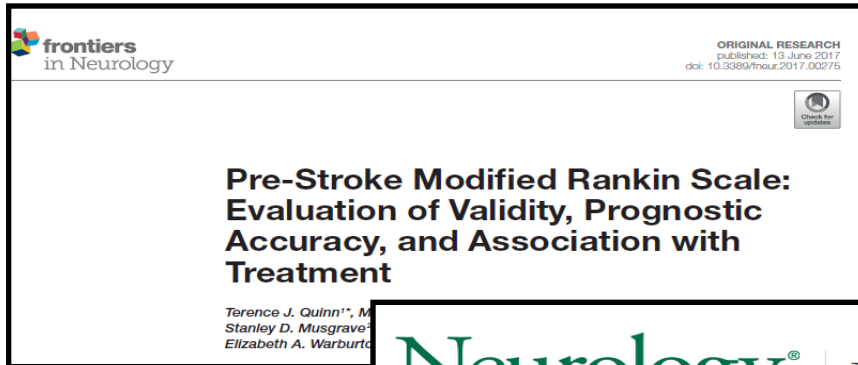


CFS grade	Length of stay	Readmission rate	In-patient mortality	Care intentions	Service referrals	Post-discharge support
1	4	4%	2%	Detect and manage geriatric syndromes e.g. delirium	General internal medicine	Self-care
2	5	7%	2%			
3	7	11%	2%			Prevention (e.g. falls, memory clinic)
4	8	13%	3%			
5	10	15%	4%			
6	12	15%	6%			
7	13	14%	11%	Think about palliative vs. restorative care	Geriatric medicine	Transitional care
8	12	10%	24%			
9	10	13%	31%			

- **What is frailty**
- **Why is it important**
- **How to assess for frailty**
- **How to treat frailty**



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Prestroke Modified Rankin Stroke Scale Has Moderate Interobserver Reliability and Validity in an Acute Stroke Setting

Patrica Fearon, MRCP; Kate S. McArthur, MRCP; Kevin Garrity; Laura J. Graham; Geraldine McGroarty; Sarah Vincent; T. J. Quinn, MD



Frailty as cumulative burden

The more things go wrong the more likely the system will fail

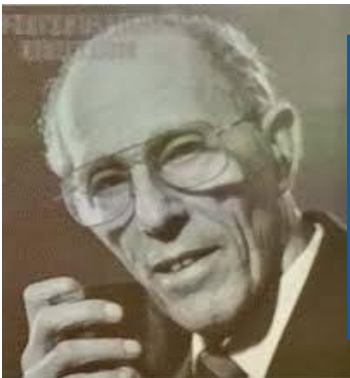
Frailty index



Frailty as a syndrome with recognisable features

Frailty can be clinically assessed and quantified

Frailty phenotype



Frailty is recognised in the manifestation of ill health

Final common pathways that follow all physiological insults

Frailty syndromes



Frailty as cumulative burden

The more things go wrong the more likely the system will fail

Frailty index

Appendix 1: List of variables used by the Canadian Study of Health and Aging to construct the 70-item CSHA Frailty Index

- | | | |
|---|---|--------------------------------------|
| • Changes in everyday activities | • Mood problems | • Seizures, partial complex |
| • Head and neck problems | • Feeling sad, blue, depressed | • Seizures, generalized |
| • Poor muscle tone in neck | • History of depressed mood | • Syncope or blackouts |
| • Bradykinesia, facial | • Tiredness all the time | • Headache |
| • Problems getting dressed | • Depression (clinical impression) | • Cerebrovascular problems |
| • Problems with bathing | • Sleep changes | • History of stroke |
| • Problems carrying out personal grooming | • Restlessness | • History of diabetes mellitus |
| • Urinary incontinence | • Memory changes | • Arterial hypertension |
| • Toileting problems | • Short-term memory impairment | • Peripheral pulses |
| • Bulk difficulties | • Long-term memory impairment | • Cardiac problems |
| • Rectal problems | • Changes in general mental functioning | • Myocardial infarction |
| • Gastrointestinal problems | • Onset of cognitive symptoms | • Arrhythmia |
| • Problems cooking | • Clouding or delirium | • Congestive heart failure |
| • Sucking problems | • Paranoid features | • Lung problems |
| • Problems going out alone | • History relevant to cognitive impairment or loss | • Respiratory problems |
| • Impaired mobility | • Family history relevant to cognitive impairment or loss | • History of thyroid disease |
| • Musculoskeletal problems | • Impaired vibration | • Thyroid problems |
| • Bradykinesia of the limbs | • Tremor at rest | • Skin problems |
| • Poor muscle tone in limbs | • Postural tremor | • Malignant disease |
| • Poor limb coordination | • Intention tremor | • Breast problems |
| • Poor coordination, trunk | • History of Parkinson's disease | • Abdominal problems |
| • Poor standing posture | • Family history of degenerative disease | • Presence of snout reflex |
| • Irregular gait pattern | | • Presence of the palmomental reflex |
| • Falls | | • Other medical history |

$$\frac{\text{No of items present}}{\text{No of items on list}} = \text{Frailty Index}$$



Frailty as cumulative burden

The more things go wrong the more likely the system will fail

Frailty index



Frailty as a syndrome with recognisable features

Frailty can be clinically assessed and quantified

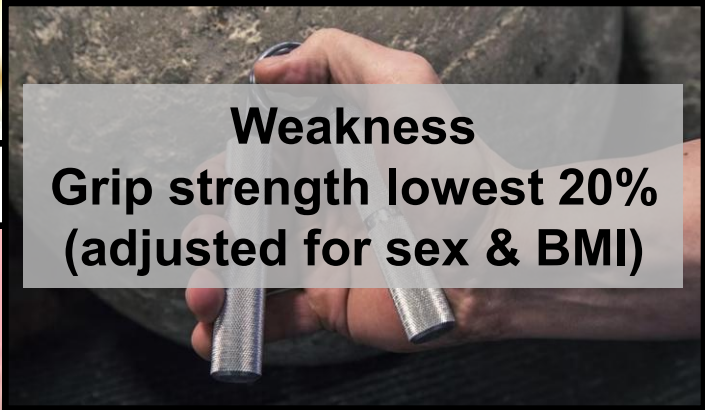
Frailty phenotype



**Unintentional
weight loss
10 lbs (or >5%)
in last year**



**Low physical
activity
Kilocal per week
lowest quintile**



**Weakness
Grip strength lowest 20%
(adjusted for sex & BMI)**

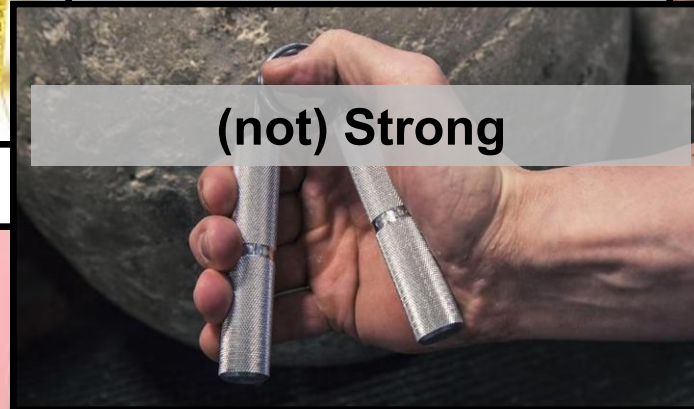


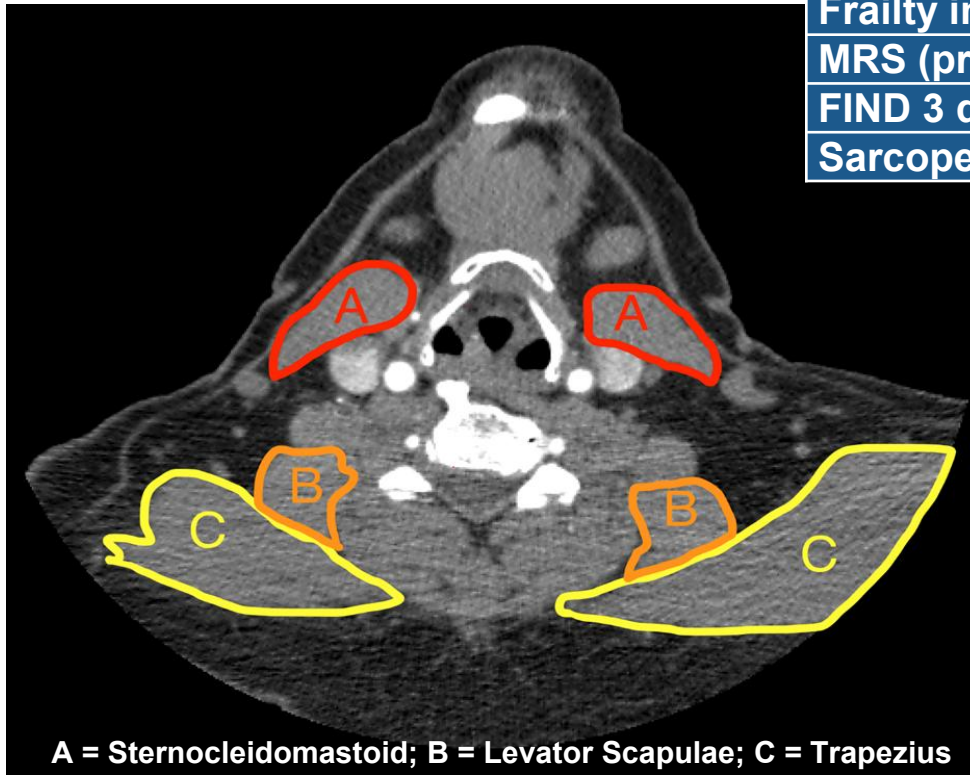
**Self report
exhaustion**



**Slowness
Time to walk 4.5 m
(slowest 20%)**

© Shutterstock / alexklich





Frailty Measure	Death/disability
Frailty index (tertiles)	6.54 (95%CI: 2.45-17.5)
MRS (pre-stroke)	3.20 (95%CI: 1.69-6.04)
FIND 3 questions	3.96 (95%CI: 1.88-8.35)
Sarcopenia plus FIND	13.74 (95%CI: 3.71-50.94)

Clinical Frailty Scale*



1 Very Fit – People who are robust, active, energetic and motivated. These people commonly exercise regularly. They are among the fittest for their age.



2 Well – People who have **no active disease symptoms** but are less fit than category 1. Often, they exercise or are very **active occasionally**, e.g. seasonally.



3 Managing Well – People whose **medical problems are well controlled**, but are **not regularly active** beyond routine walking.



4 Vulnerable – While **not dependent** on others for daily help, often **symptoms limit activities**. A common complaint is being “slowed up”, and/or being tired during the day.



5 Mildly Frail – These people often have **more evident slowing**, and need help in **high order IADLs** (finances, transportation, heavy housework, medications). Typically, mild frailty progressively impairs shopping and walking outside alone, meal preparation and housework.



6 Moderately Frail – People need help with **all outside activities** and with **keeping house**. Inside, they often have problems with stairs and need **help with bathing** and might need minimal assistance (cuing, standby) with dressing.



7 Severely Frail – Completely dependent for **personal care**, from whatever cause (physical or cognitive). Even so, they seem stable and not at high risk of dying (within ~ 6 months).



8 Very Severely Frail – Completely dependent, approaching the end of life. Typically, they could not recover even from a minor illness.



9. Terminally Ill - Approaching the end of life. This category applies to people with a **life expectancy <6 months**, who are **not otherwise evidently frail**.

Scoring frailty in people with dementia

The degree of frailty corresponds to the degree of dementia.

Common **symptoms in mild dementia** include forgetting the details of a recent event, though still remembering the event itself, repeating the same question/story and social withdrawal.

In **moderate dementia**, recent memory is very impaired, even though they seemingly can remember their past life events well. They can do personal care with prompting.

In **severe dementia**, they cannot do personal care without help.

* 1. Canadian Study on Health & Aging, Revised 2008.

2. K. Rockwood et al. A global clinical measure of fitness and frailty in elderly people. CMAJ 2005;173:489-495.

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HIS Frailty Assessment Tool

		YES	NO	UNSURE
F	Functional impairment (new or worsening) e.g. difficulty with self-care			
R	Resident in care-home?			
A	Altered mental state such as confusion or dementia (use the 4AT)			
I	Immobility/instability. New decline in mobility, difficulty mobilising without help or fall leading up to admission			
L	Living at home with daily support (homecare; one or more visits per day)			



- **What is frailty**
- **Why is it important**
- **How to assess for frailty**
- **How to treat frailty**



- **What is frailty**
- **Why is it important**
- **How to assess for frailty**
- **How to treat frailty**



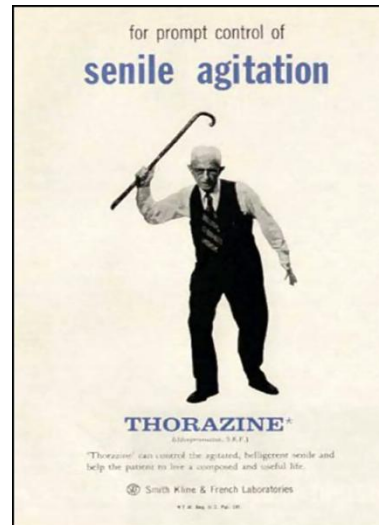
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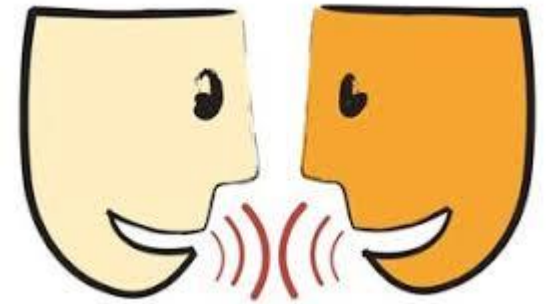
Physiotherapy.

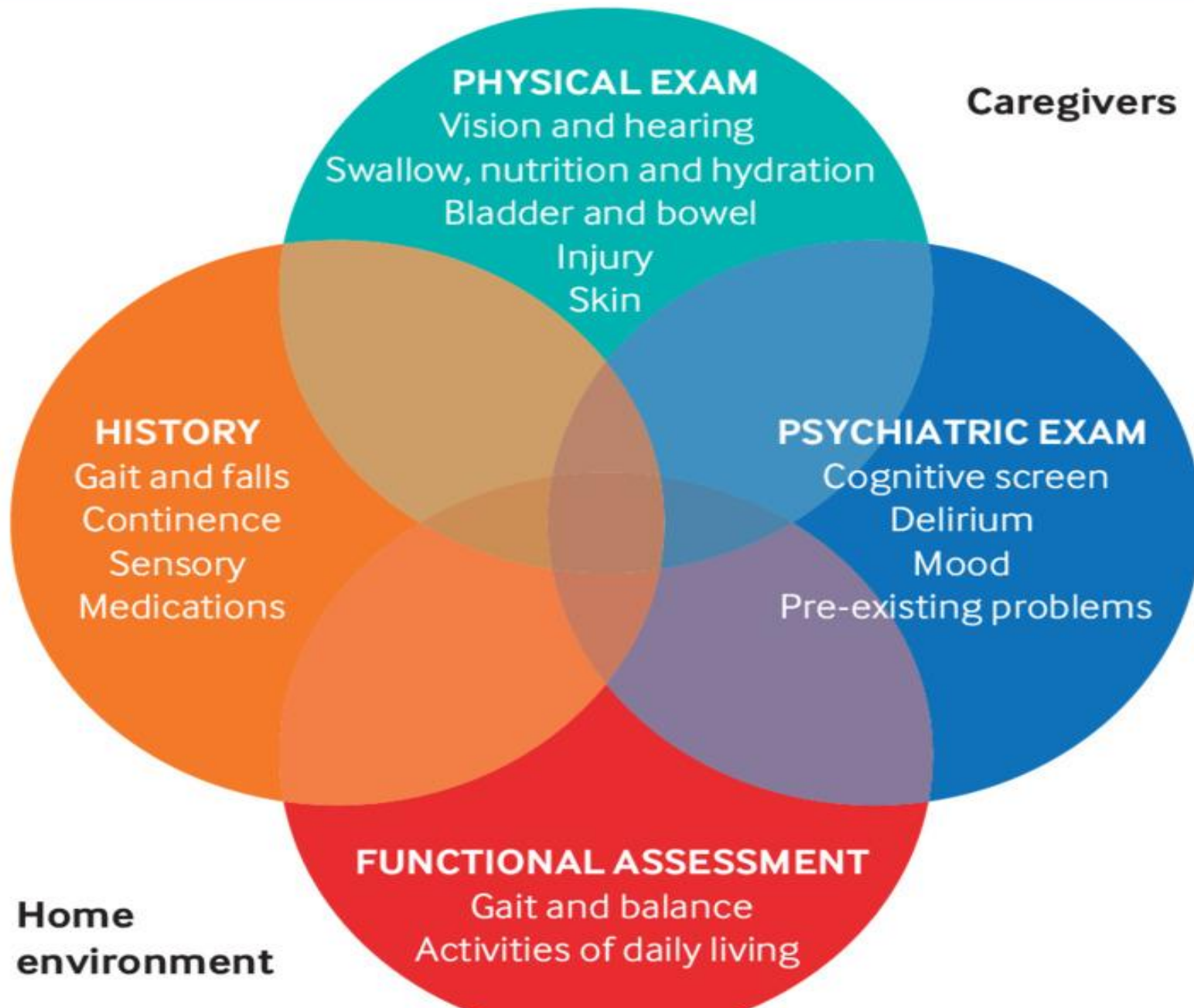


DOCTOR



dietitian

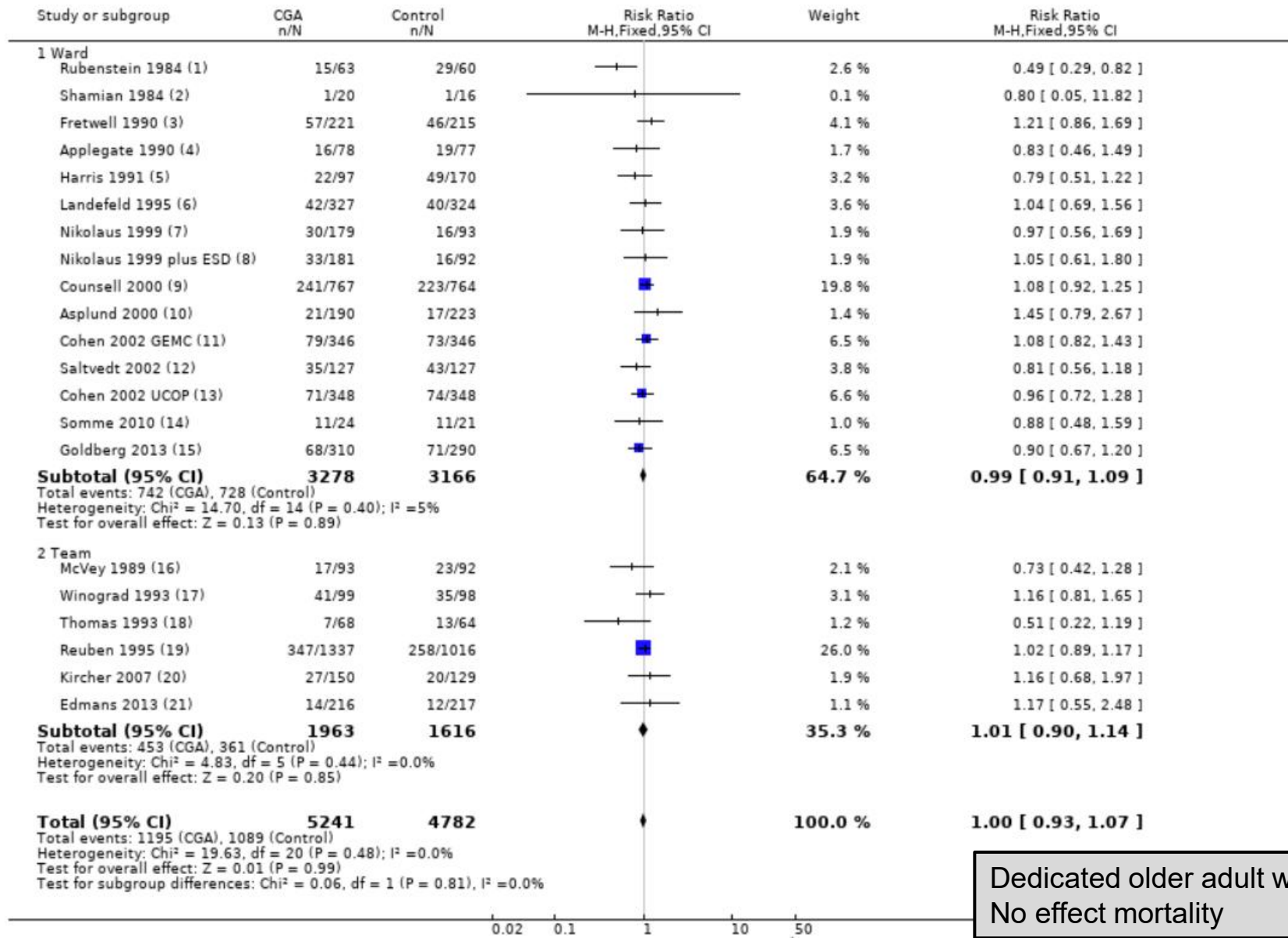




Comprehensive Geriatric Assessment



Review: Comprehensive geriatric assessment for older adults admitted to hospital
Comparison: 1 CGA versus usual care
Outcome: 4 Mortality (end of follow-up 3 to 12 months)



Dedicated older adult ward (CGA)
No effect mortality



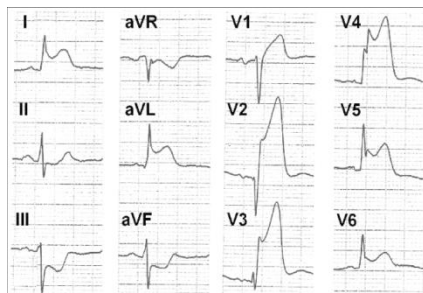
Mortality



Hospital admission



Disability



M.I



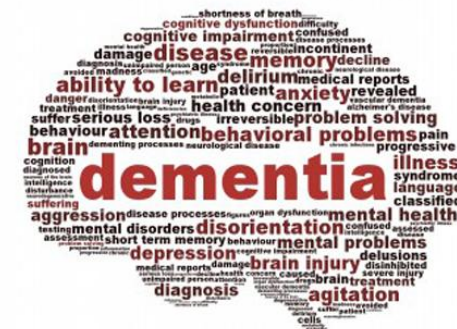
Care-home



BP

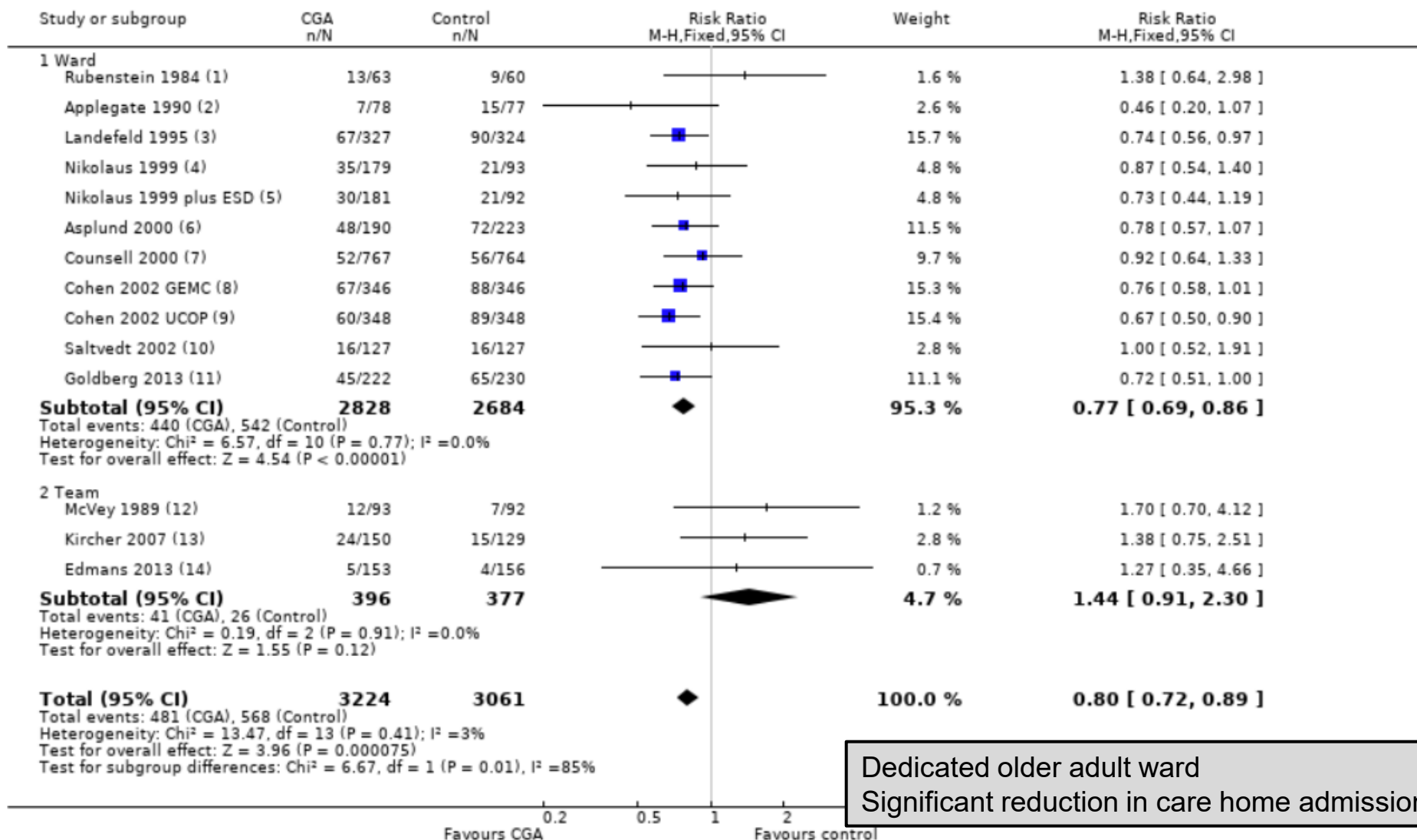


Treatment burden



Cognitive decline

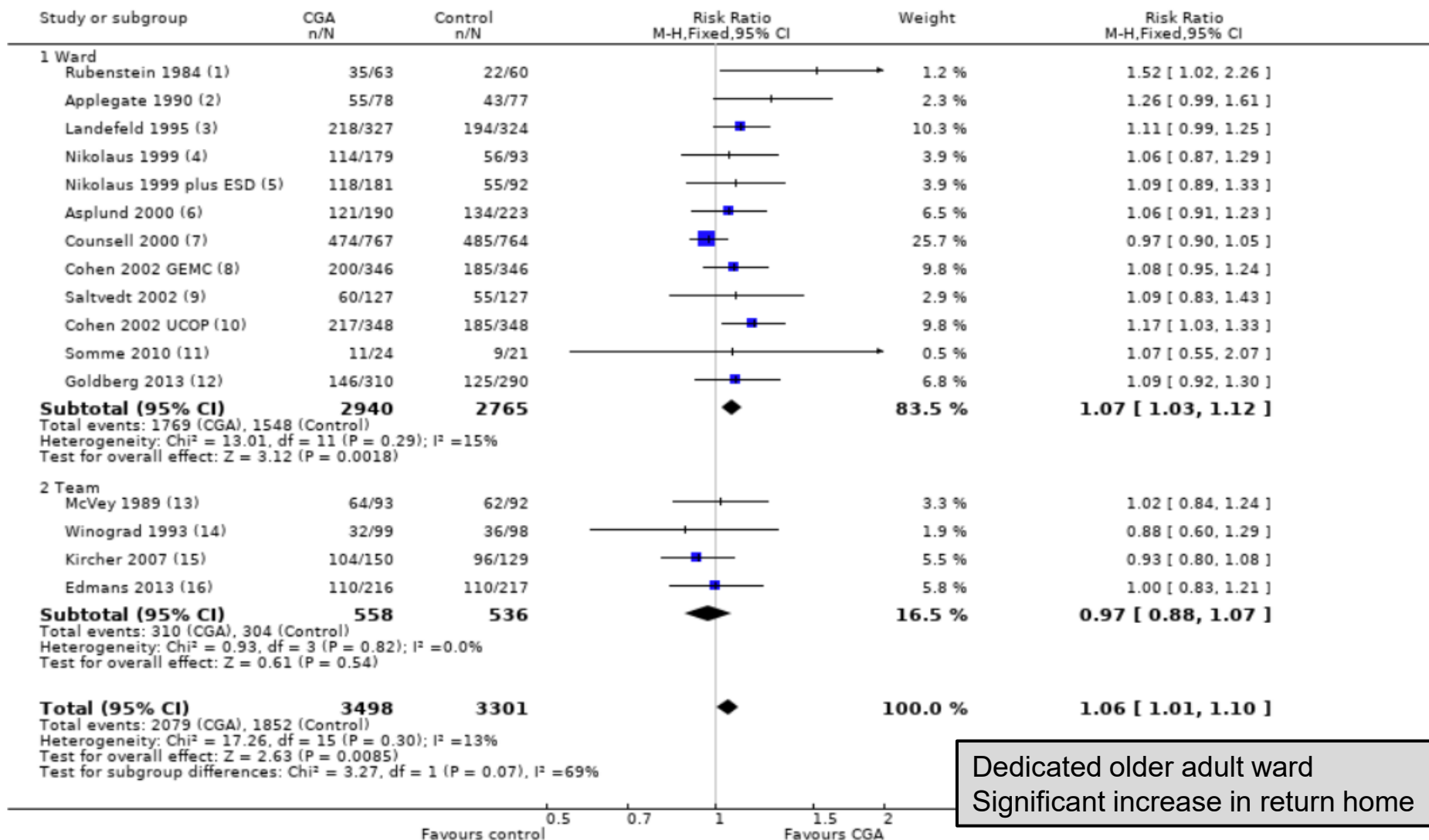
Review: Comprehensive geriatric assessment for older adults admitted to hospital
Comparison: 1 CGA versus usual care
Outcome: 6 Admission to a nursing home (end of follow-up 3 to 12 months)



Review: Comprehensive geriatric assessment for older adults admitted to hospital

Comparison: 1 CGA versus usual care

Outcome: 2 Living at home (end of follow-up 3 to 12 months)





University
of Glasgow

Cognition in stroke

Doesn't need to be confusing

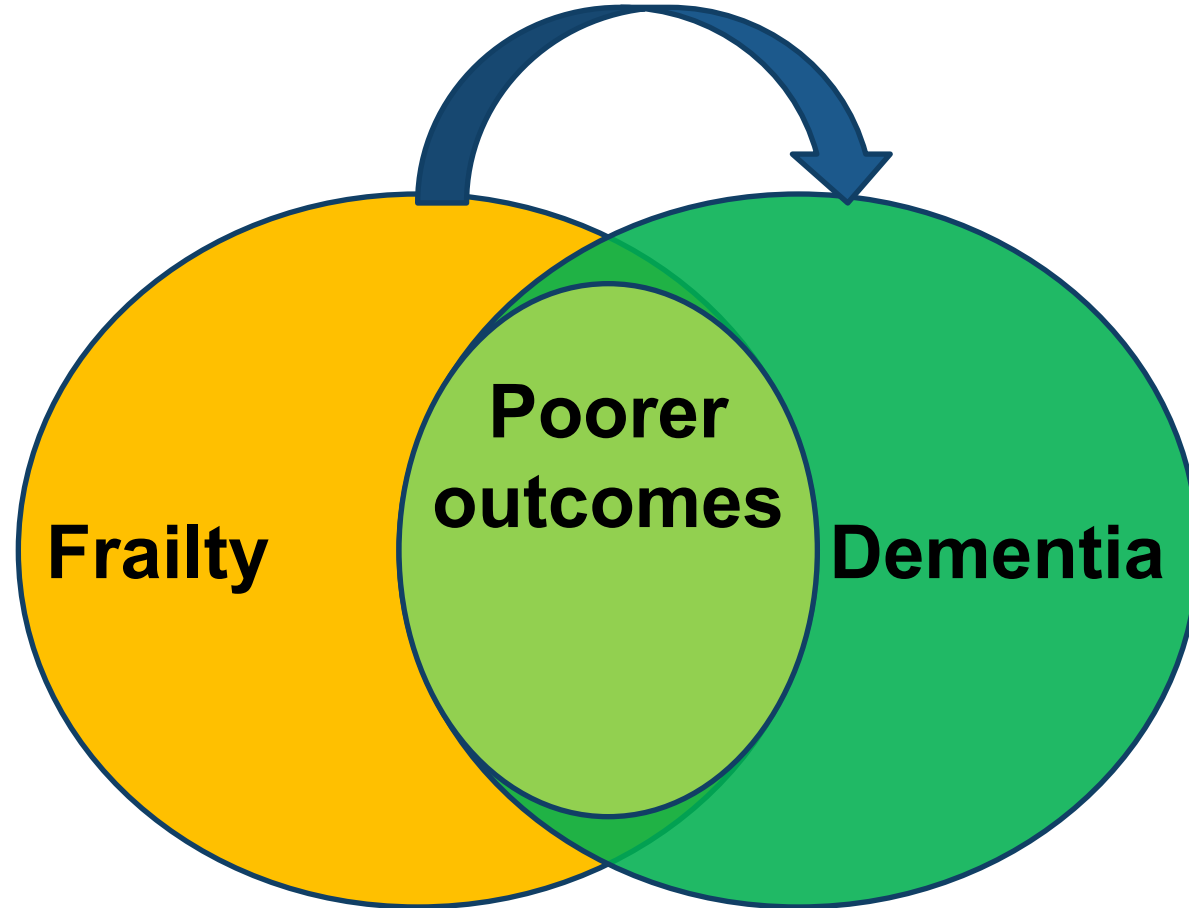
Terry Quinn



Terry.quinn@glasgow.ac.uk

[@DrTerryQuinn](https://twitter.com/DrTerryQuinn)

People with frailty 8 times more likely to have dementia



Approx. 32% people with dementia are living with frailty



TIME magazine © YEAR Time Inc. Reprinted by permission.

- Disconnect between neuropathology and clinical disease
- Life course factors may mediate expression of disease
- Interplay of vascular disease, physical frailty and neurodegenerative factors



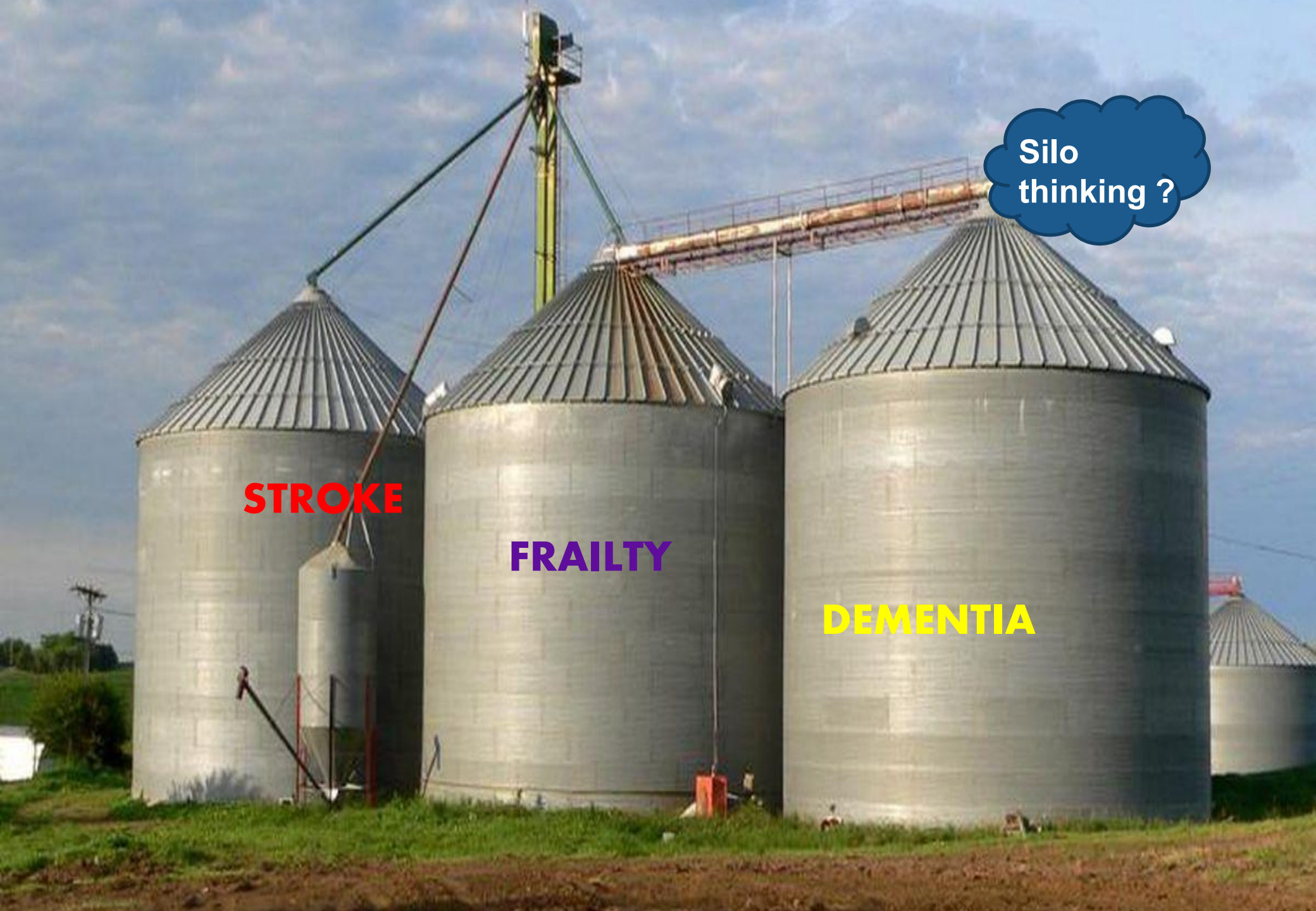
Cognitive impairment
(but not dementia)

+

Physical frailty



Cognitive frailty

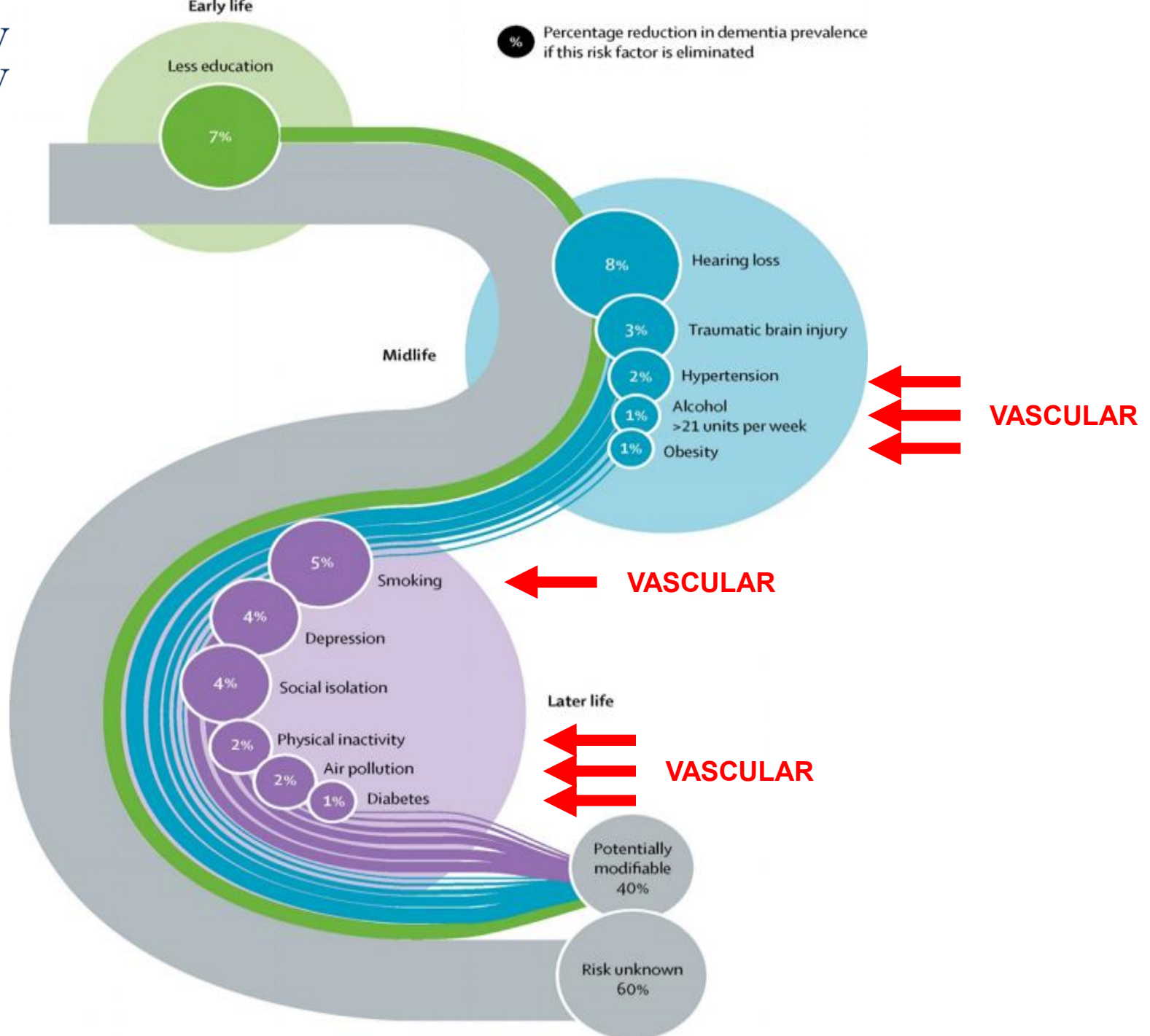


Silo
thinking ?

STROKE

FRAILTY

DEMENTIA

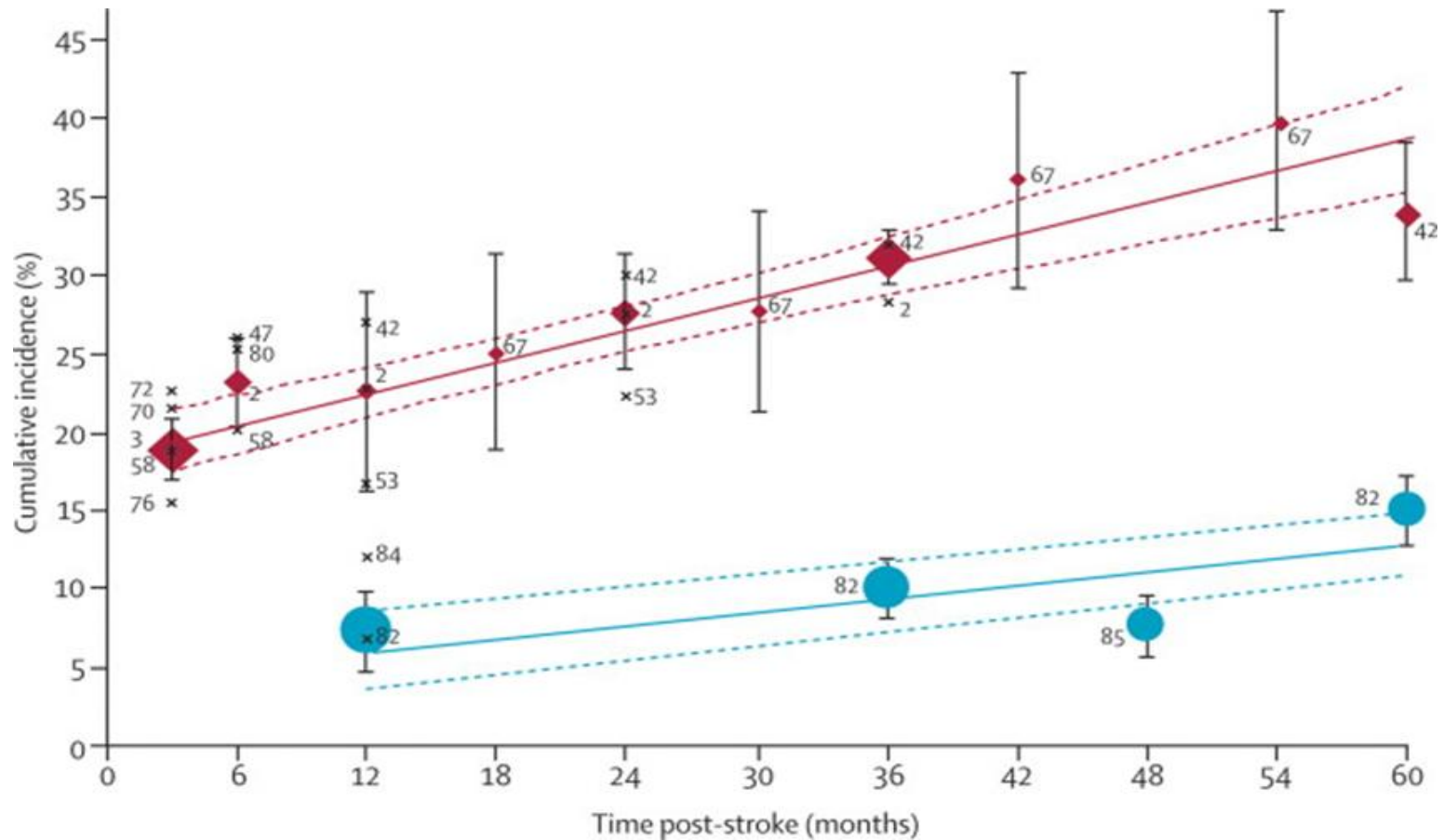


- Post stroke cognitive issues are common & important
- Its more complex than 'stroke causes dementia'
- Assessment at scale may not be perfect
- Drugs are not the answer



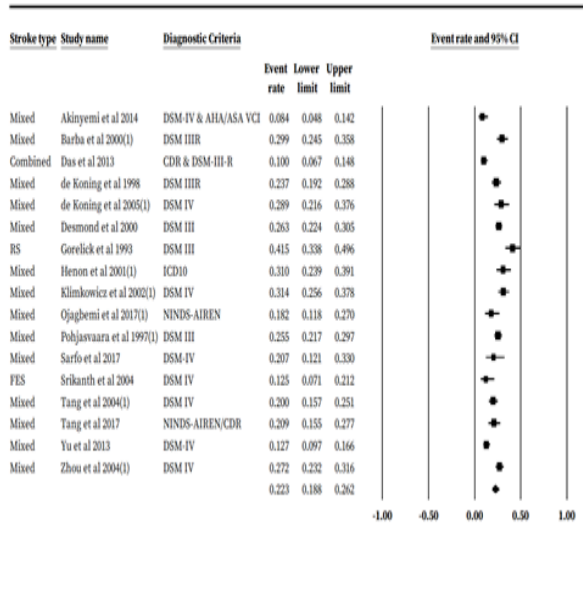
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Pendlebury et al
Lancet Neurol 2009



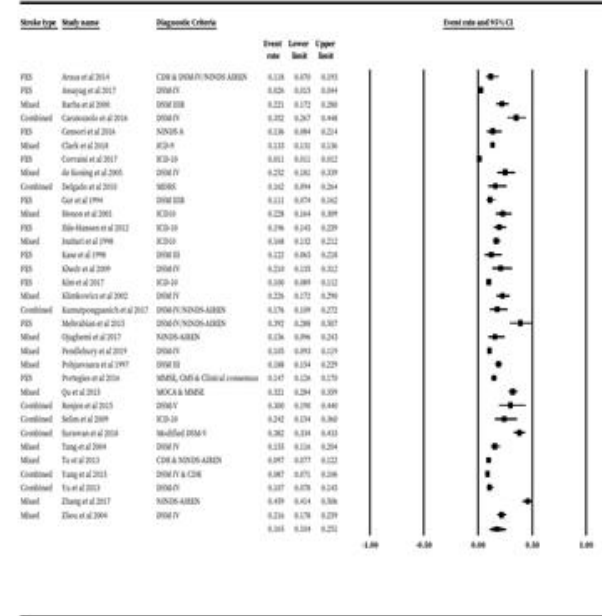
- ◆ Hospital cohorts, all stroke
- Community cohorts, first ever stroke only

One in five stroke survivors has dementia



**Prevalence of post-stroke dementia
(including pre-stroke dementia)**

Estimate: **22.3%** (95%CI: 18.8-26.2)
17 studies



**Prevalence of post-stroke dementia
(excluding pre-stroke dementia)**

Estimate: **16.5%** (95%CI: 10.4-25.1)
33 studies



Dementia and stroke: 1 in 5
Cognitive issues: 1 in 3



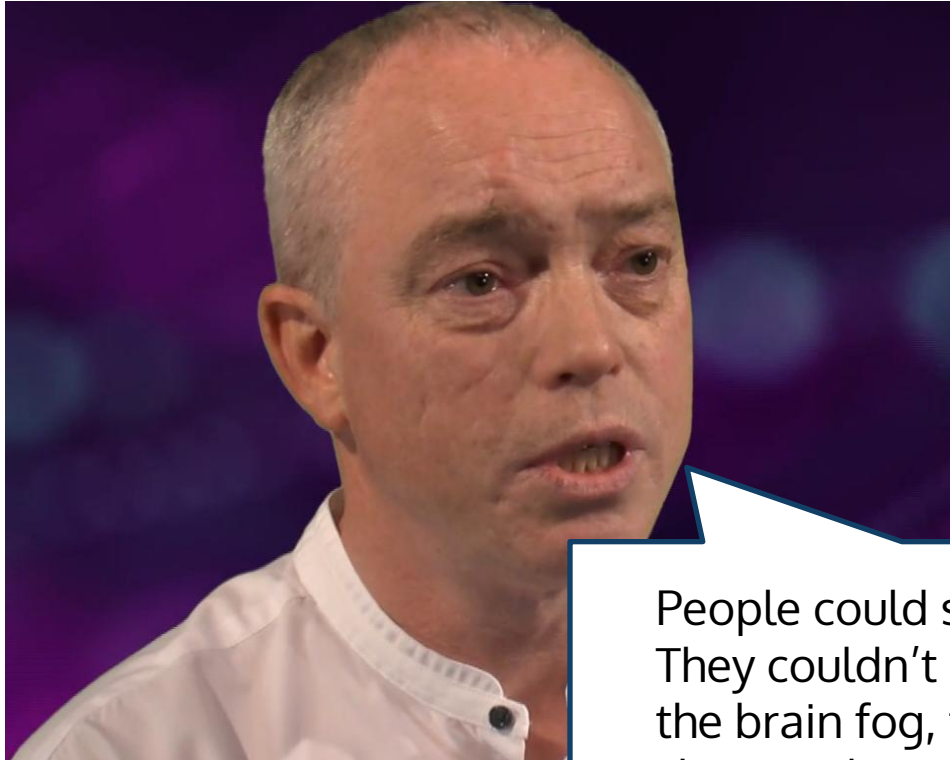
Anxiety and stroke: 1 in 4



Depression and stroke: 1 in 3



- Post stroke cognitive issues are common & **important**
- Its more complex than 'stroke causes dementia'
- Assessment at scale may not be perfect
- Drugs are not the answer



People could see my weak arm
They couldn't see.....
the brain fog, tiredness,
shattered confidence



1. What are the best ways to improve cognition after a stroke
2. What are the best ways to help people come to terms with long term consequences of stroke
3. What are the best ways to help people recover from aphasia
4. What are the best treatments for arm recovery
5. What are the best ways to treat visual problems after a stroke
6. What are the best ways to manage or prevent fatigue
7. What are the best treatments for balance, gait and mobility
8. How can stroke survivors & families cope with speech problems
9. What are the best ways of improving confidence after stroke
10. Are exercise and fitness programmes beneficial

Priorities in stroke rehabilitation and long-term care

Stroke
Association

James
Lind
Alliance
Priority Setting Partnerships

- Psychological problems
- Cognitive problems
- Communication
- Fatigue
- Community services
- Return to usual activities
- Timing and dose of rehabilitation
- Care-givers
- Strength and fitness
- Stages of stroke recovery

CHOCOLATE CAN HALT DEMENTIA



JENNIFER ANISTON ENGAGED
...just a few days before ex-hubby Brad Pitt



SIMPLE WAY TO FIGHT OFF DEMENTIA

Solving puzzles is an effective
as taking drugs say experts



TV APPRENTICE STAR: 'HOW I WAS TREATED LIKE A LACKEY'

3P BLOOD PRESSURE PILL BEATS DEMENTIA

ARTHRITIS DRUG WILL FIGHT OFF DEMENTIA



DEMENTIA CAUSED BY STRESSFUL LIFESTYLE

Breakthrough in fight for cure



HOME OFFICE FOREIGN AID CASH WOULD PAY FOR 62,745 NEW POLICE OFFICERS

SUGAR SPEEDS UP DEMENTIA

EAT CURRY TO BEAT DEMENTIA



DEMENTIA RISK 'RISES IF YOU LIVE NEAR A BUSY ROAD'

Millions exposed to noise and fumes more likely to develop disease, says major study



DAVID EMANUEL MY SHOCK AS DOCTOR SAID I HAD CANCER

PUZZLES BEST WAY TO FIGHT DEMENTIA

DEMENTIA RISK FROM SLEEPING TABLETS



DAILY DRINK TO LOSE WEIGHT TO BEAT DEMENTIA

£3.50 vitamin cocktail stops memory loss



JOAN COLLINS I MARRIED MY FIRST HUSBAND EVEN AFTER HE RAPED ME

COFFEE FIGHTS ALZHEIMER'S

EAT SALADS TO BEAT DEMENTIA



LOSE WEIGHT TO BEAT DEMENTIA

Researcher says decline of faster rate, say experts

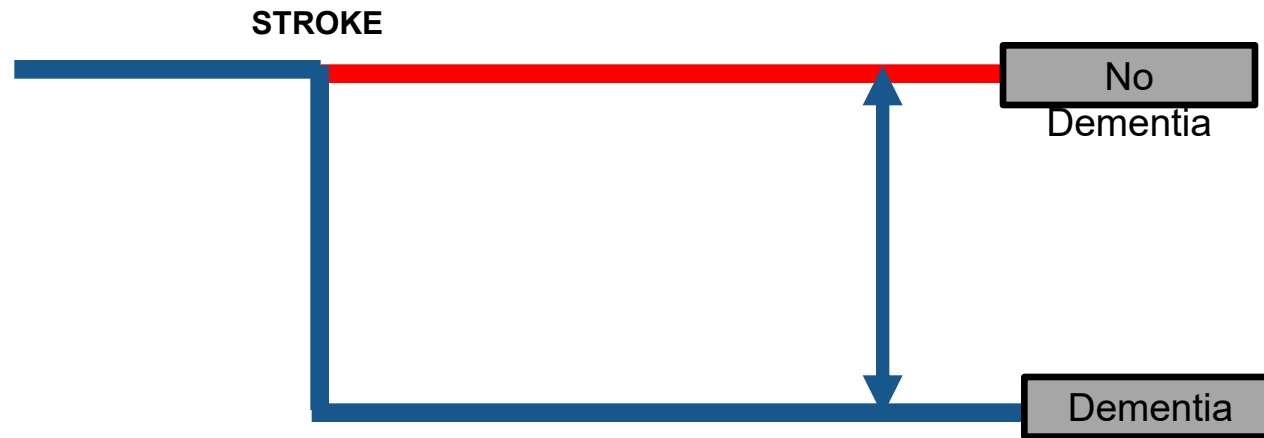


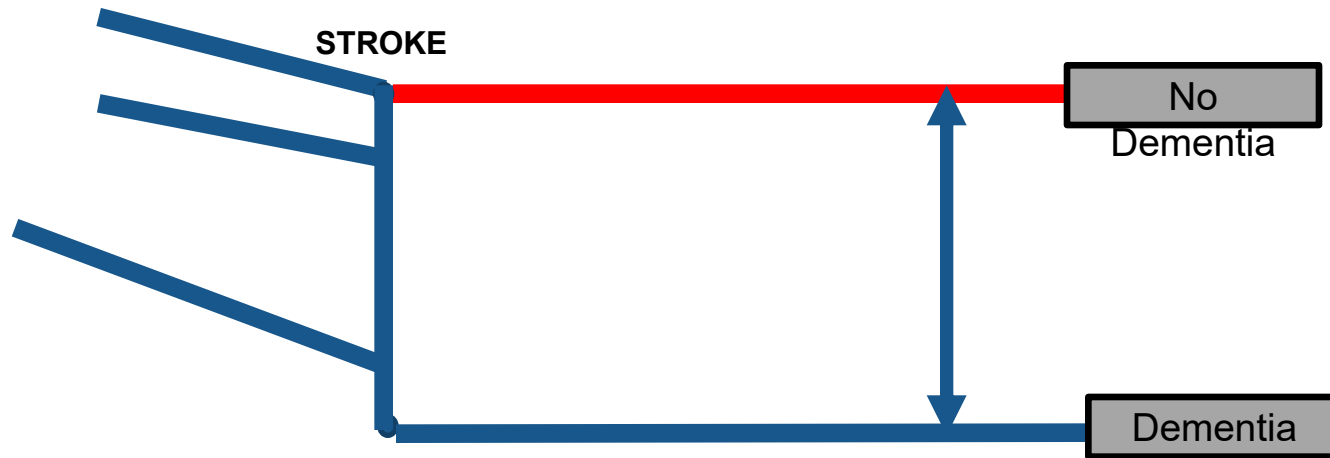
FLOWERS THINK IT'S SPRING BUT NEW BIG FREEZE IS ON THE WAY

HOW BLOOD PRESSURE DRUG BEATS DEMENTIA

- Post stroke cognitive issues are common & important
- Its more complex than 'stroke causes dementia'
- Assessment at scale may not be perfect
- Drugs are not the answer

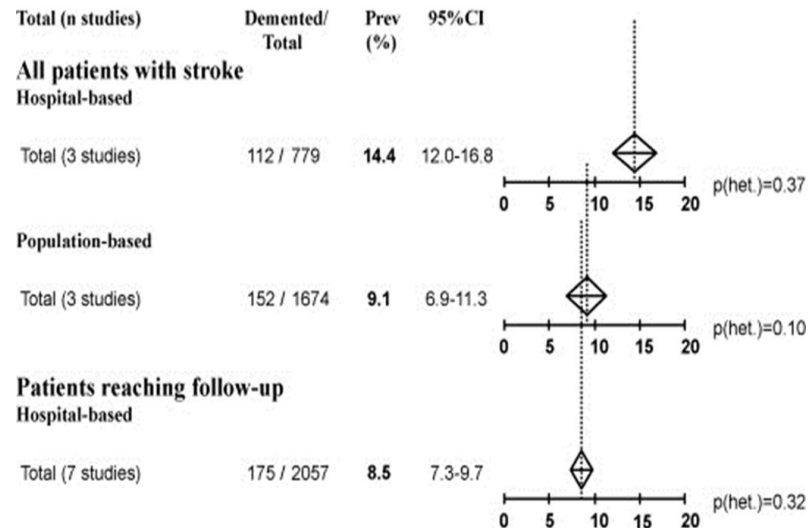
- Post stroke cognitive issues are common & important
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Pendlebury et al
Lancet Neurol 2009



Updated analysis (2022)

Pooled estimate pre-stroke dementia: 7.6 (95%CI: 4 to 14. 25 studies)

Post-stroke dementia (excluding pre-stroke) 16.5 (95%CI:10 to 25, 33 studies)

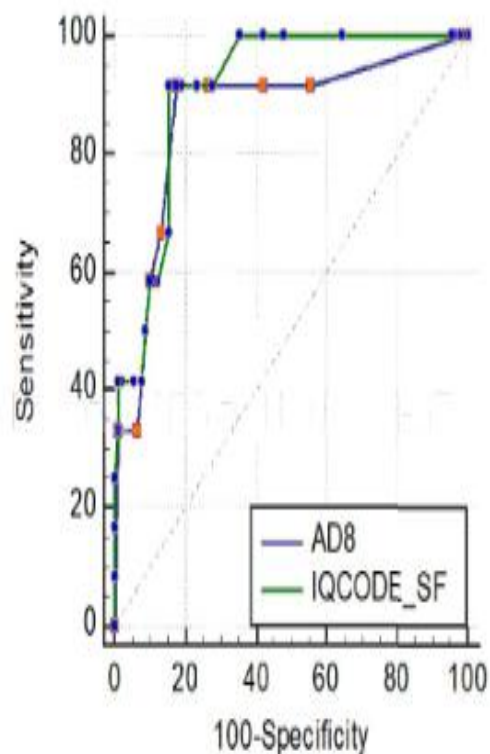
Post-stroke dementia (inclusive pre-stroke) 22.3 (95%CI:19 to 26, 17 studies)

AD8 Dementia Screening Interview

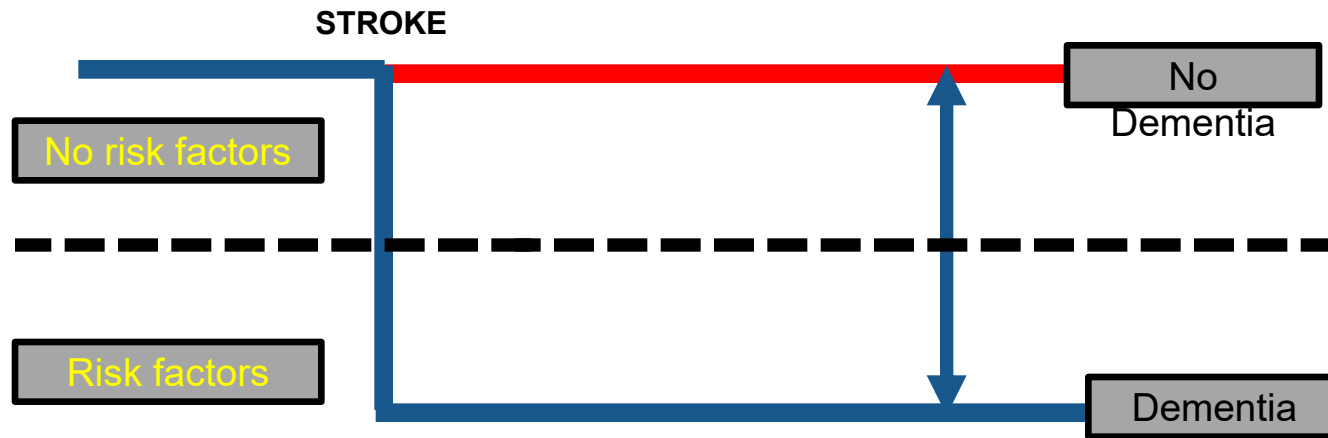
Patient ID#: _____
CS ID#: _____
Date: _____

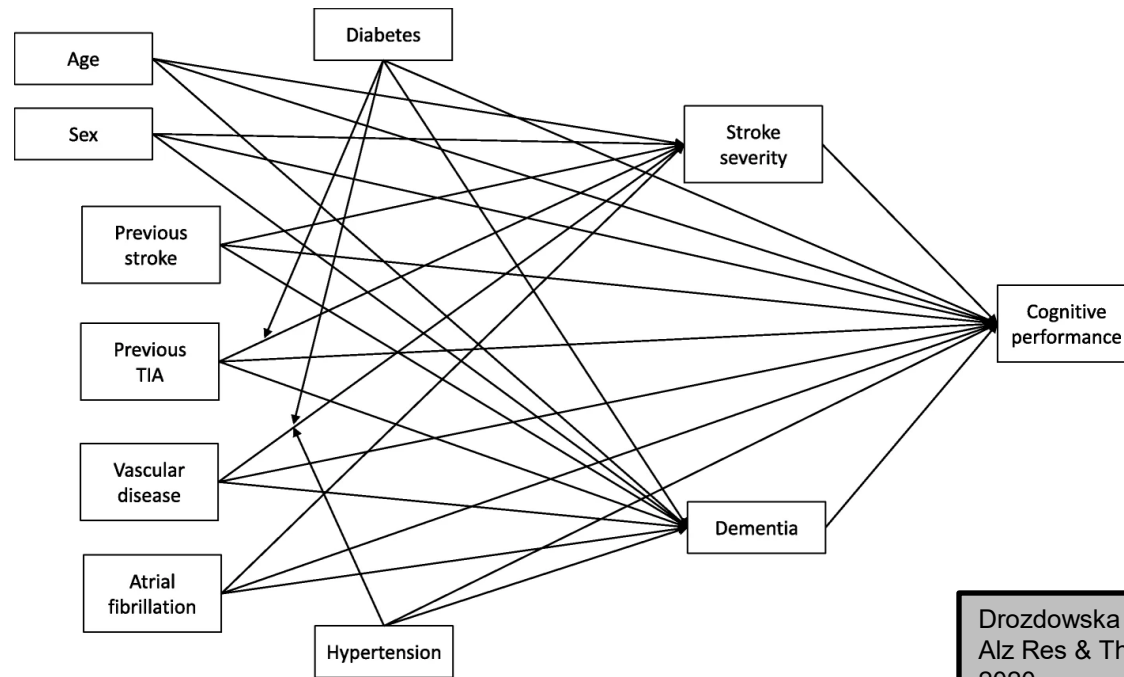
Taylor-Rowan et al
Int J Geri Psych 2022

Remember, "Yes, a change" indicates that there has been a change in the last several years caused by cognitive (thinking and memory) problems.	YES, A change	NO, No change	N/A, Don't know
1. Problems with judgment (e.g., problems making decisions, bad financial decisions, problems with thinking)			
2. Less interest in hobbies/activities			
3. Repeats the same things over and over (questions, stories, or statements)			
4. Trouble learning how to use a tool, appliance, or gadget (e.g., VCR, computer, microwave, remote control)			
5. Forgets correct month or year			
6. Trouble handling complicated financial affairs (e.g., balancing checkbook, income taxes, paying bills)			
7. Trouble remembering appointments			
8. Daily problems with thinking and/or memory			
TOTAL AD8 SCORE			



	AD8	IQCODE-SF
Positive likelihood ratio	2.16 (95%CI= 1.61 to 2.90)	5.17 (95%CI=3.19 to 8.38)
Negative likelihood ratio	0.14 (95%CI= 0.02 to 0.95)	0.11 (95%CI= 0.02 to 0.72)
Positive Predictive Value	22.0% (95%CI= 17.4% to 27.4%)	38.5% (95%CI= 27.8% to 50.3%)
Negative Predictive Value	98.2% (95%CI= 88.9% to 99.7%)	98.7% (95%CI= 92.0% to 99.8%)
Prevalence (pre-stroke dementia)	11.5%	10.8%





Drozdowska et al
Alz Res & Therapy
2020

One year		
	Prevalence %(95% CI), no of studies	Prevalence %(95% CI), no of studies
	Excluding pre-stroke dementia	Including pre-stroke dementia
Recurrent stroke	23.5 (12.7 to 39.1), n=1	33.4 (9.3 to 70.9), n=7
First-ever stroke	11.0 (6.7 to 17.5), n=2	17.7 (6.1 to 41.9), n=11

- Post stroke cognitive issues are common & important
- Its more complex than 'stroke causes dementia'
- Assessment at scale may not be perfect
- Drugs are not the answer

- Post stroke cognitive issues are common & important
- Its more complex than 'stroke causes dementia'
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- Drugs are not the answer

Assessment for cognitive deficits
appears desirable

Best practice statement

Assessing the patient's cognition
should be part of rehabilitation

Best practice statement

..in the early phase routine
cognitive screening should be
undertaken

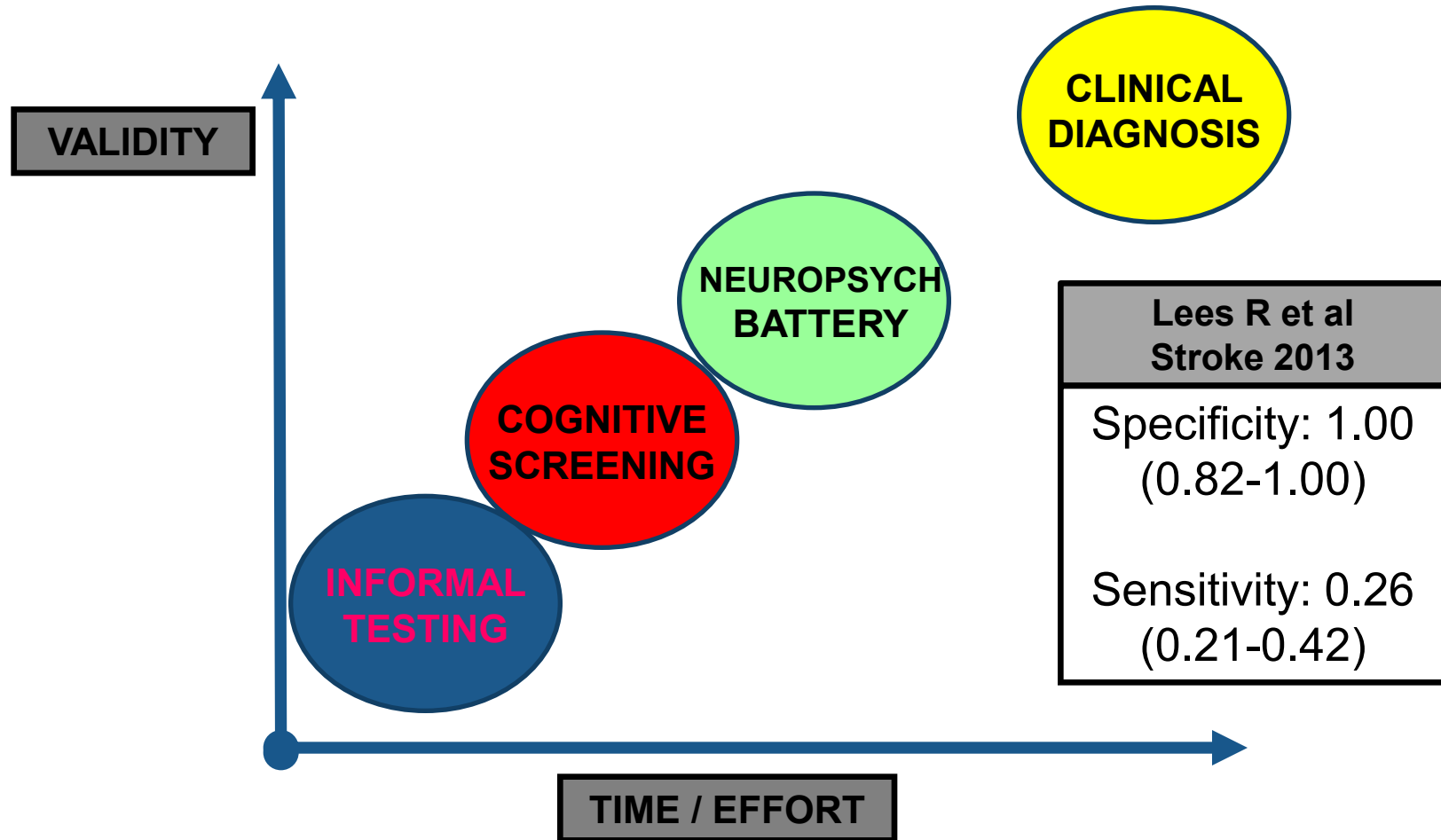
Best practice statement

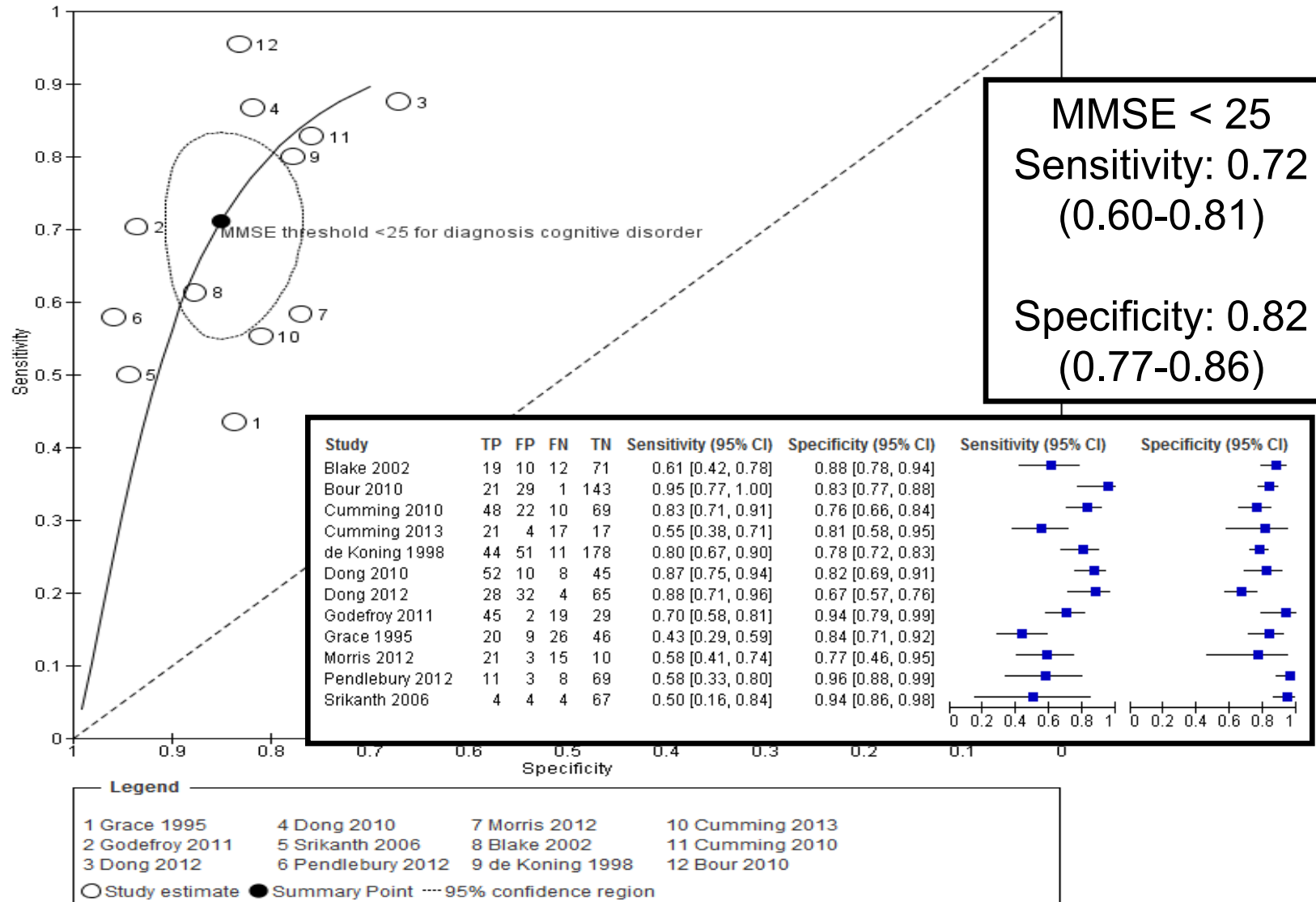
..all patients should be screened
for cognitive impairment

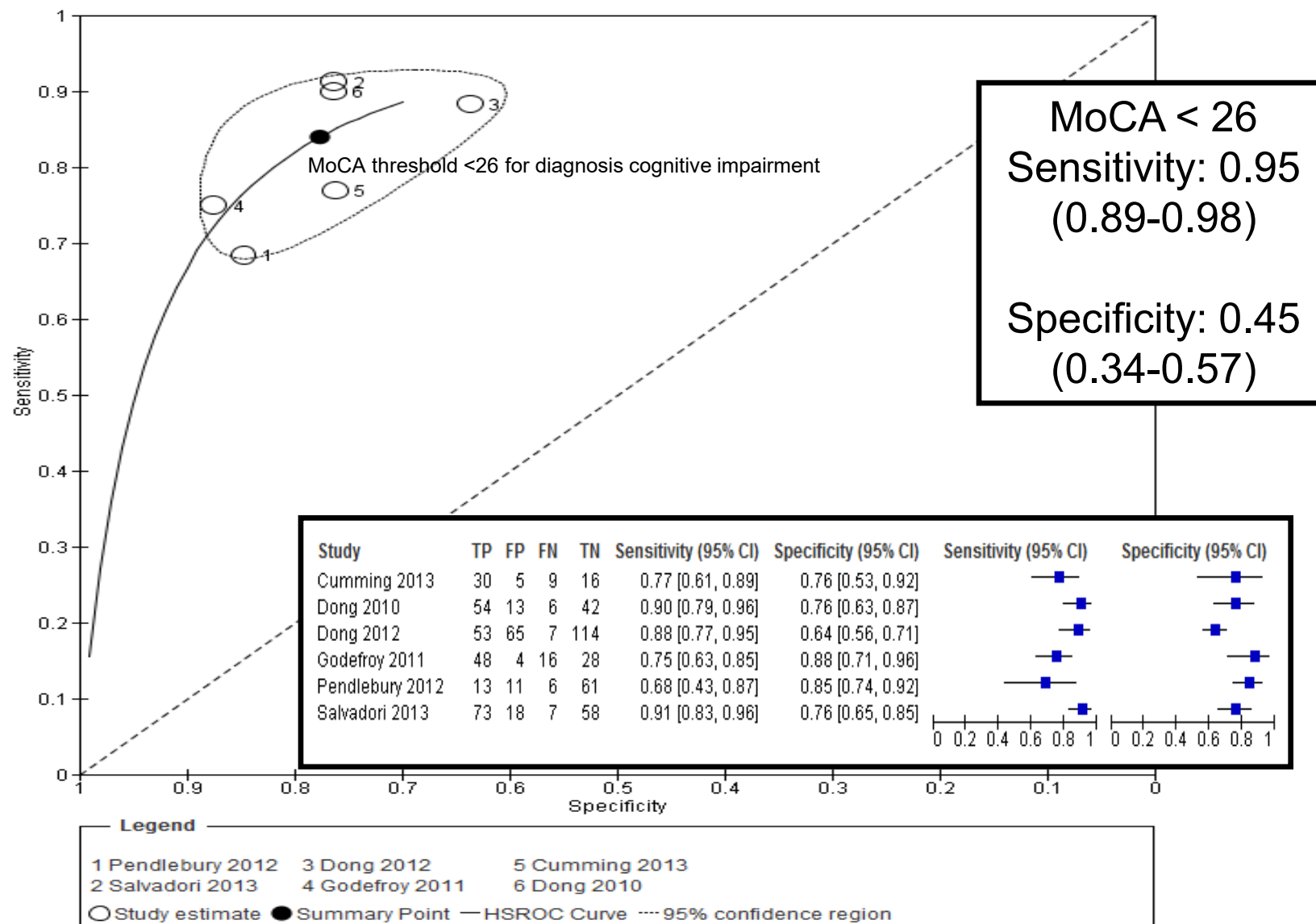
Best practice statement

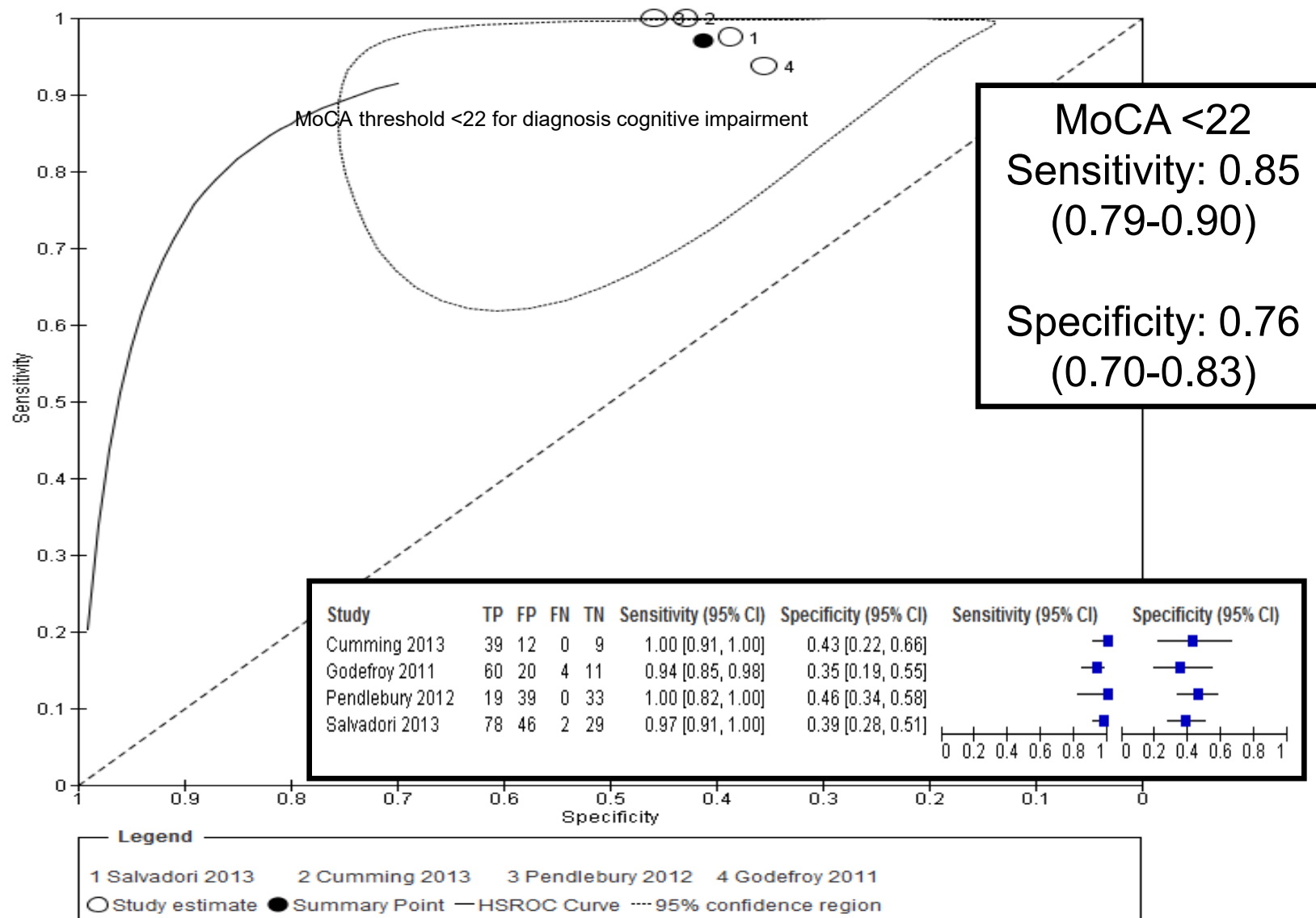


Quinn TJ et al
Alz Res & Treat 2014











We suggest that in post-acute stroke settings, screening of cognition using the Montreal Cognitive Assessment (MoCA) is considered, but it is not a substitute for comprehensive clinical assessment.

At the conventional threshold for test positivity, MoCA screening will detect most stroke survivors with important cognitive issues but at the cost of substantial false positives.

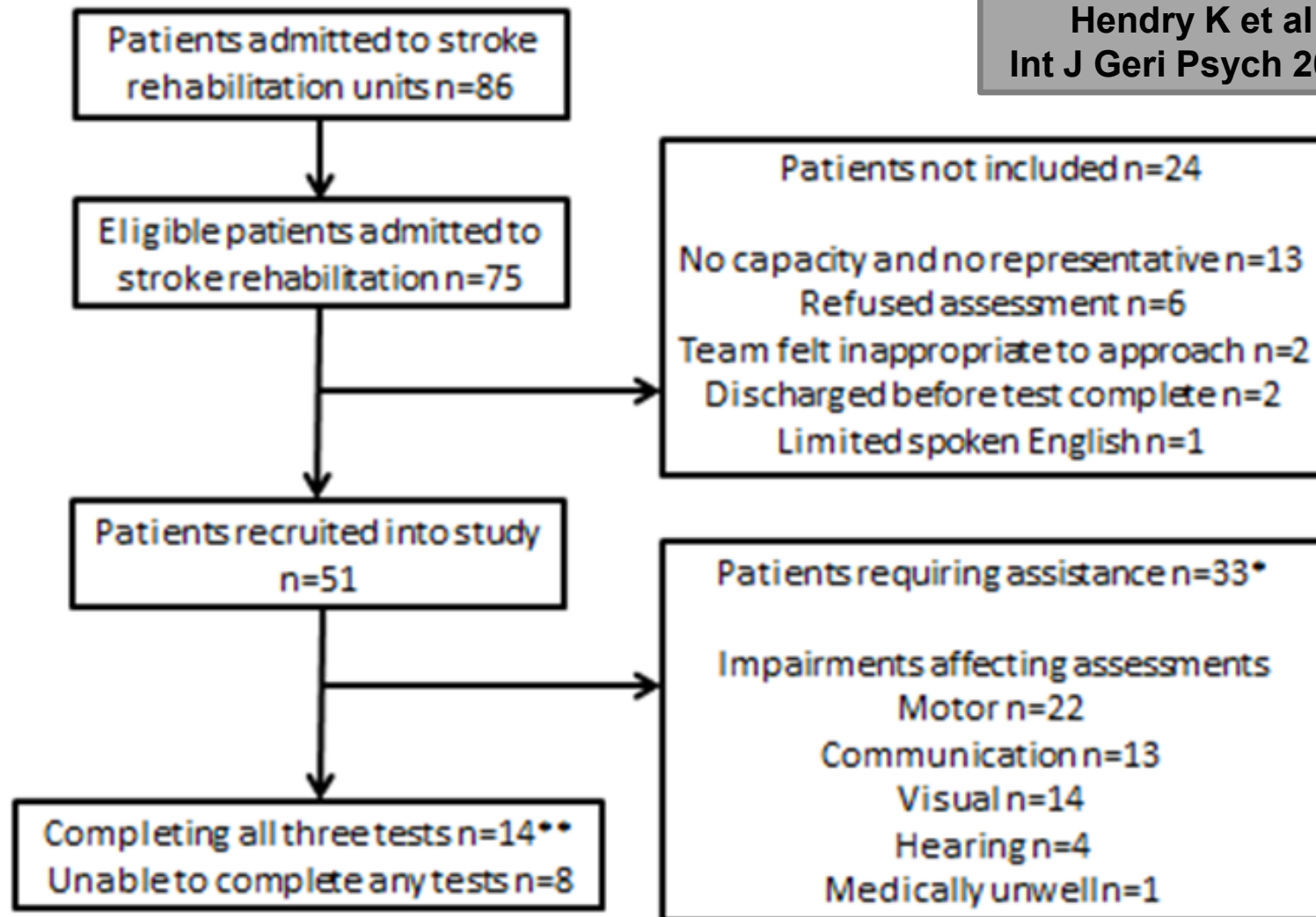
We suggest that a revised (lower) threshold be considered for stroke populations.

Quality of evidence: **Low** ⊕⊕

Strength of recommendation: **Weak for intervention** ↑?



Test	Sensitivity	Specificity	Free to use	Admin time	Stroke Validation	Aphasia friendly
ACE-R	0.96	0.70	Y	20	Y	N
IQCODE	0.81	0.83	Y	5	Y	Y
MMSE	0.72	0.82	N	5	Y	N
MoCA <26/30	0.95	0.45	?	10	Y	N
OCS	?	?	Y	15	Y	Y
RCAMCOG	0.81	0.92	N	15	Y	N



- Post stroke cognitive issues are common & important
- Its more complex than 'stroke causes dementia'
- Assessment at scale may not be perfect
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Prevention



Pharmacological



Non-pharmacological

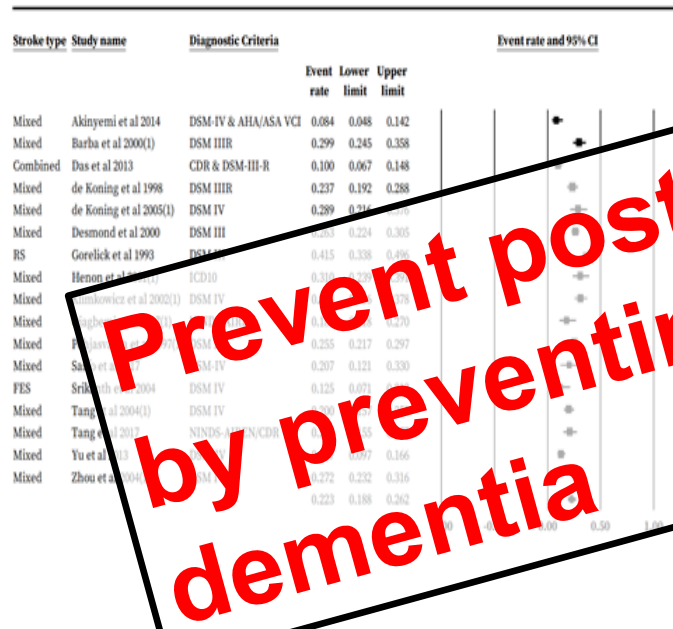
Treatment



Pharmacological

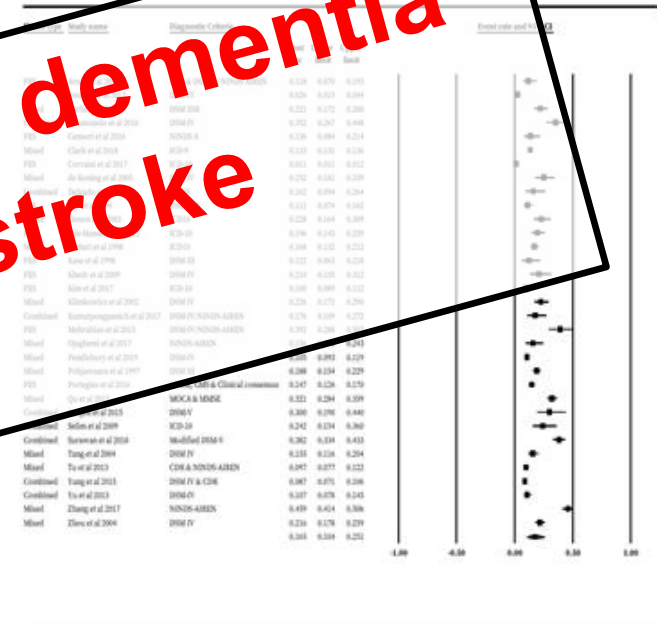


Non-pharmacological



Prevalence of post-stroke dementia (including pre-stroke dementia)

Estimate: **22.3%** (95%CI: 18.8-26.2)
17 studies



Prevalence of post-stroke dementia (excluding pre-stroke dementia)

Estimate: **16.5%** (95%CI: 10.4-25.1)
33 studies



Prevalence one year post stroke		
	Prevalence %(95% CI)	Prevalence %(95% CI)
	Excluding pre-stroke dementia	Including pre-stroke dementia
Recurrent stroke	23.5 (12.7 to 39.1)	33.4 (9.3 to 70.9)
First-ever stroke	11.0 (6.7 to 17.5)	17.7 (6.1 to 41.9)



Prevention



Treatment





Cochrane Database of Systematic Reviews

Cholinesterase inhibitors for vascular dementia and other vascular cognitive impairments: a network meta-analysis (Review)

Battle CE, Abdul-Rahim AH, Shenkin SD, Hewitt J, Quinn TJ

Network plot: Cognition

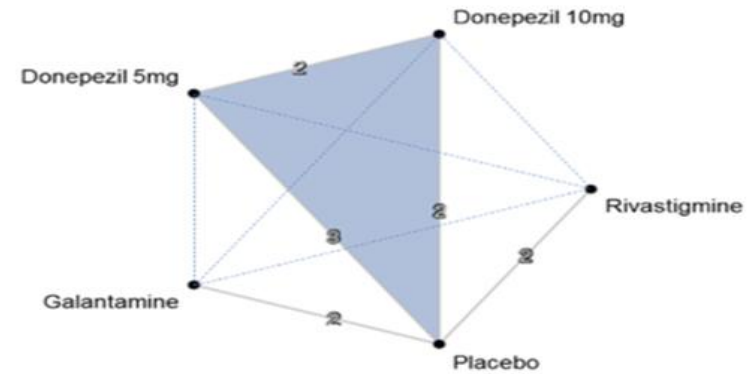
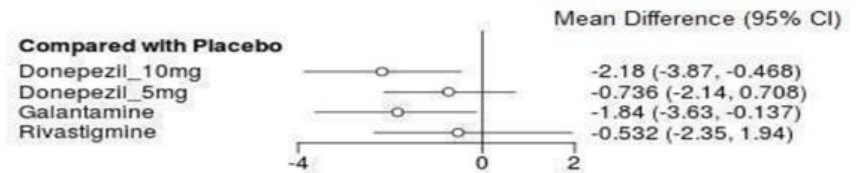


Figure 5. Forest plot (Bayesian model) network meta-analysis results: Cognition.



Citicoline

- **No high-quality evidence**

L-Dopa

- **No high-quality evidence**

Memantine

- **No high-quality evidence**

Nicergoline

- **No high-quality evidence**

Piracetam

- **No high-quality evidence**

SSRIs

- **No evidence of cognitive effect**

Stimulants

- **No high-quality evidence**



Prevention



Treatment



In people with post-stroke cognitive impairments,
does cognitive rehabilitation (skill training or compensation strategies)
compared to no rehabilitation,
delay cognitive decline, improve performance in ADL, decrease caregiver
burden?

- Randomised controlled trial
- At least n=50 in each arm
- At least 6 months follow-up

N=1 RCT

- Post stroke cognitive issues are common & important
because stroke survivors tell us
- Its more complex than 'stroke causes dementia'
but stroke DOES cause dementia
- Assessment at scale may not be perfect
but can be good enough
- Drugs are not the answer
prevention better than cure



University
of Glasgow

Bringing together cognition and frailty Delirium

Terry Quinn



Terry.quinn@glasgow.ac.uk

[@DrTerryQuinn](https://twitter.com/DrTerryQuinn)

Mrs A is a 88 year old woman, inpatient on ASU for six days.

She has a past medical history of mild cognitive impairment, visual impairment and alcohol excess.

This admission was with a major stroke, treated with tPA.

She was making good progress but now you note a change.

She is drowsy during day, but awake & distressed at night.

She is not engaging in rehabilitation anymore and struggles to focus on tasks.

You have noted her picking at the air as if hallucinating.

During the doctors morning round she seems fine.

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During the doctors morning round she seems fine.

What we will cover:

- **What is delirium**
- **Why is delirium important**
- **How to diagnose delirium**
- **How to predict delirium**
- **How to manage delirium**

DSM IV

Disturbance of consciousness
with reduced ability to focus, sustain or shift attention

Accompanied by change in cognition or perception
that is not better accounted for by a preexisting, established or
evolving dementia.

That develops over a short period of time and tends to fluctuate.

With evidence that the disturbance is caused by consequences
of a medical problem.

DSM IV

Disturbance of consciousness
with reduced ability to focus, sustain or shift attention

Accompanied by change in cognition or perception
that is not better accounted for by a preexisting, established or
evolving dementia. **Stroke is NOT this (but can look like it)**

That develops over a short period of time and tends to fluctuate.

With evidence that the disturbance is caused by consequences
of a medical problem. **eg stroke! (or other complications of stroke)**



Acute onset

AND

Change in arousal

OR

Inattention

AND

Another cognitive
deficit

Bleeped to stroke ward

Mr B

78 year old man

Dementia (AD) mild

Polypharmacy

**Admitted with minor stroke,
aspiration pneumonia**

Acute change in cognition

Pacing ward

Lashing out at nurses

Hallucinations

Good / bad periods

for prompt control of
senile agitation



Hyperactive delirium
in acute stroke:
approx 7%

THORAZINE*

(chlorpromazine, S.R.F.)

"Thorazine" can control the agitated, belligerent senile and help the patient to live a composed and useful life.

 Smith Kline & French Laboratories

NY, NY Reg. U.S. Pat. Off.

Bleeped to stroke ward

Mr B

78 year old man

Dementia (AD) mild

Polypharmacy

Admitted with minor stroke

Acute change in cognition

Not holding conversations

Not working with therapists

Drowsy at times

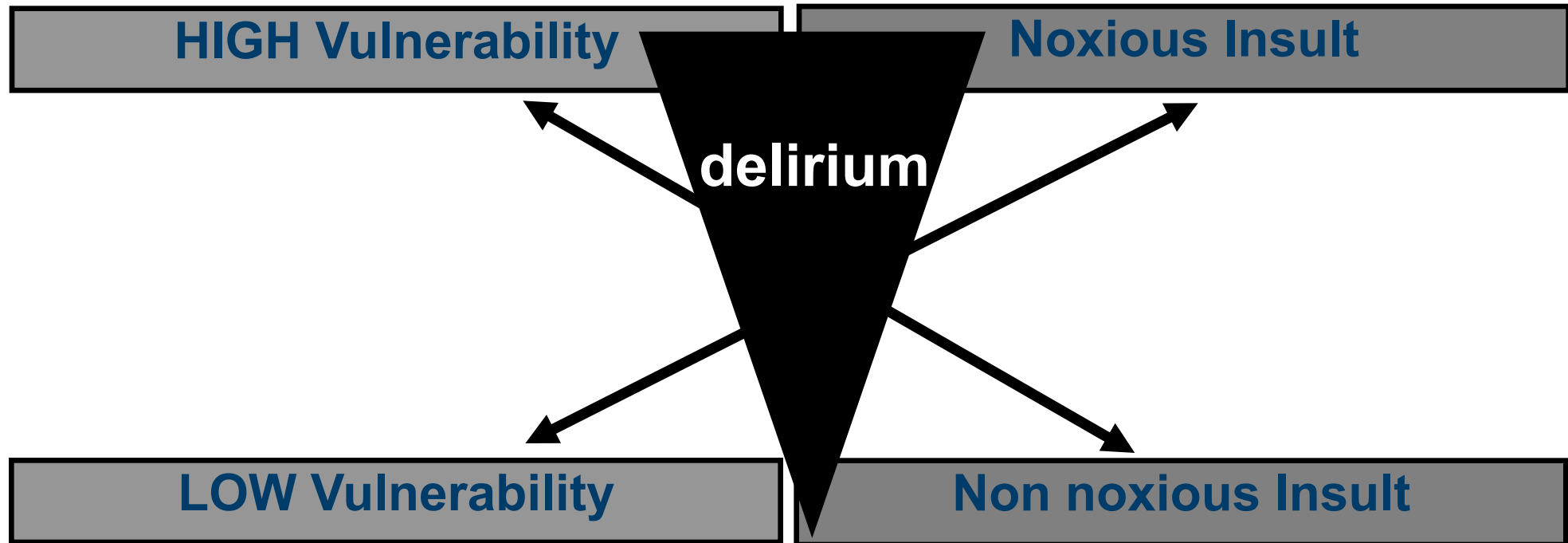
Good / bad periods

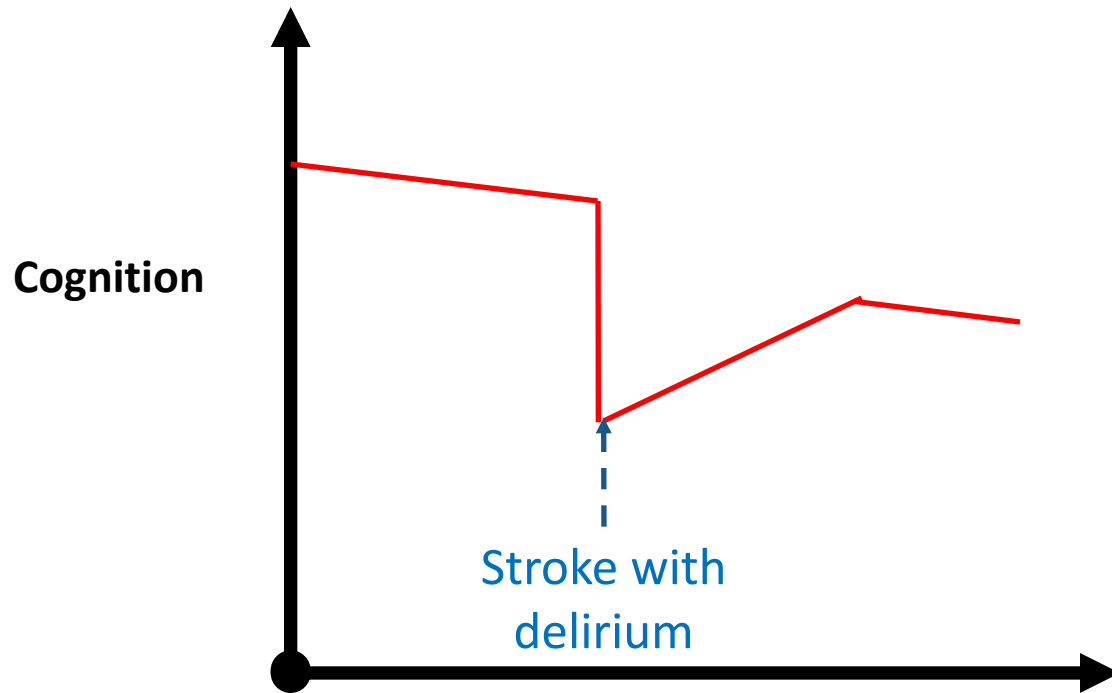


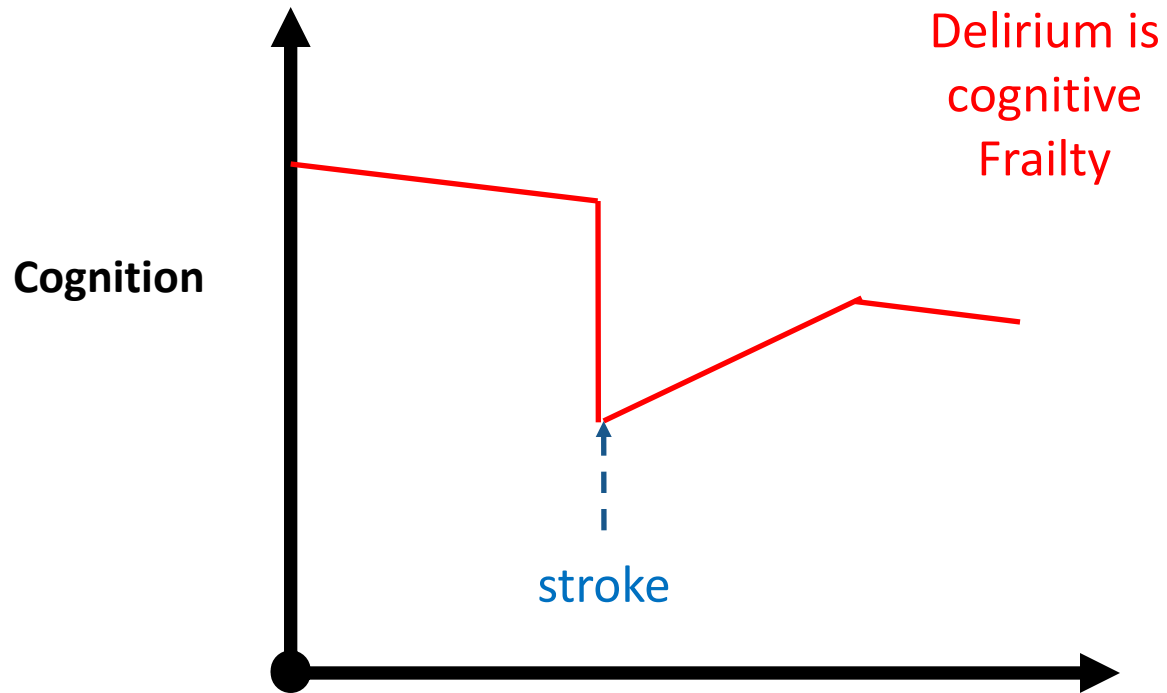


Predisposing factors
brain frailty (cSVD, prev stroke)

Precipitating factors
stroke +/- complications

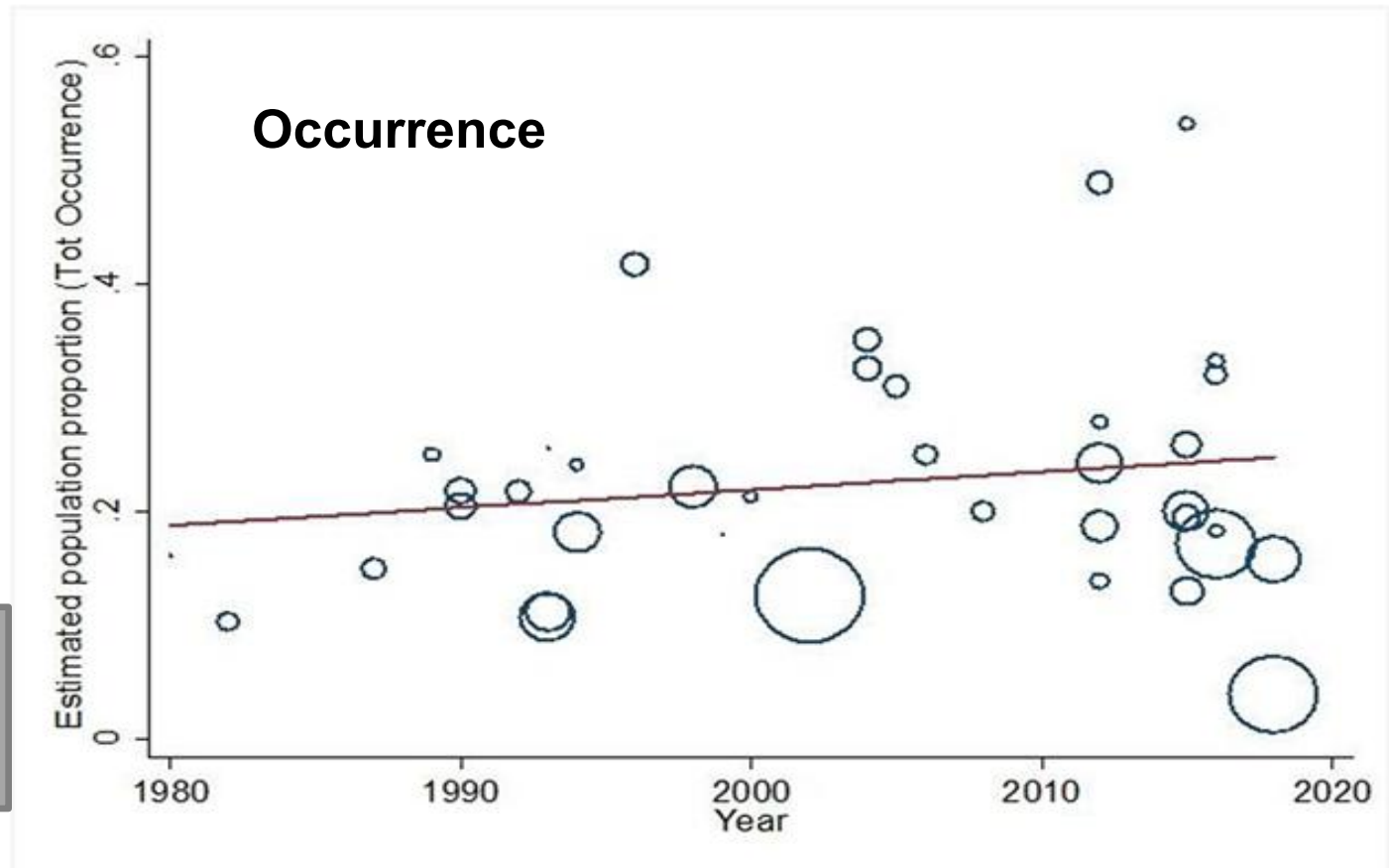
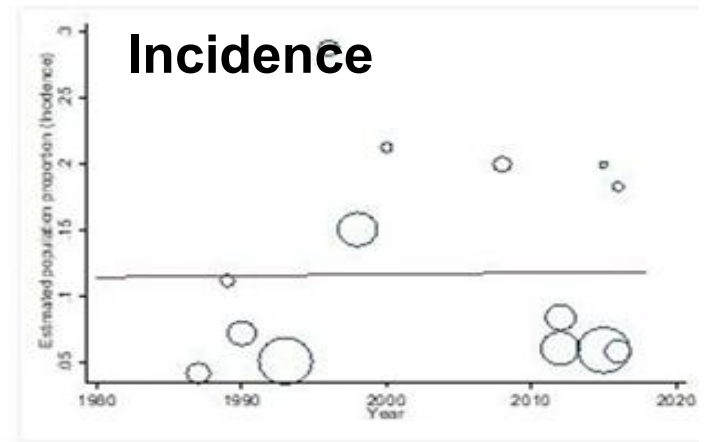
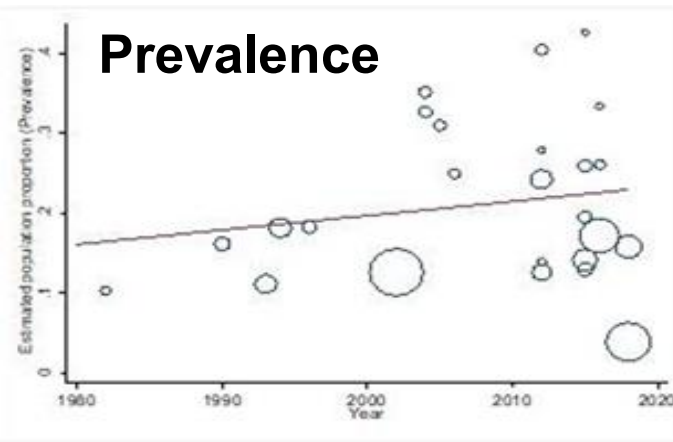






What we will cover:

- What is delirium
- **Why is delirium important**
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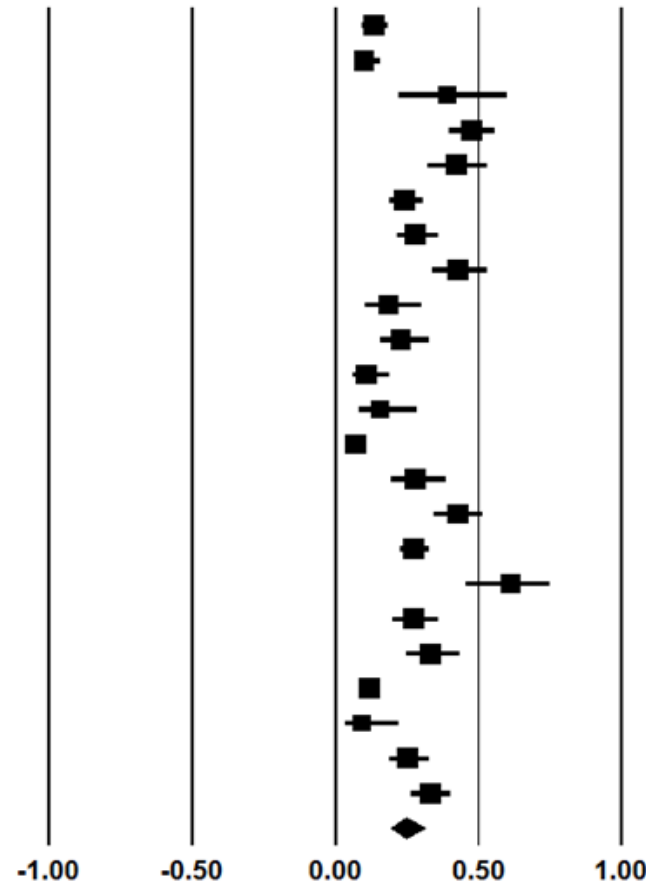


Study name

Statistics for each study

Event rate and 95% CI

	Event rate	Lower limit	Upper limit
Caeiro 2004	0.13	0.09	0.18
Dahl 2010	0.10	0.06	0.15
Fassbender 1994	0.39	0.22	0.60
Gustafson 1991	0.48	0.40	0.56
Gustafson 1993	0.42	0.32	0.53
Henon 1999	0.24	0.19	0.31
Kara 2013	0.28	0.21	0.36
Kostalova 2012	0.43	0.34	0.53
Kozak 2017	0.18	0.10	0.30
Kutlubaeu 2013	0.23	0.16	0.32
Lees 2013	0.11	0.06	0.19
Lees 2016	0.16	0.08	0.28
Lim 2017	0.07	0.05	0.10
McManus 2011	0.28	0.19	0.39
Mitasova 2012	0.43	0.34	0.51
Miu 2013	0.27	0.23	0.33
Mori 1987	0.61	0.45	0.75
Naidech 2013	0.27	0.20	0.36
Ojagbemi 2017	0.33	0.25	0.43
Oldenbeuving 2013	0.12	0.09	0.15
Reding 1993	0.09	0.03	0.22
Sheng 2006	0.25	0.19	0.32
Turco 2013	0.33	0.26	0.40
	0.25	0.19	0.31



Possible underestimate

- Selection bias
- Consent
- Aphasia
- Prior dementia
- Alcohol/drugs
- Complete test data

In a true unselected
HASU cohort with daily
testing delirium
occurrence: **30%**

Delirium occurrence 25% in acute stroke unit

**Shaw R et al
Stroke 2019**



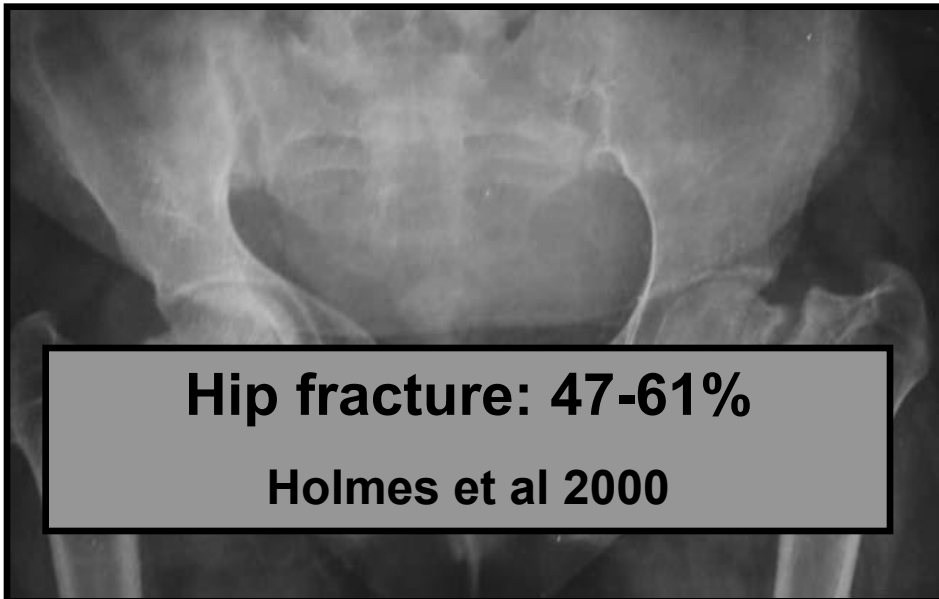
Medical inpatients: 11-42%

Siddiqi et al 2006



Post-operative: 15-53%

Inouye et al 2006



Hip fracture: 47-61%

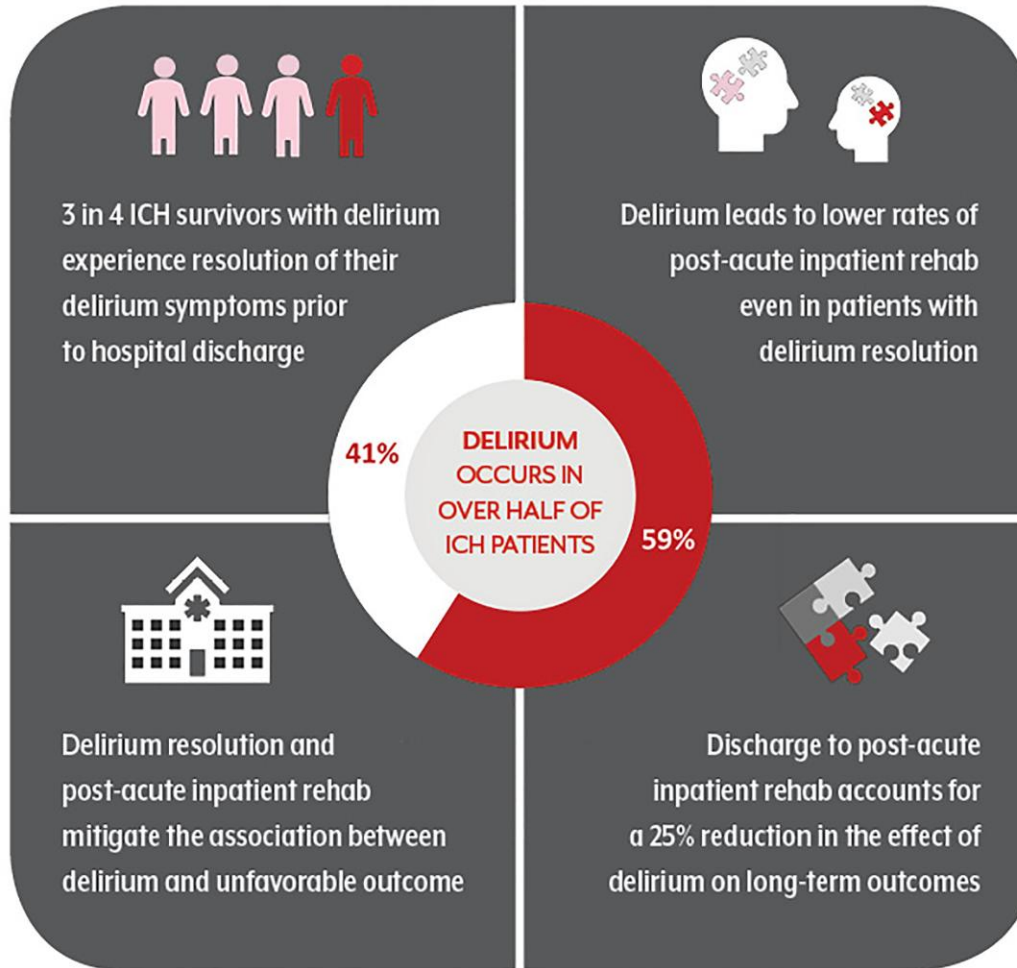
Holmes et al 2000

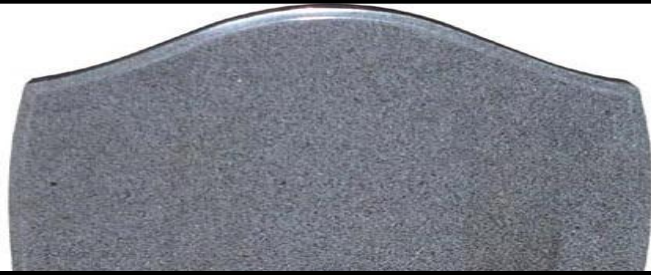


Intensive care: 70-87%

Pisani et al 2003

IMPACT OF DELIRIUM ON OUTCOMES AFTER INTRACEREBRAL HEMORRHAGE





Mortality:
HR:1.95 (1.51-2.52)

Siddiqi et al 2006



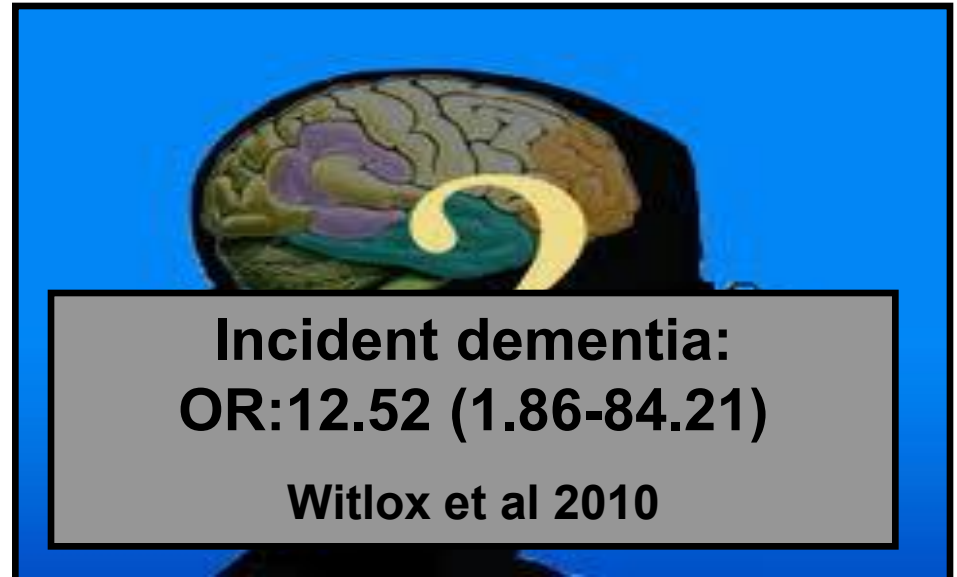
Institutionalization:
OR:2.41 (1.77-3.29)

Siddiqi et al 2006



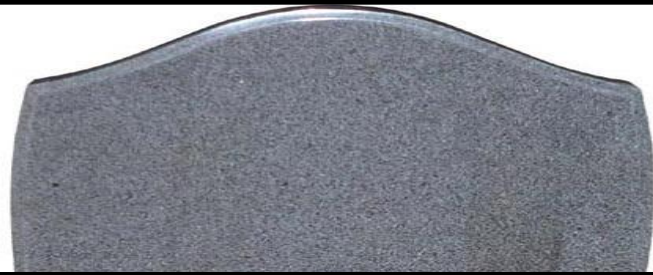
Functional decline:
RR:1.91 (1.30-2.80)

Rudolph et al 2010



Incident dementia:
OR:12.52 (1.86-84.21)

Witlox et al 2010



Mortality in stroke:
HR:4.91 (3.2-7.6)

Shi Q et al 2012



Institutionalization in stroke:
OR:3.39 (2.2-5.2)

Shi Q et al 2012



Functional decline in stroke:

Delirium mRS 4 (IQR:2-6)
No Delirium mRS 1 (IQR:0-3)

Pasinska et al 2019



Incident dementia in stroke:

?



What we will cover:

- What is delirium
- Why is delirium important
- **How to diagnose delirium**
- How to predict delirium
- How to manage delirium



Confusion in acute stroke



Dementia

Dysphasia

Delirium

Depression

Deaf
(sensory impairment)



Acute onset

AND

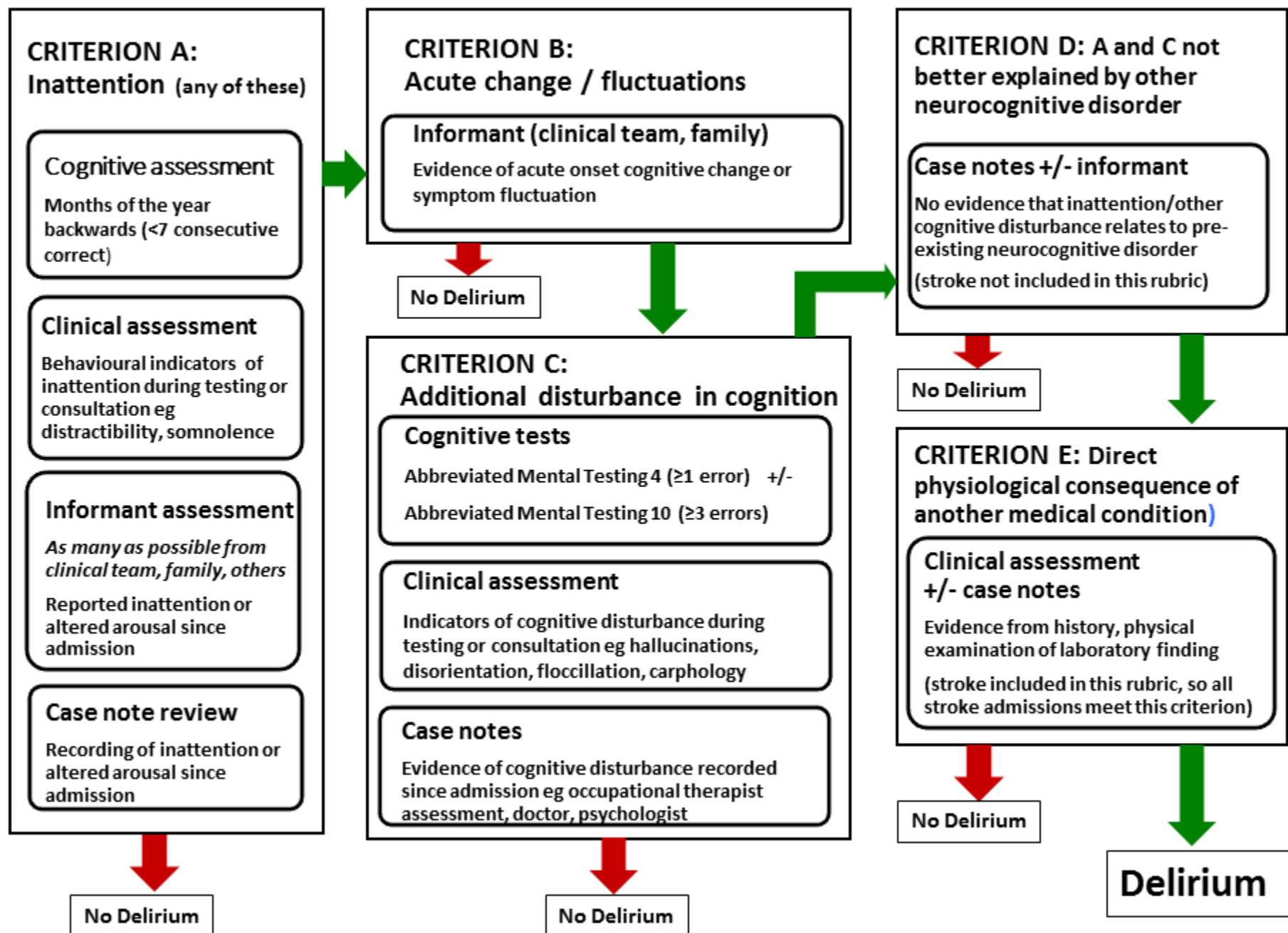
Change in arousal

OR

Inattention

AND

Another cognitive
deficit





- 1) Assess level of arousal**
- 2) Test cognition (specifically attention)**
- 3) Acute onset and/or fluctuating course?**



RAPID CLINICAL TEST FOR
DELIRIUM

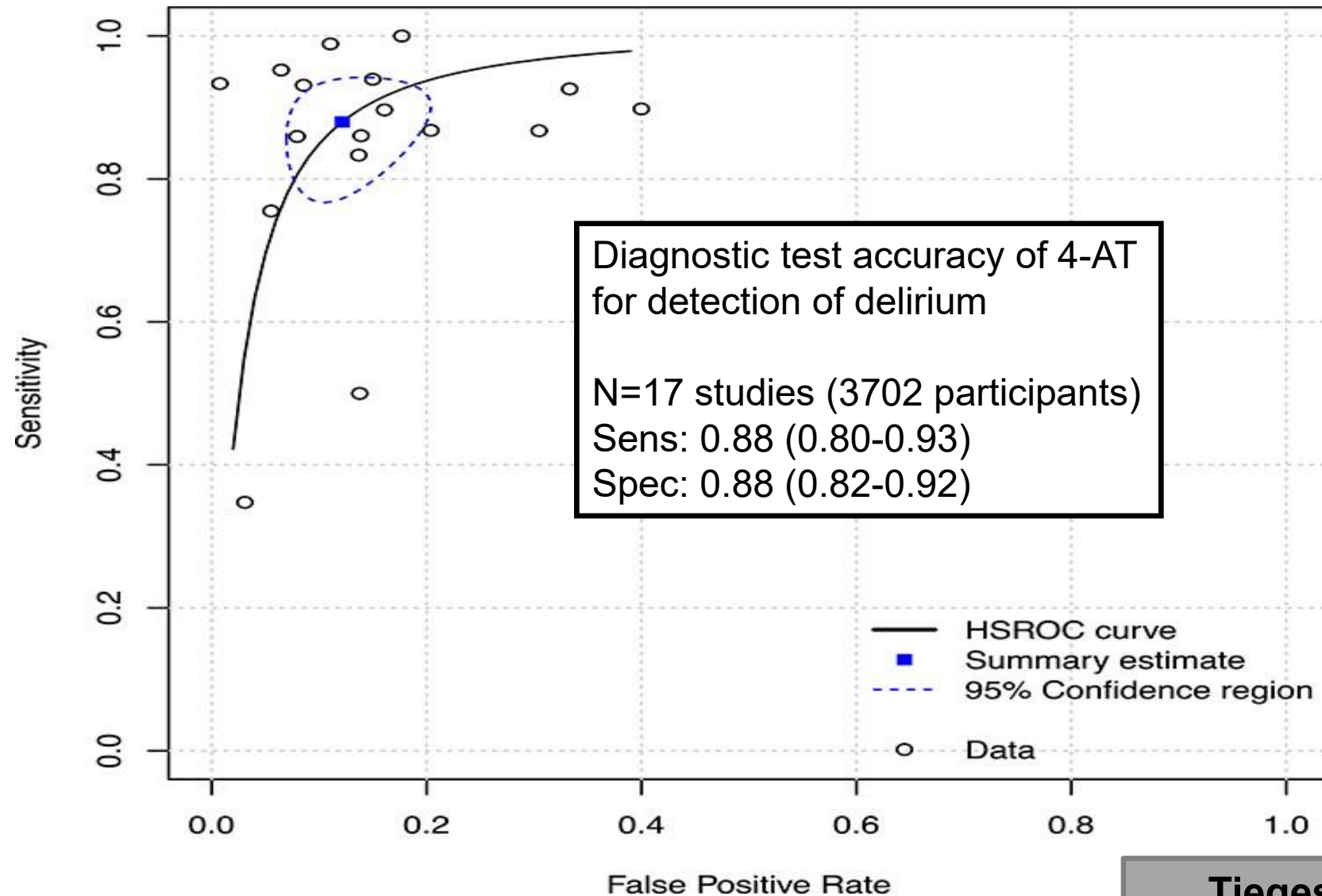
4 “A”’s:

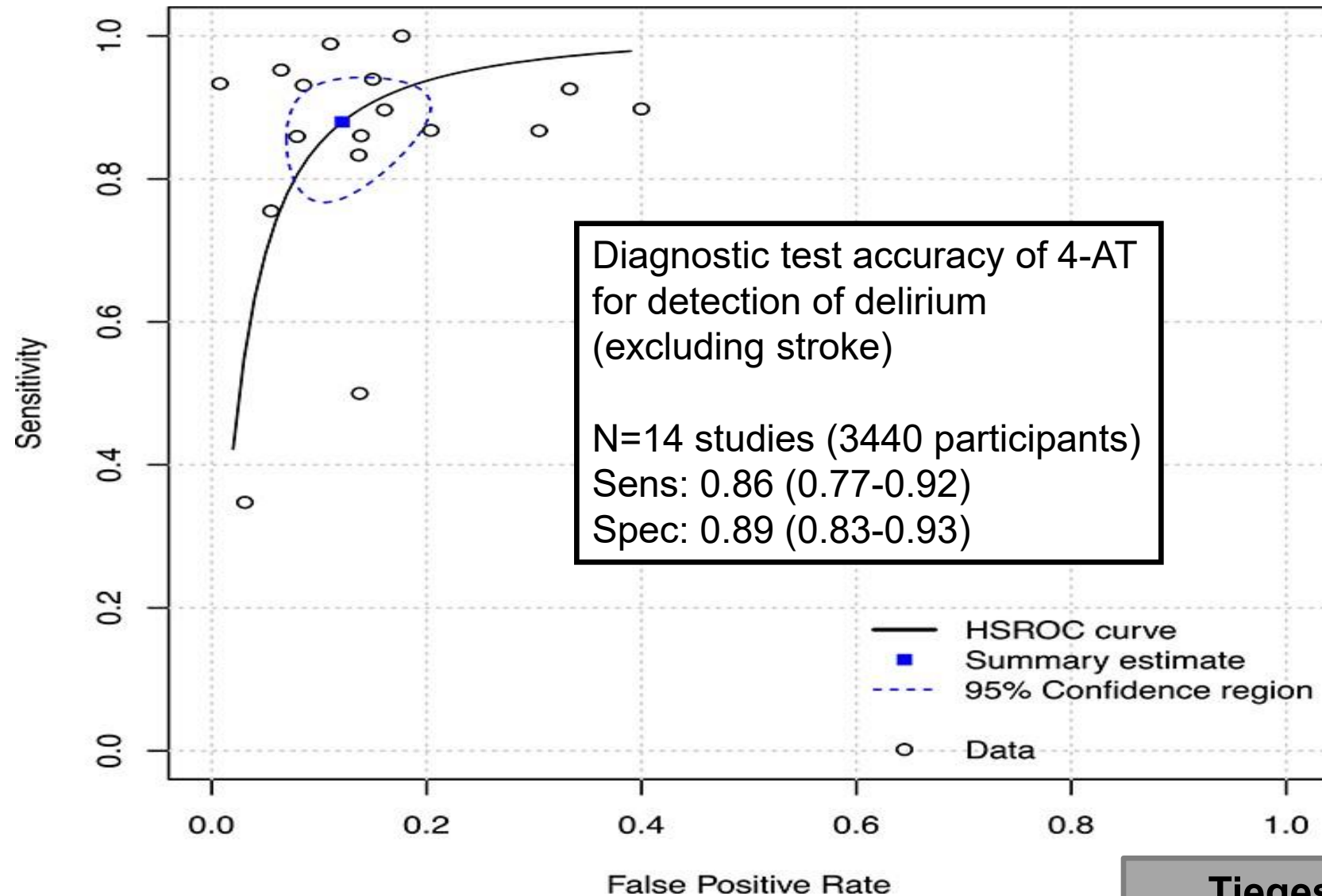
Alertness

AMT4

Attention

Acute change or fluctuating course





- Single centre, consecutive admissions
- N=141 stroke and high risk TIA (Age 74 years, NIHSS 6.4)
- Median observation 6 days
- Twice daily assessment screening tools and DSM clinical diagnosis

Tool	No. of patients with PSD	% of patients with PSD	Statistical significance vs DSM-5 rating
Confusion assessment method	n=58	41.1%	$P=0.248$
Rapid assessment test for delirium	n=65	46.1%	$P=0.016$
Nursing delirium screening scale	n=77	54.6%	$P<0.001$



Tool	No. of patients with PSD	Sensitivity	Specificity	Positive predictive value	Negative predictive value
Confusion assessment method	n=58	82% (71%–91%)	80% (70%–87%)	72% (64%–80%)	87% (80%–92%)
Rapid assessment test for delirium	n=65	86% (73%–93%)	74% (63%–82%)	68% (60%–76%)	89% (82%–93%)
Nursing delirium screening scale	n=77	93% (83%–98%)	66% (56%–76%)	64% (55%–72%)	94% (88%–97%)

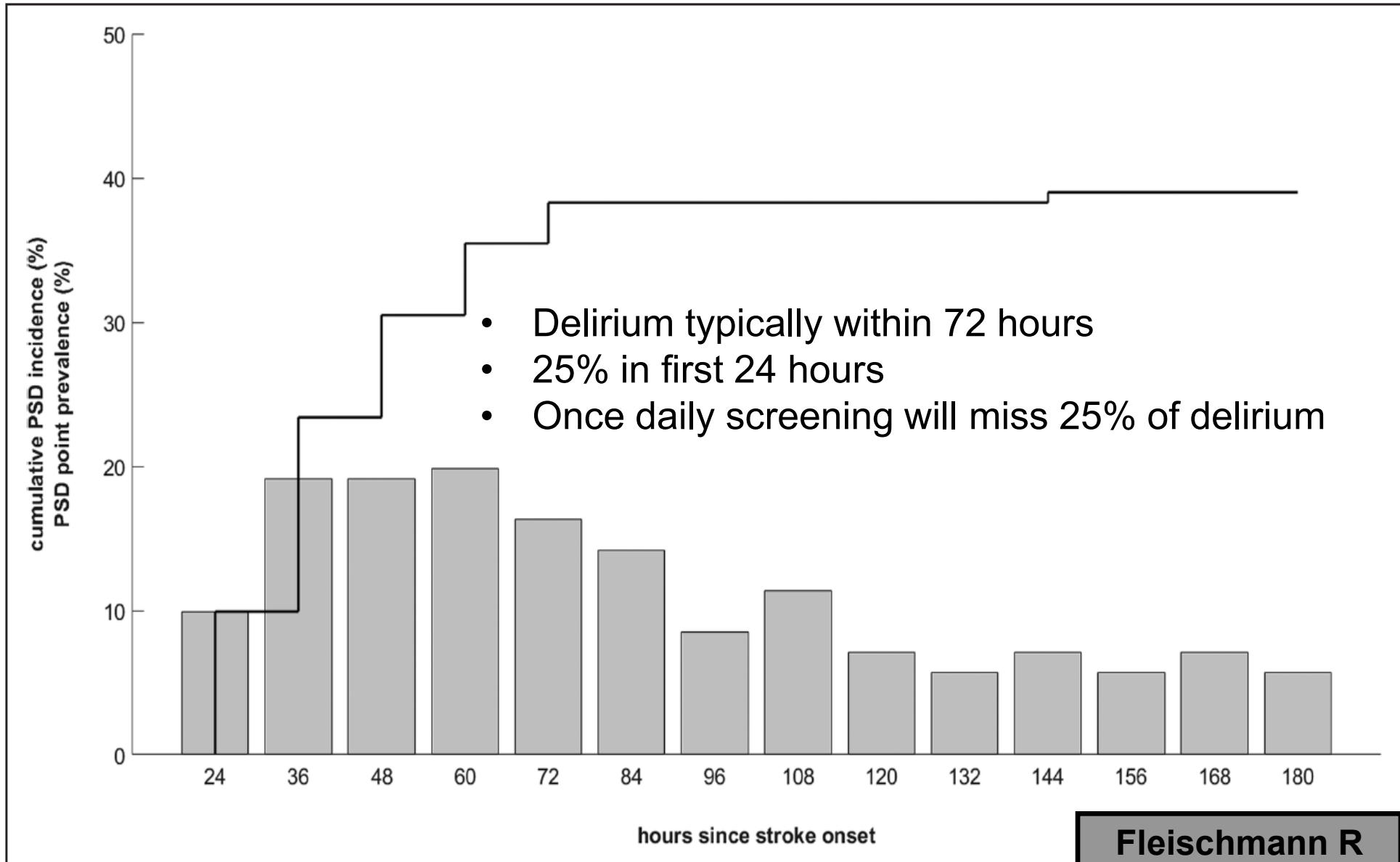


Figure. Poststroke delirium (PSD) incidence and point prevalence.

What we will cover:

- What is delirium
- Why is delirium important
- How to diagnose delirium
- **How to predict delirium**
- How to manage delirium



Hypoxia

Pain

Dehydration

Constipation

Malnutrition

Sleep disturbance

Infection

Functional impairment

Cognitive decline

Sensory impairment

Polypharmacy



Hypoxia

Pain

Dehydration

Constipation

Malnutrition

Sleep disturbance

Infection



Incident
delirium as a
hospital quality
indicator

Functional impairment

Cognitive decline

Sensory impairment

Polypharmacy

	Delirium N=105	No delirium N=290	Univariable OR (95% CI)	Multivariable OR (95%CI)
Age (years) (Median IQR)	79 (70-87)	65 (55-76)	1.07 (1.05-1.09)	1.05 (1.03-1.08)
Sex (Male)	173/290	48/105	0.71 (0.51-0.99)	0.61 (0.34-1.08)
Pre-stroke disability (mRS 2-5)	62/105	91/290	2.86 (2.01-4.08)	1.54 (0.84-2.81)
Pre-stroke cognitive impairment	31/105	28/290	3.51 (2.27-5.43)	1.99 (0.98-4.08)
NIHSS (Median, IQR)	5 (2-11)	2 (1-4)	1.28 (1.20-1.36)	1.23 (1.15-1.32)
Previous depression	9/105	59/290	0.51 (0.31-0.85)	0.52 (0.22-1.22)
Previous stroke	34/105	83/290	1.17 (0.81-1.71)	0.96 (0.52-1.77)
Drug or alcohol misuse	15/105	29/290	1.41 (0.82-2.42)	2.64 (1.10-6.26)
Deliriogenic drugs	32/105	82/290	1.10 (0.75-1.62)	0.92 (0.50-1.71)
Medication count (Median, IQR)	8 (6-11)	6 (3-10)	1.07 (1.03-1.12)	1.02 (0.95-1.10)
Sensory impairment	14/105	20/290	1.70 (0.97-2.99)	1.16 (0.47-2.84)

Kostalova et al (a) Brain Injury 2012

Age

ICH

Lesion volume

GGT

Bilirubin

Kostalova et al (b) Brain injury 2012

Age

ICH

Lesion volume

SOFA (organ failure)

Kotfis et al J Alz Dis 2019

Age

NIHSS

Hemianopia

Aphasia

WCC parameters

CRP

Nakamizo et al J Neurol Sciences 2020

Prior delirium

NIHSS

Dementia

Alcohol excess

Sensory impairment

Oldenbeuving et al JNNP 2014 (delirium)

Age

NIHSS

TACS

Infection

Right hemisphere

Admission IQCODE

**Drozdowska BA et al
Euro Stroke J 2021**



What we will cover:

- What is delirium
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- How to diagnose delirium
- How to predict delirium
- How to manage delirium



Cochrane Database of Systematic Reviews

Benzodiazepines for delirium

Lonergan E, Luxenberg J, Areosa Sastre A



Cochrane Database of Systematic Reviews

Antipsychotics for treatment of delirium in hospitalised non-ICU patients

Burry L, Mehta S, P



Cochrane Database of Systematic Reviews

Cholinesterase inhibitors for the treatment of delirium in non-ICU settings (Review)

Yu A, Wu S, Zhang Z, Denning T, Zhao S, Pinner G, Xia J, Yang D



The Hospital
Elder Life
Program (HELP)



Targets key delirium risk factors

Dehydration

Sensory loss (hearing aids, glasses)

Immobility

Use of sedatives

Cognitive re-orientation program

Delivered by elder life specialists, trained volunteers

Controlled trial

HELP ward : 2 standard care wards (n=852)

incident delirium

OR: 0.60 (95%CI:0.39-0.92)

economics: cost saving in longer term

Inouye et al

NEJM 1999



Cochrane
Library

Cochrane Database of Systematic Reviews

Interventions for preventing delirium in hospitalised non-ICU patients (Review)

Siddiqi N, Harrison JK, Clegg A, Teale EA, Young J, Taylor J, Simpkins SA

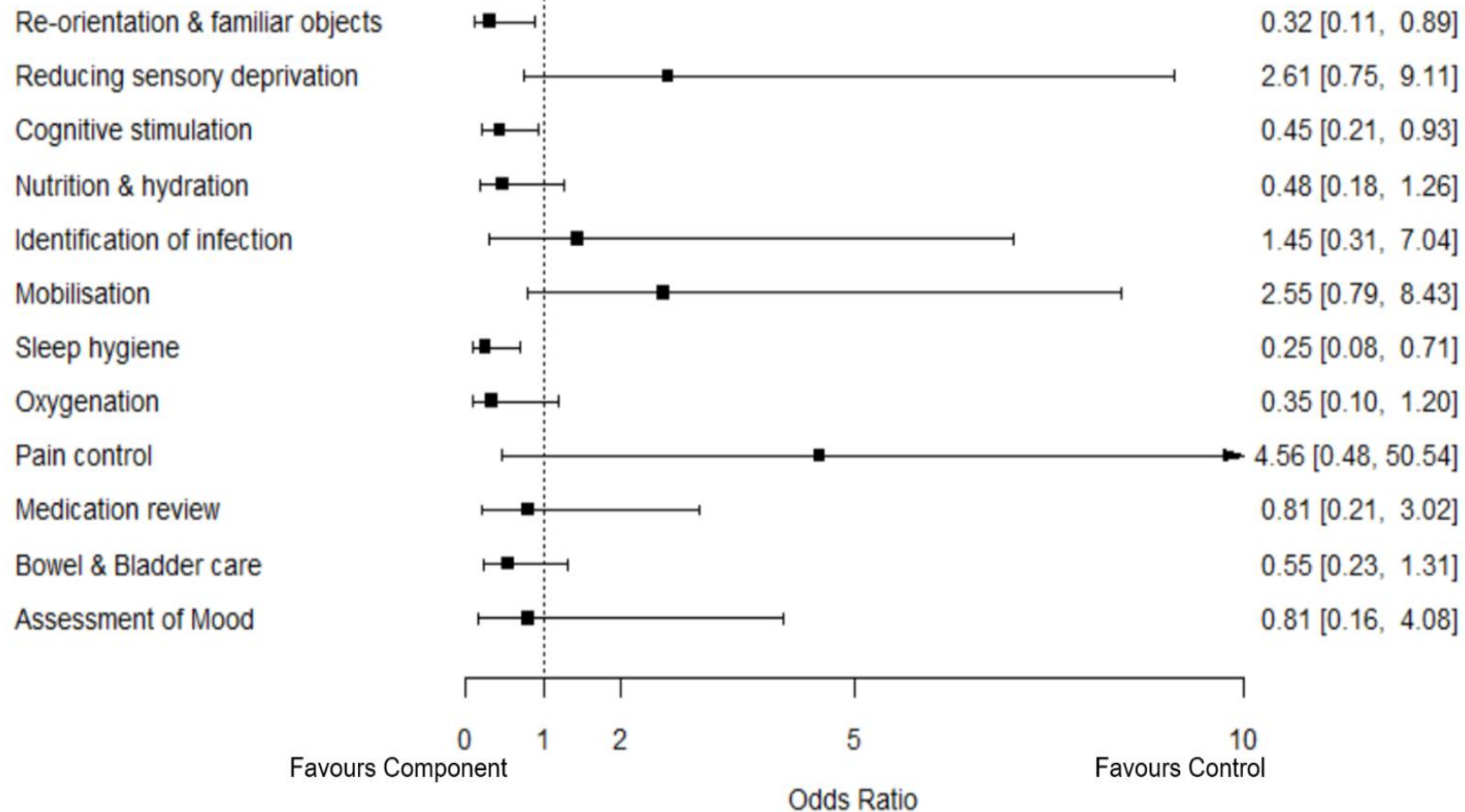
There is strong evidence supporting multi-component interventions to prevent delirium in hospitalised patients.

Outcomes No of participants (studies)	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	Certainty of the evidence (GRADE)
	Assumed risk Risk with usual care	Corresponding risk Risk with multicomponent intervention		
Incidence of delirium during hospital admission validated diagnostic instruments ¹ 3693 participants (14 studies)	184 per 1000 ²	105 per 1000 (85 to 216)	RR 0.57 (0.46 to 0.71)	⊕⊕⊕○ MODERATE ³
Inpatient mortality 2640 participants (10 studies)	45 per 1000 ²	52 per 1000 (37 to 73)	RR 1.16 (0.83 to 1.61)	⊕⊕○○ LOW ⁴
Delirium severity (any time during hospital admission) validated diagnostic instruments ⁶ 147 participants (5 studies)		The standardised mean severity of delirium in the intervention groups was 0.49 standard deviations lower (1.13 lower to 0.14 higher) ¹⁰		⊕⊕○○ LOW ⁷
Length of hospital admission (days) 3351 participants (10 studies)	The mean length of hospital admission in the control groups ranged from 5 to 38 days	The mean length of admission in the intervention groups was 1.30 days shorter (2.56 days shorter to 0.04 days shorter)		⊕⊕○○ LOW ⁸
Discharge from hospital to new long-term care placement 536 participants (1 study)	247 per 1000 ²	190 per 1000 (136 to 264)	RR 0.77 (0.55 to 1.07)	⊕⊕○○ LOW ⁹



Component

OR (95% CrI)



***Table.* The Most Common Components of Successful Delirium Prevention Programs**

Anesthesia protocols
Assessment of bowel/bladder functions
Early mobilization
Extra nutrition
Geriatric consultation
Hydration
Medication review
Pain management
Prevention and treatment of medical complications
Sleep enhancement
Staff education
Supplemental oxygen
Therapeutic cognitive activities/orientation
Vision and hearing protocols

Table. The Most Common Components of Successful
STROKE UNIT CARE

Anesthesia protocols
Assessment of bowel/bladder functions
Early mobilization
Extra nutrition
Geriatric consultation
Hydration
Medication review
Pain management
Prevention and treatment of medical complications
Sleep enhancement
Staff education
Supplemental oxygen
Therapeutic cognitive activities/orientation
Vision and hearing protocols



Components of acute stroke unit care

- Review Medications
- Ensure hydration and nutrition
- Assess function, mobility and cognition
- Assess continence
- Care by an experienced team

**Systematic review
of interventions for
frailty in acute care**

**Stake holder
events to describe
current practice**

List of potential acute frailty interventions

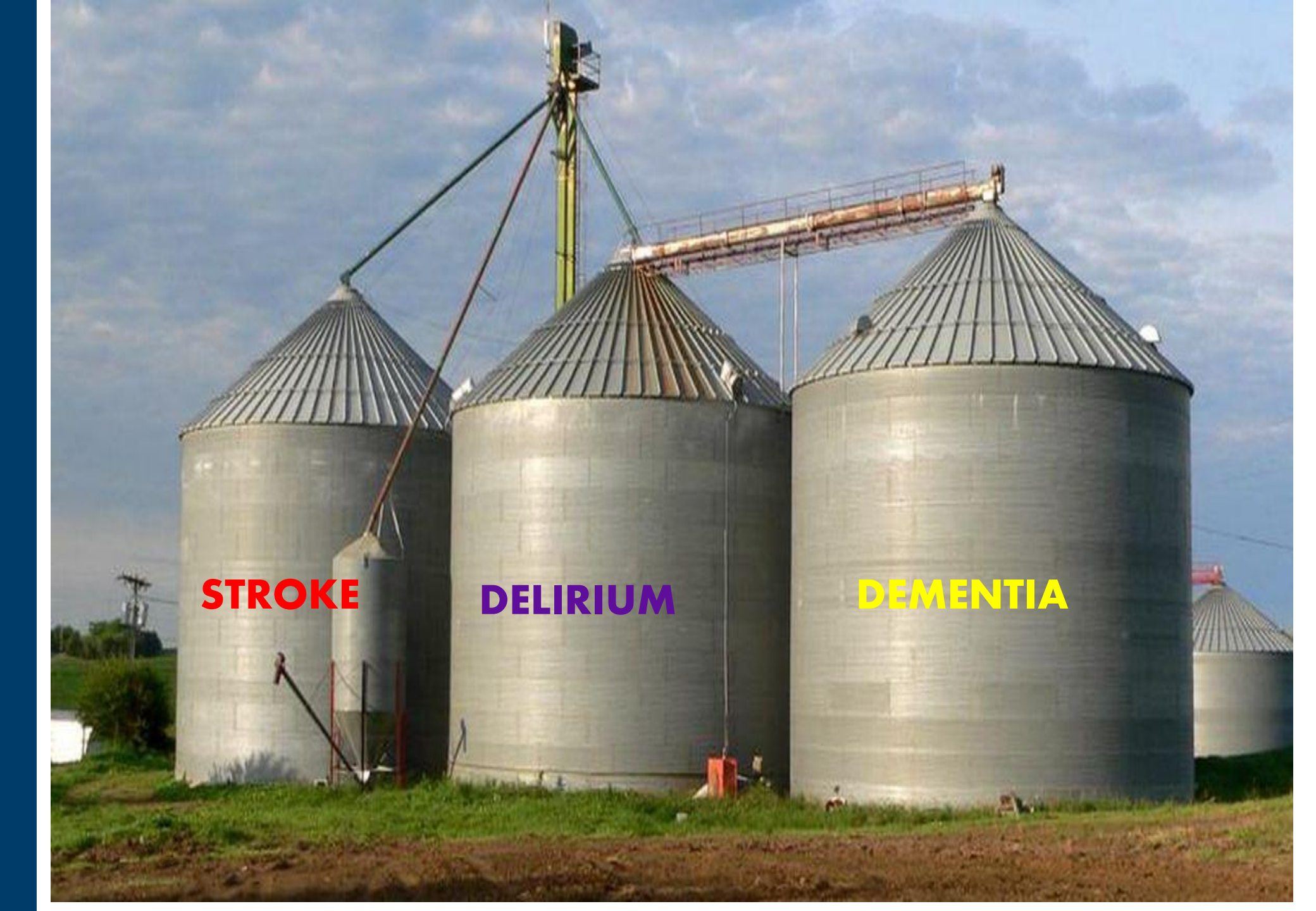
Expert Delphi

**Consensus
Core Components
Frailty Bundle**

- Get collateral history
- Review Medications
- Ensure hydration and nutrition
- Assess function, mobility and cognition
- Assess continence
- Discuss the persons preferences

Factors associated with successful CGA

- Clinical leadership
- Structured assessment
- Multidisciplinary working
- Goal setting
- Involving patients and their families
- Specialist knowledge
- Dedicated environment

A photograph of three large, cylindrical metal grain silos with conical roofs, situated in a grassy field under a blue sky with scattered clouds. A long metal conveyor system with a walkway is positioned between the silos. The word 'STROKE' is overlaid in red on the leftmost silo.

STROKE

DELIRIUM

DEMENTIA



Paging the
stroke-ologist

Paging the
delirium-ologist

Paging the
dementia-ologist







University
of Glasgow

Physical & cognitive frailty in stroke

Terry Quinn



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[@DrTerryQuinn](https://twitter.com/DrTerryQuinn)