Stroke Rehab
GPCME 2013 Rotorua

What works
What doesn't, The practical approach
Where is the evidence?
Possible ways forward

Dr Ajay Kumar,
Stroke Physician & Geriatrician,
Middlemore Hospital

Pre Ground Zero

- “Know your enemy”
- Keep them close to you
- Be proactive
- Controlled aggression, treat the Risk Factors!!

- *Risk profile /stratify- $CHADS_2$-VASC,R_2CHADS_2
- There is urgency ! beware stroke is coming,
- Time is Brain!!!
- Stroke - Facing the aftermath - our own doing’s

Disclosures

- My fare/accommodation paid Boerringer Ingleheim
- I am very passionate about Stroke prevention, rehab and all involved in tackling this beast!

Time is the enemy!!
Action is salavation!!

But the enemy can be defeated- together!!!!!!

Nov 2011

Stroke TEAM

COUNTIES MANUKAU DISTRICT HEALTH BOARD
A Community Partnership

Acute Stroke Unit
MIDDLEMORE HOSPITAL

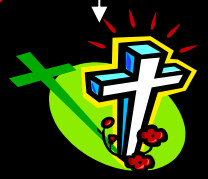
NIH RECOMMENDED EMERGENCY RESPONSE TIMES

"Reducing" The "Golden hour" for evaluating and treating acute stroke

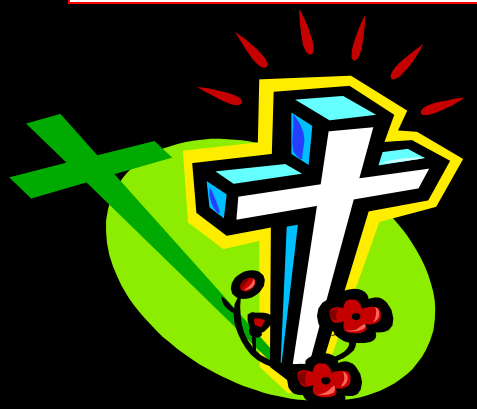
Minutes 0 → 10 → 15 → 25 → 45 → 60

- 0: Suspected stroke patient arrives In EC
- 10: Initial Medical evaluation
- 15: Stroke Team notified
- 25: CT Scan initiated
- 45: CT & labs interpreted
- 60: tPA given if patient eligible

19 million neurons



57 million neurons



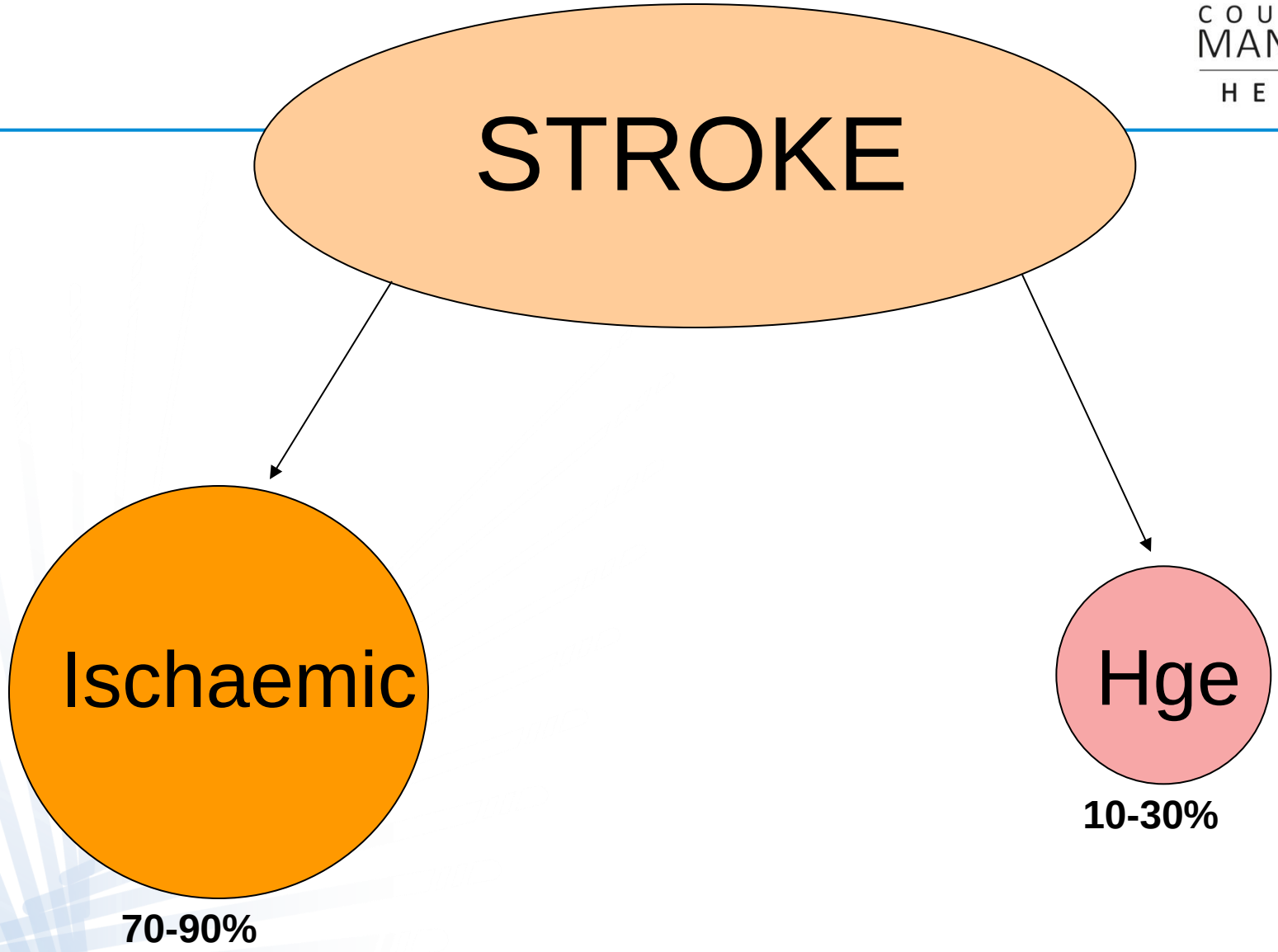
114 million neurons

Ground Zero

- Brain imaging – type of stroke
- Investigations, Lab, ECG, Carotids, others
- Stroke classification (TACI, PACI, POCI, LACI)[1] - prognosis
- Stroke scale (NIHSS)[2] – prognosis
- Swallow assessment/nutrition, hydration[15,28]
- Stroke unit[16]
- Meet, greet and treat

Risk of stroke/death after TIA

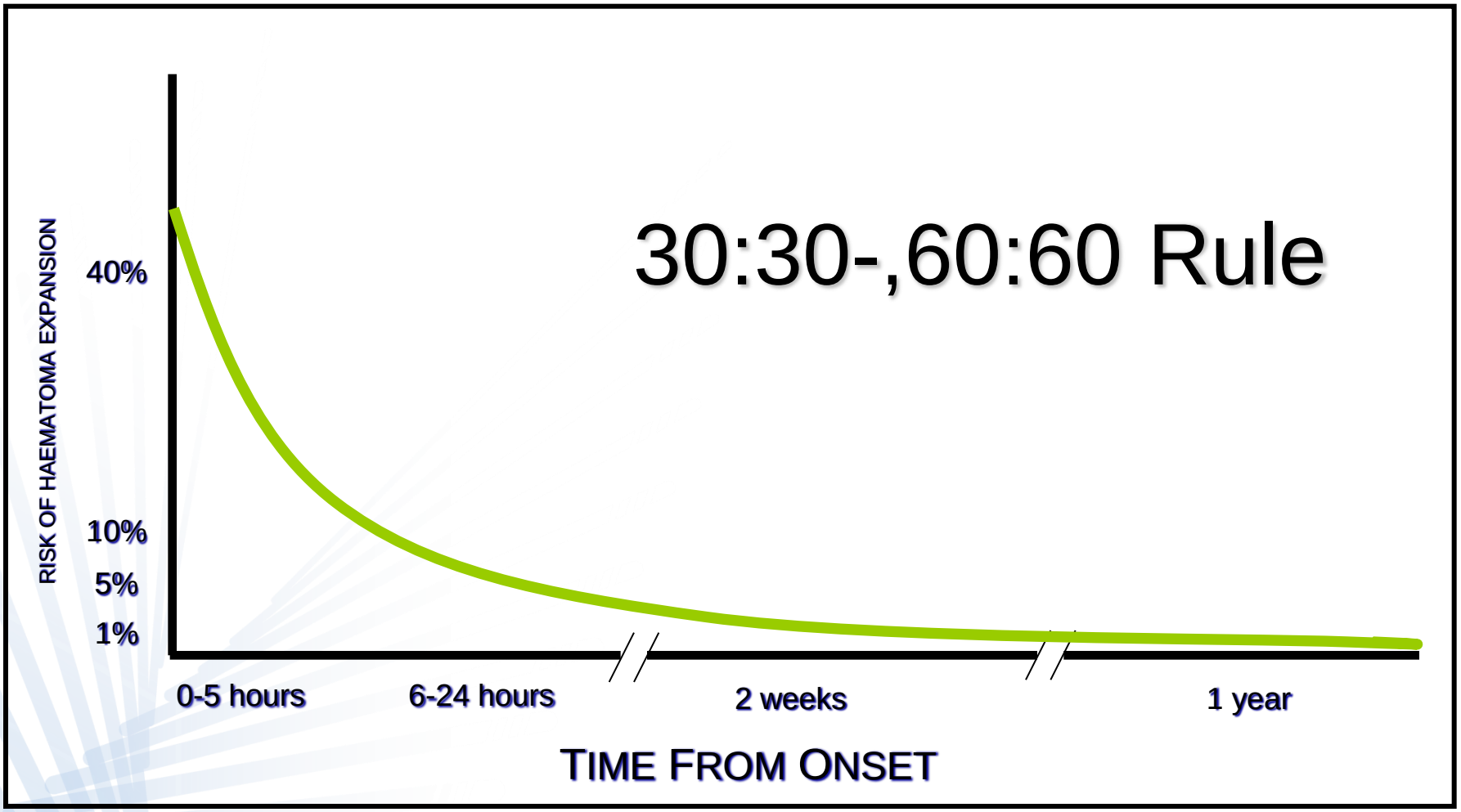
- Significantly underestimated in the past
- TIA and stroke are on a continuum of risk


STROKE
Ischaemic
70-90%
Hge
10-30%

ICH

- Volume, GCS, location-prognosis[1]
- Causality, hypertension, Amyloid, other[2]
- Bp management[3]
- ICH –complication[4]
- Intervention[5]
- *Rehab
- Follow up imaging
- Future Antiplatelets[6]/other[7]

ICH Haematoma expansion and Mortality



J Neurosurg 1994 Jan;80(1):51-7.
Cerebrovasc Dis 1999 Mar-Apr;9(2):102-8.

Primary Intracerebral Hemorrhage

- Ongoing/recurrent bleeding is infrequent after 24hrs
- 40% : 40% Rule
- 30 d mortality 30-50%

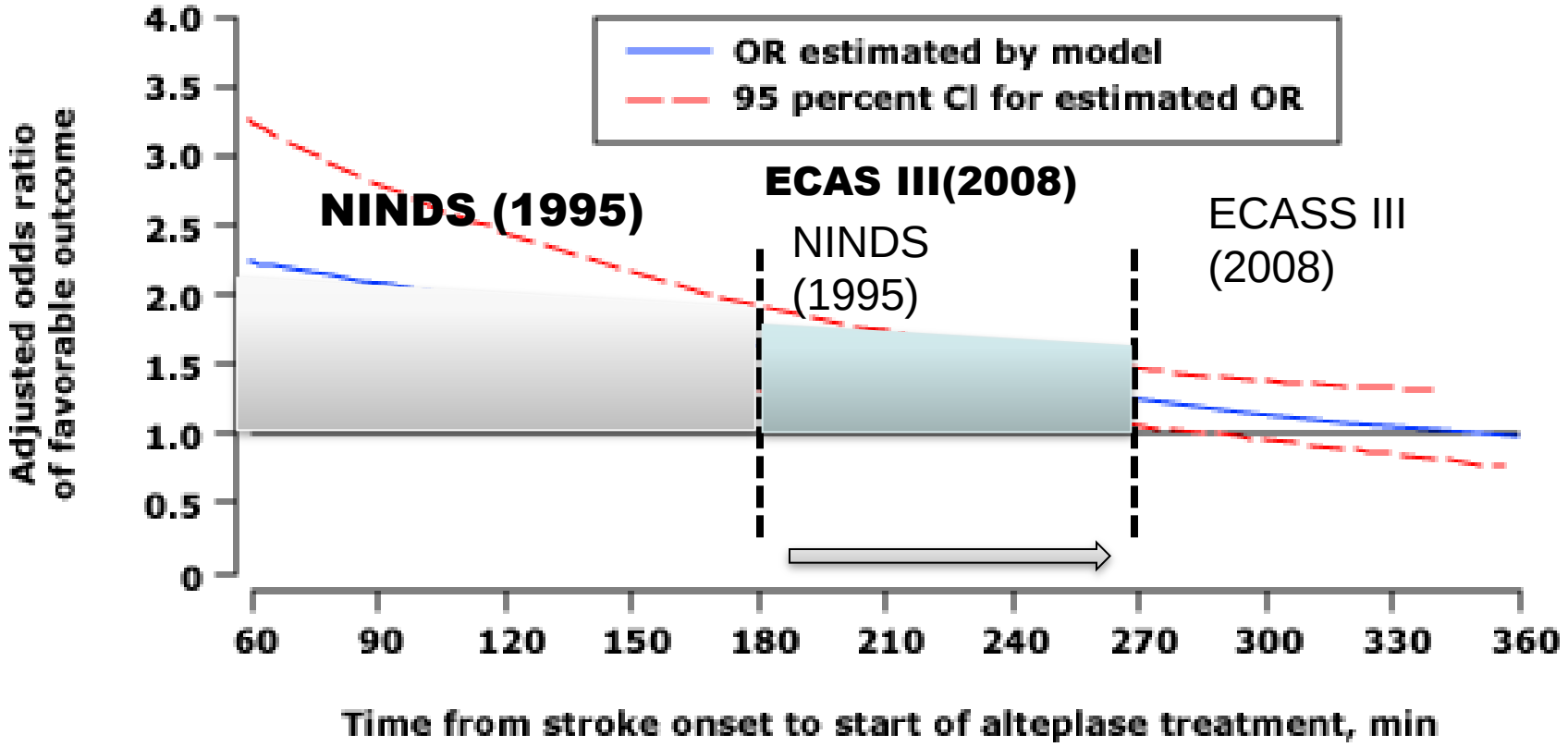
Timing	% of patients at risk of haematoma expansion	
0 - 5hrs	~40%	
6 – 24hrs	10-15%	J Neurosurg 1994 Jan;80(1):51-7. Stroke 1997 Jan;28(1):1-5. Neurology 1994 Aug;44(8):1379-84.
24hrs – 2 weeks	~5%	J Neurosurg 1994 Jan;80(1):51-7. Cerebrovasc Dis 1999 Mar-Apr;9(2):102-8.
At 1 year	1-2%	

Ischaemic Strokes

- Acute stroke treatments < 4.5hrs – Thrombolysis, earlier the better[10,11]
- Stroke unit, MDT input[12]
- Secondary prevention[13]
- Complication prevention[14]
- Rehab options[15]
  - Inpatient,
  - Outpatient
    - community based
    - outpatient clinic based

Narrow Therapeutic Window

Hacke et al Lancet 2004



Stroke rehab

- HASU, ASU – early, hrs to days[17]
- Inpatient impairment based[12]
  - Neuro-rehab
  - AT&R
- *Community[18]
  - CBRT
  - Home Health care
  - Outpatients
  - Day wards
- Follow ups –How long??shared care?

In patient rehab

- How soon??
- How much??
- Early rehab[24] - AVERT TRIAL[17]
- Team effort - Geographical area, MDT
- Holistic approach
- Discharge planning[25]
- Phasing back into mainstream life/work[26]

Community -Availabilty

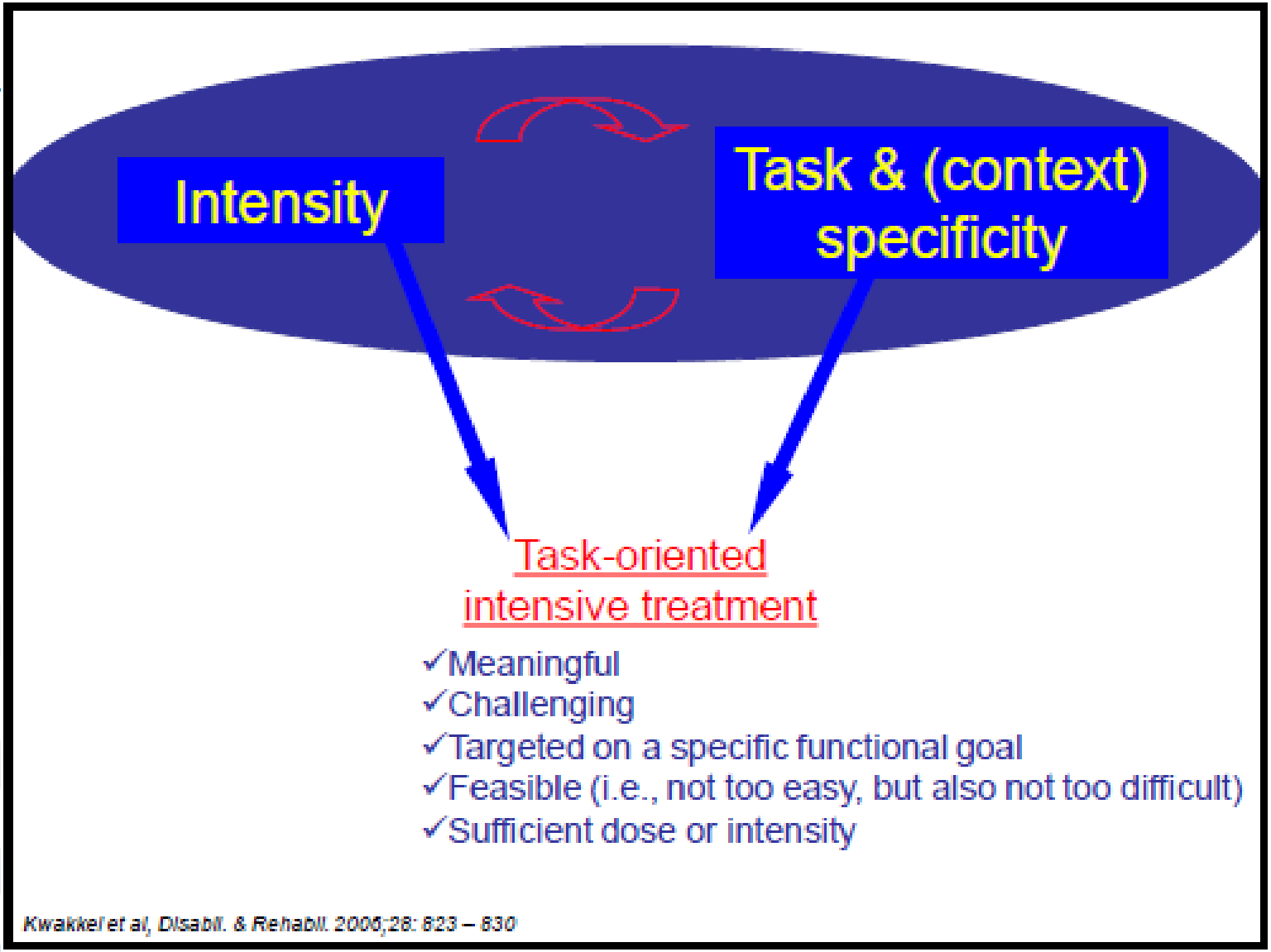
- Type of services[18]
- Know your rehab team!! PT, OT, SLT, SW, NASC
- Know your hospital team
- Support groups in the area, Stroke foundation, Age concern etc
- Others, University run clinics
- Private funders

Equipment, aids, modifications

- Equipment for ADLS, toilets, showers, others[19]
- Walking aids, orthotics, sticks, crutches, frames, wheel chairs, other[20]
- Modification, home, car, work
- Other specialised aids[22]

Motor rehab

- Evidence
- Dose
- Intensity
- Duration
- Post hospital
- Medical adjuvant
- Aids
- Modifications, home, travel, workplace


Intensity
Task & (context) specificity
Task-oriented intensive treatment
✓Meaningful
✓Challenging
✓Targeted on a specific functional goal
✓Feasible (i.e., not too easy, but also not too difficult)
✓Sufficient dose or intensity
Kwakkel et al, Disabil. & Rehabil. 2006;28: 823 – 830

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Summary Effect Size (SES) for walking ability

Study or Subgroup	Experimental Mean	Experimental SD	Experimental Total	Control Mean	Control SD	Control Total	Weight	Std. Mean Difference IV, Fixed, 95% CI
Allison 2007	5	6.11	7	5.5	4.81	10	4.4%	-0.09 [-1.05, 0.88]
Cooke (1) 2009	36.6	10.4	38	34.6	10.8	18	12.9%	0.19 [-0.37, 0.75]
Cooke (2) 2009	37.7	8.6	35	34.6	10.8	18	12.4%	0.33 [-0.25, 0.90]
GAPS 2004	9.7	3.3	35	8.1	3.6	35	18.0%	0.46 [-0.02, 0.93]
Kwakkel 1999	4	1.48	31	3	2.22	37	17.3%	0.52 [0.03, 1.00]
Mudie (1) 2000	36.8	13.6	10	36.5	12.55	5	3.5%	0.02 [-1.05, 1.09]
Mudie (2) 2000	29.4	12.65	10	36.5	12.55	5	3.4%	-0.53 [-1.63, 0.57]
Peurala 2009	9.8	0.9	20	8	1.4	10	5.3%	1.61 [0.74, 2.49]
Richards (1) 1993	25.8	14.8	10	26.8	18.5	5	3.5%	-0.06 [-1.13, 1.02]
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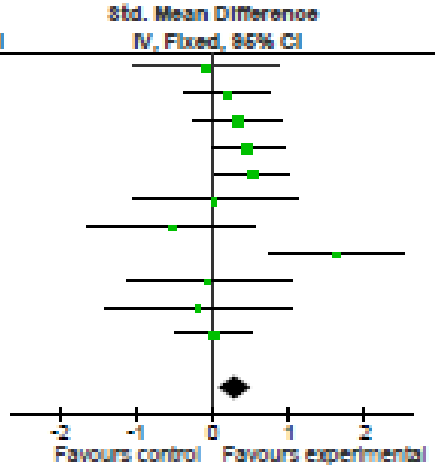
Askim 2010	36.83	10,697	30	35.38	10.472	32	16.4%	0.00 [-0.50, 0.50]
Total (95% CI)			234			179	100.0%	0.28 [0.08, 0.50]

Heterogeneity: Chi² = 15.49, df = 10 (P = 0.12); I² = 35%
Test for overall effect: Z = 2.85 (P = 0.004)



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Total (95% CI)			167			117	100.0%	0.34 [0.10, 0.58]

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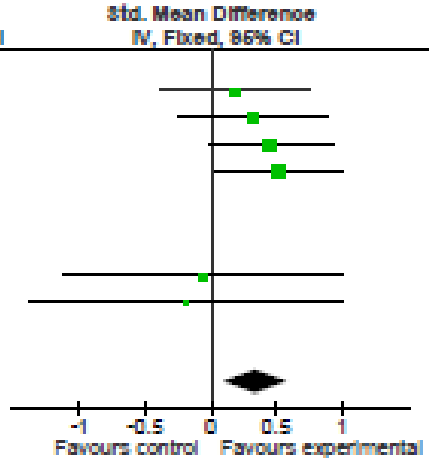

Veerbeek et al, Stroke. 2011 Nov;42(11):3311-5.

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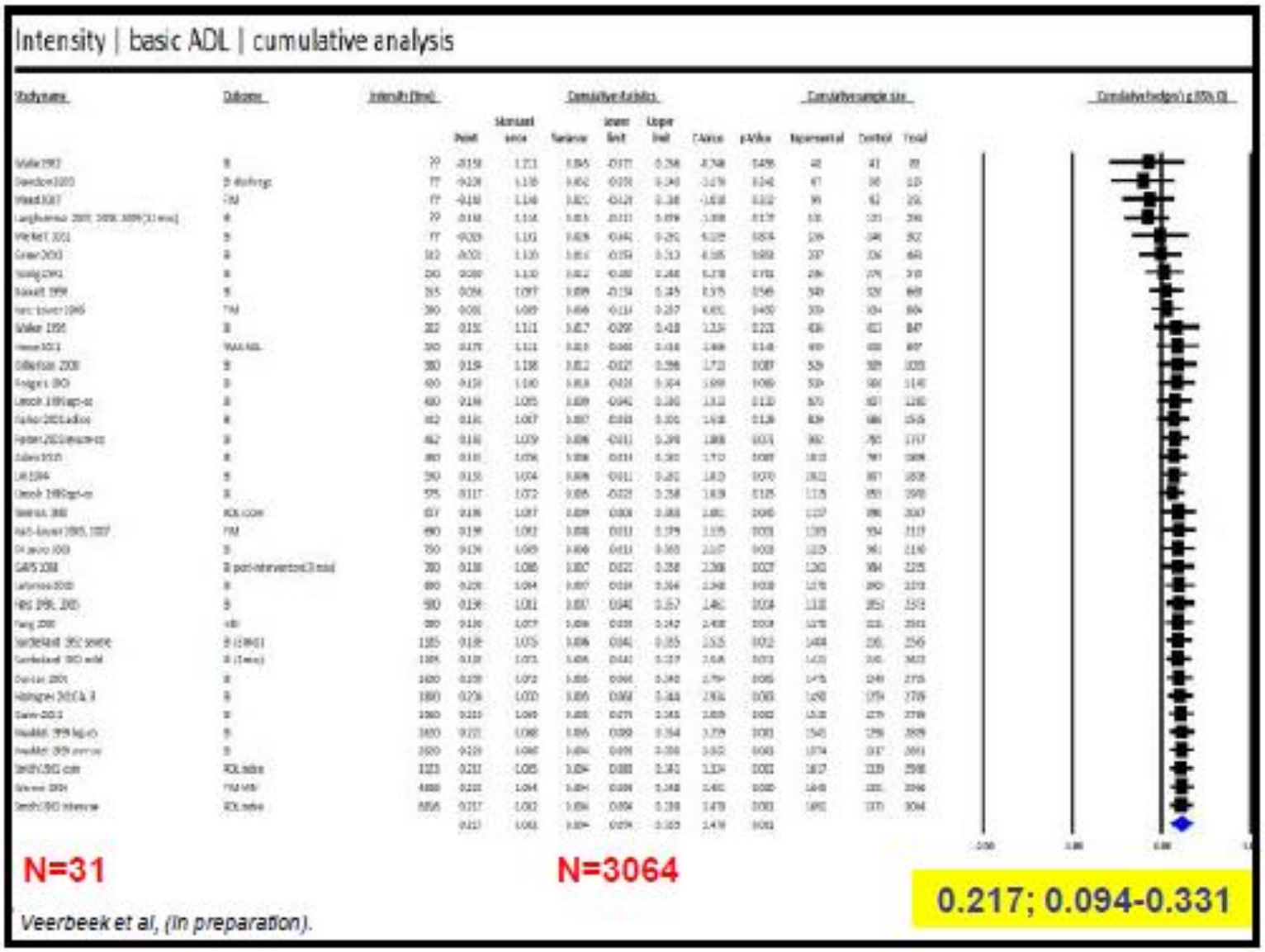
Intensity | basic ADL | cumulative analysis



N=31

N=3064

0.217; 0.094-0.331

Veerbeek et al, (In preparation).

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SIGN / NICE Guidelines (UK) (updated 12 July 20126) & Concept 'Zorgstandaard CVA', Netherlands:

Quality statement:
Patients with stroke are offered a minimum of **45 minutes** of each active therapy that is required, for a minimum of **5 days a week**, at a level that enables the patient to meet their rehabilitation goals for as long as they are continuing to benefit from the therapy and are able to tolerate it.

Quality measure:
Structure: Evidence that local arrangements are in place for the provision of a minimum of 45 minutes of each active therapy for a minimum of 5 days a week that enables patients with stroke to meet their rehabilitation goals.

Process:
Proportion of patients with stroke who are offered 45 minutes of each active therapy that is required, for as long as they are continuing to benefit from the therapy and are able to tolerate it.
Numerator: the number of patients who are offered a minimum of 45 minutes of each active therapy for a minimum of 5 days a week.
Denominator: the number of patients with a new stroke episode in hospital.

Royal College of Physicians NHS Improvement Stroke The Stroke Association social care institute for excellence scie

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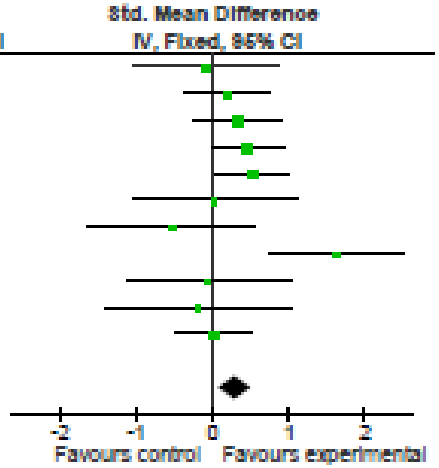

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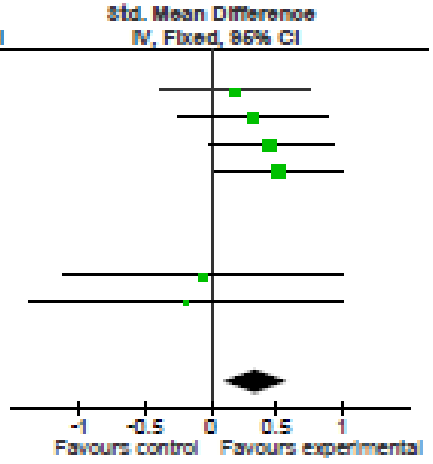

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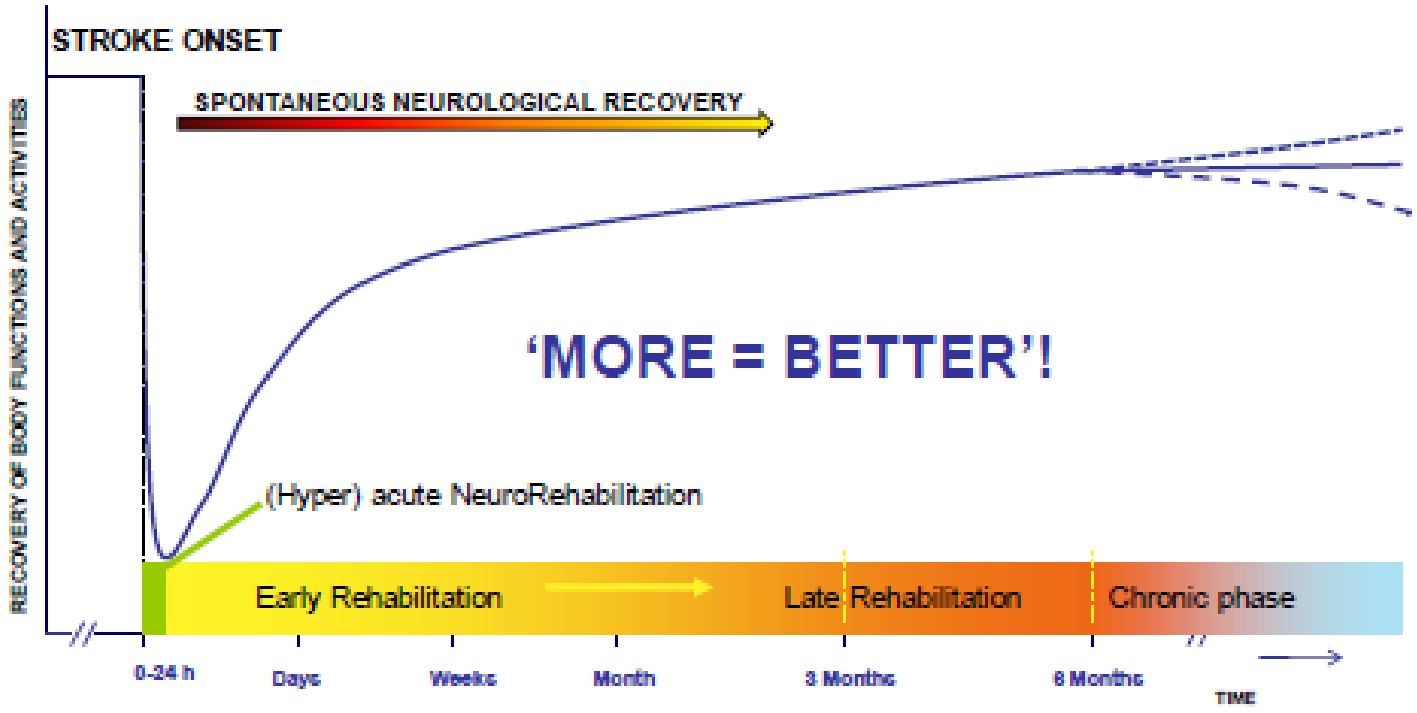

"…however, more trials are needed to evaluate the impact of different doses of the same therapy on outcome in terms of body functions, activities and participation."

Kwakkel et al, Stroke 2004:35; 2529-39
French B et al, Cochrane Database Syst Rev. 2007 Oct 17;(4):CD006073.
Cooke et al, BMC Medicine 2010, 8:60.
Veerbeek et al, 2012; May;42(5):1482-6
Langhorne et al, Lancet. 2011 May 14;377(9778):1693-702.

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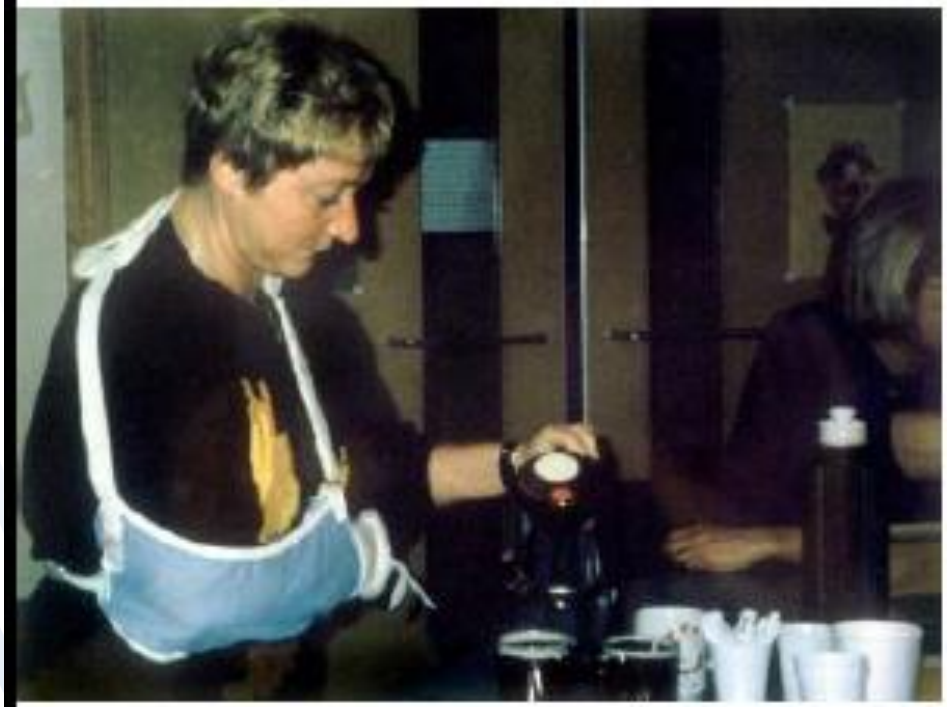
How to increase the (cost)-effectiveness of intensive task-oriented practice in the next future?

✓ Using forced-use paradigms (e.g., CIMT: 41 RCTs, N=1408)



Post intervention scores:

- MD **FM-arm** (n=383); 4.870 (Random, 95%CI: 1.914-7.827)
- Hedges's g **ARAT/WMFT time** (n=907); 0.477 (Random, 95%CI: 0.346-0.608)
- Hedges's g **ADL** (n=311); 0.380 (Random, 95%CI: 0.156-0.603)

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The CAREgiver Exercises Programme for stroke: 'CARE4stroke'

Offering an exercise book

Offering App's with instructions

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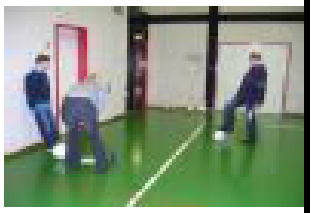
Circuit Class Training

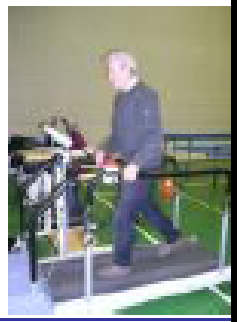
Balance control

Transfers

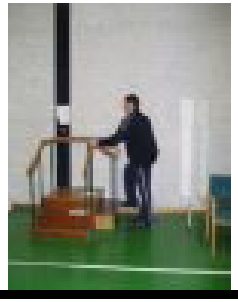


Physical condition

4-8 patients
&
1-2 staff members



Gait performance



Gait-related activities

1
2
3
4
5
6
7
8

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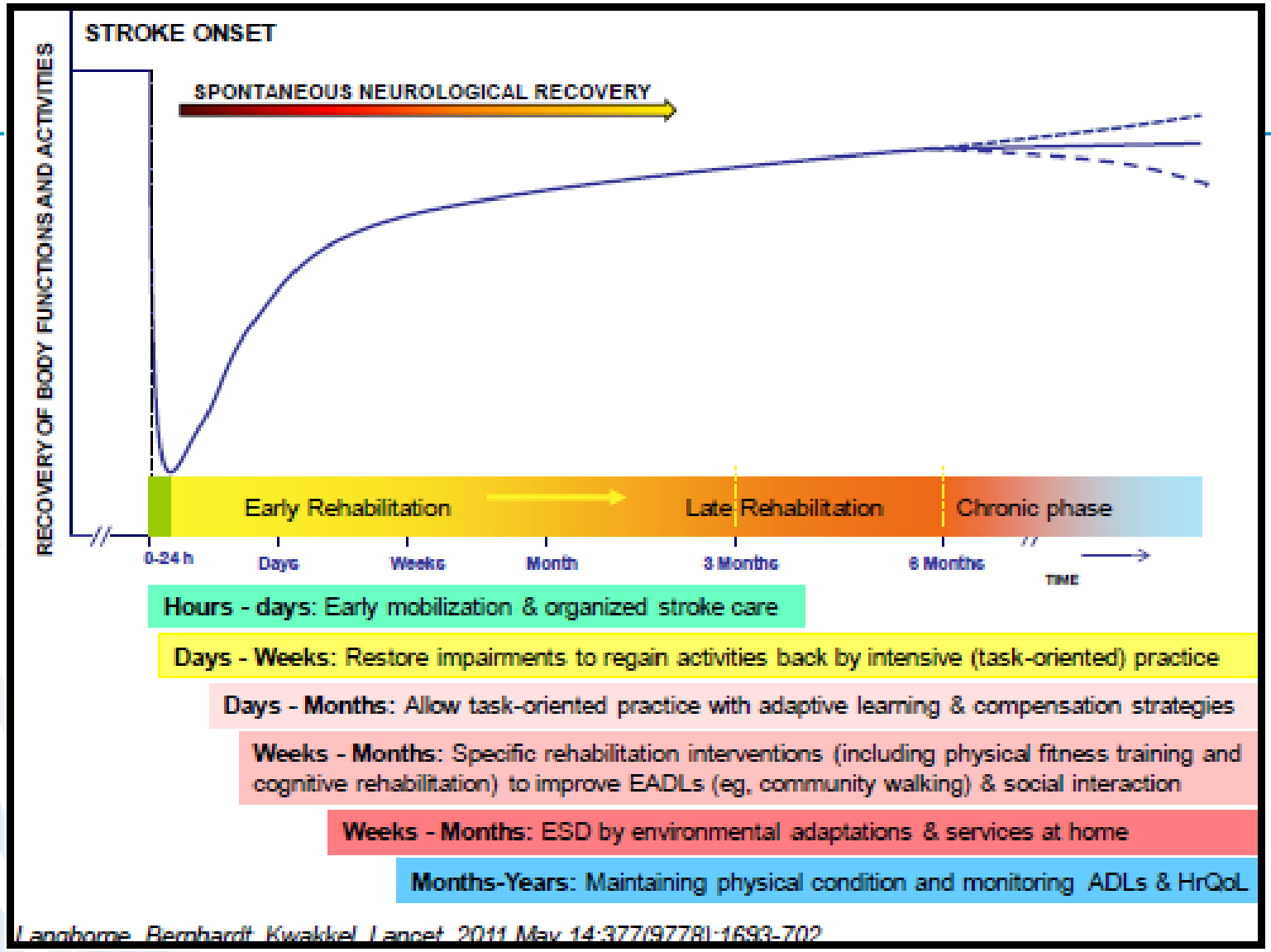
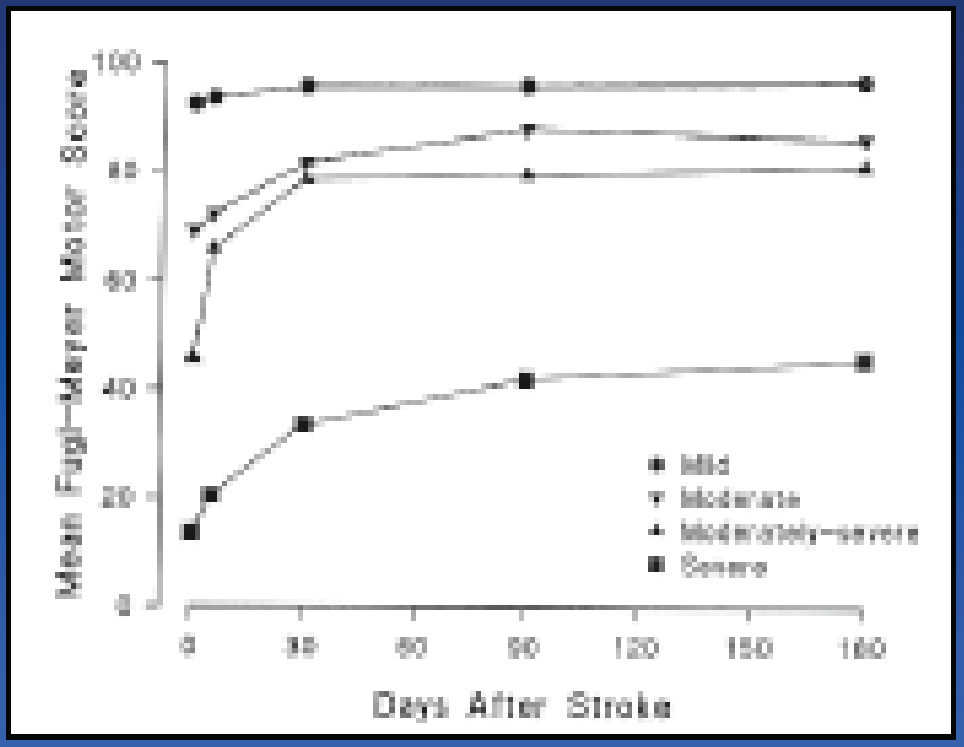


Langhorne, Bernhardt, Kwakkel. Lancet. 2011 May 14;377(9778):1693-702

Main Points

- Many post-stroke biological targets exist in relation to recovery
- Many therapies are under evaluation to improve recovery
- How to match the right patient with the right therapy?

Motor recovery after stroke: impairment scale



FM score, by days after CVA

Duncan et al Stroke '92

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Molecular events underlying stroke recovery

Ipsilesional changes

- ↑ inflammatory markers
- ↑ growth-associated proteins
- ↑ cell cycle proteins
- ↑ growth factors

GABA receptor downregulation

↑ NMDA receptor binding

angiogenesis

hyperexcitabil' y & facil' n of LTP

synaptogenesis

- ↑ dendrite branching/spine density
- ↑ neuronal sprouting

extracellular matrix remodelling

↑ cortical thickness

Contralesional changes

- ↑ inflammatory markers
- ↑ growth-associated proteins

GABA rcpt' r downregulation

↑ NMDA receptor binding

neuronal hyperexcitability

↑ dendrite br/spine density

synaptogenesis

↑ cortical thickness

Nudo, Curr Op Nbio, 96; Cramer & Chopp, TINS, 00; Wieloch & Nikolich, Curr Op Nbio 06

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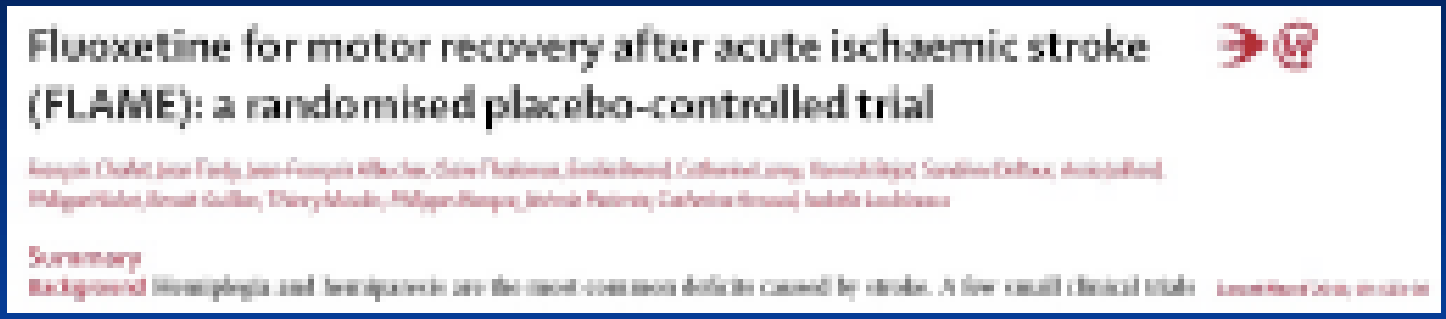

Fluoxetine for motor recovery after acute ischaemic stroke (FLAME): a randomised placebo-controlled trial

Summary

Double-blind, placebo-controlled trial of 118 patients enrolled 5–10 after stroke to 20 mg fluoxetine or placebo QD x 3 mo

Baseline NIHSS = 13, but severe weakness

Primary endpoint outcome: Larger Fugl-Meyer score change with fluoxetine (34 vs. 24 points, p=0.003)

Also: significant effect for mRS (% ≤ 2) but not NIHSS (% ≤ 5)

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Telerehabilitation

www.stroketelerehab.com

Thus far, good compliance with prescribed home telerehabilitation (97.8% of 277 assigned days)

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Many Sources of Variance affecting Stoke outcome

- Pre-Stoke Disability
- Genetics
- Age
- Handedness
- Medical co-morbidities
- Initial and final deficits
- Injury mechanism, side topography, volume
- Effects on brain function
- Acute stroke interventions
- Time post-stroke
- Post-stroke depression
- Medication(+ and -)
- Caregiver, social factors
- Quantity, quality, and timing
- Of post –stroke therapy

Speech Therapy

- Important issue?
- Does it work?
- Dose?
- Intensity?
- Is it ever too late?
- Personnel
- Modification/assistive devices
- Telerehab, web based

Important issue

Editorial Comment

Aphasia Therapy Works!

Medical education, it seems to me, has failed the patient with aphasia. Aphasia therapy works. Why isn't the message getting out?

authors provide strong evidence to support the following conclusion: compared with aphasia therapy administered less intensively, aphasia therapy administered intensively,

- Aphasia more prevalent than MS or PD $1x10_6$ US
- 80,000 additional per year from stroke alone

Prof. Martin L. Albert

Stroke 2003;34:992-9930

Does it work ?

[Intervention Review]

Speech and language therapy for aphasia following stroke

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Main results

We included 30 trials (41 paired comparisons) in the review: 14 subcomparisons (1064 participants) compared SLT with no SLT; six subcomparisons (279 participants) compared SLT with social support and stimulation; and 21 subcomparisons (732 participants) compared two approaches to SLT. In general, the trials randomised small numbers of participants across a range of characteristics (age, time since stroke and severity profiles), interventions and outcomes. Suitable statistical data were unavailable for several measures.

Authors' conclusions

This review shows some indication of the effectiveness of SLT for people with aphasia following stroke. We also observed a consistency in the direction of results which favoured intensive SLT over conventional SLT, though significantly more people withdrew from intensive SLT than conventional SLT. SLT facilitated by a therapist-trained and supervised volunteer appears to be as effective as the provision of SLT by a professional. There was insufficient evidence to draw any conclusions in relation to the effectiveness of one SLT approach over another.

Does it work - Dose

Intensity of Aphasia Therapy, Impact on Recovery

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Background—It has been speculated that the conflicting results demonstrated across poststroke aphasia therapy studies might be related to differences in intensity of therapy provided across studies. The aim of this study is to investigate the relationship between intensity of aphasia therapy and aphasia recovery.

Methods—A MEDLINE literature search was conducted to retrieve clinical trials investigating aphasia therapy after stroke. Changes in mean scores from each study were recorded. Intensity of therapy was recorded in terms of length of therapy, hours of therapy provided per week, and total hours of therapy provided. Pearson correlation was used to assess the relationship between changes in mean scores of outcome measures and intensity of therapy.

Results—Studies that demonstrated a significant treatment effect provided 8.8 hours of therapy per week for 11.2 weeks versus the negative studies that only provided ≈2 hours per week for 22.9 weeks. On average, positive studies provided a total of 98.4 hours of therapy, whereas negative studies provided 43.6 hours of therapy. Total length of therapy time was found to be inversely correlated with hours of therapy provided per week ($P=0.003$) and total hours of therapy provided ($P=0.001$). Total length of therapy was significantly inversely correlated with mean change in Porch Index of Communicative Abilities (PICA) scores ($P=0.0001$). The number of hours of therapy provided in a week was significantly correlated to greater improvement on the PICA ($P=0.001$) and the Token Test ($P=0.027$). Total number of hours of therapy was significantly correlated with greater improvement on the PICA ($P<0.001$) and the Token Test ($P<0.001$).

Conclusions—Intense therapy over a short amount of time can improve outcomes of speech and language therapy for stroke patients with aphasia. **(*Stroke*. 2003;34:987-993.)**

Problem: average amount of out-patient speech therapy ~ 12 hours

Does it work - Intensity

TABLE 3. Comparing Intensity of Therapy Between Positive and Negative Resultant Studies

	Therapy Measures Mean (SD)			Outcome Measures Mean (SD)	
	Length (weeks)	Hours (per week)	Total (hours)	PICA	Token Test
Positive studies n=259	11.2 (1.7)	8.8 (2.0)	98.4 (28.2)	15.1 (3.1)	13.74 (6.67)
Negative studies n=574	22.9 (2.3)	2.0	43.6 (8.3)	1.37 (1.37)	0.59 (0.79)
t statistic	12.80	8.72	5.61	8.79	2.561
P value	0.001	0.001	0.001	0.001	0.05

Problem: confounding

When is it too late?

Progress Review

Language Rehabilitation in Chronic Aphasia and Time Postonset

A Review of Single-Subject Data

Aviva Moss, MS, CCC-SLP; Marjorie Nicholas, PhD, CCC-SLP

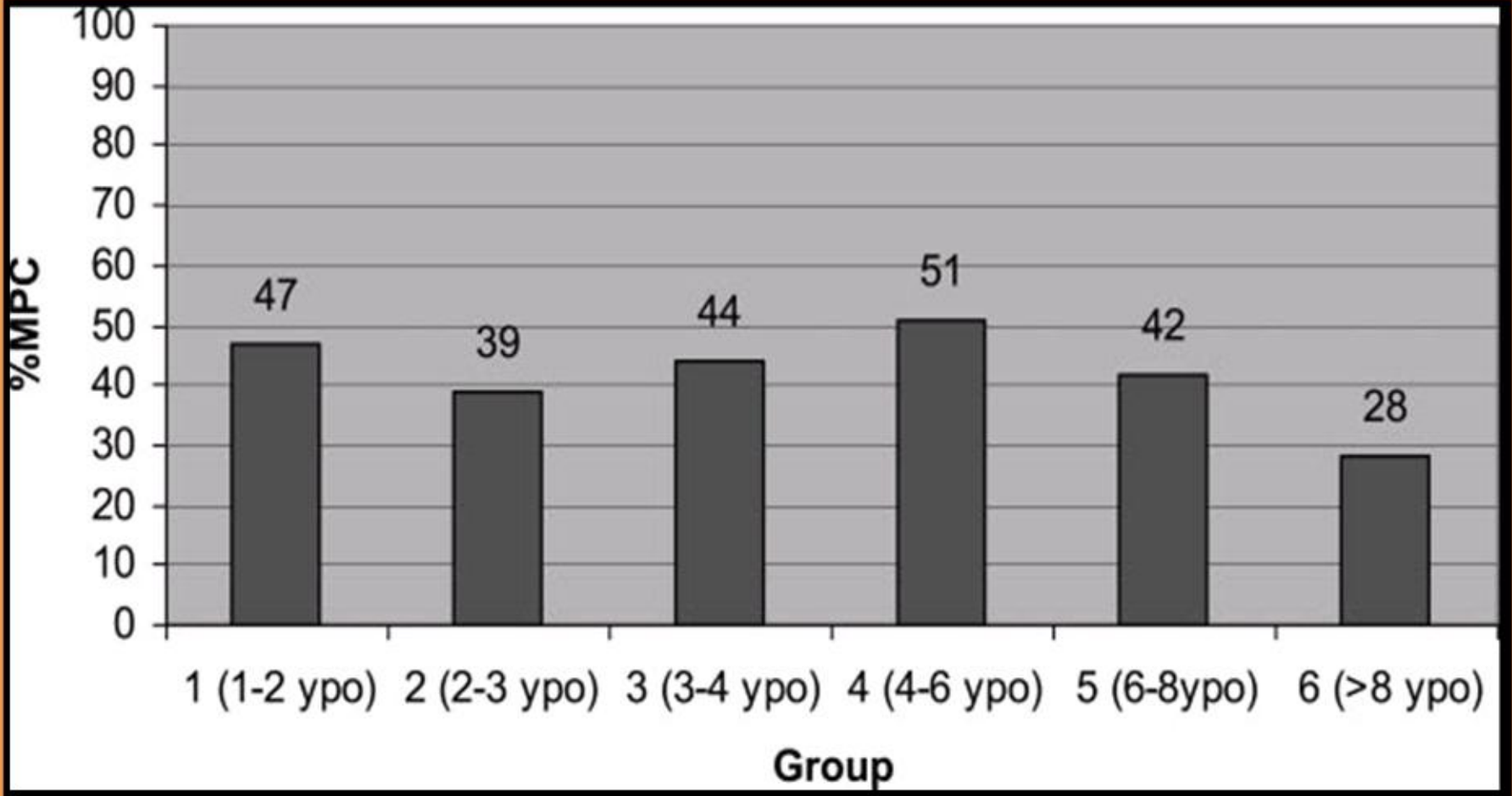
Background and Purpose—This article is a comprehensive review of aphasia treatment studies for the purpose of investigating the relationship between time postonset of aphasia and response to treatment for aphasia in chronic patients at ≥1 year after symptom onset.

Methods—Studies that demonstrated treatment response (defined as a measurable change in task performance compared with a control task performance) through the use of single-subject design methodologies on measures of verbal output or auditory comprehension were selected. Individual subject data were extracted from the 23 studies that met criteria identifying the subjects as those who received direct continuous therapy for spoken language deficits and whose changes in response to therapy were measurable. Percent of maximum possible change was used as a measurement of outcome.

Results—Nonparametric correlation statistics (Spearman ρ) and comparisons of group means (Kruskal–Wallis) were used to compare the relationship between time postonset and improvement. Time postonset at which treatment was initiated did not correlate with response to treatment. No significant differences in response to treatment were found between groups of patients according to times postonset.

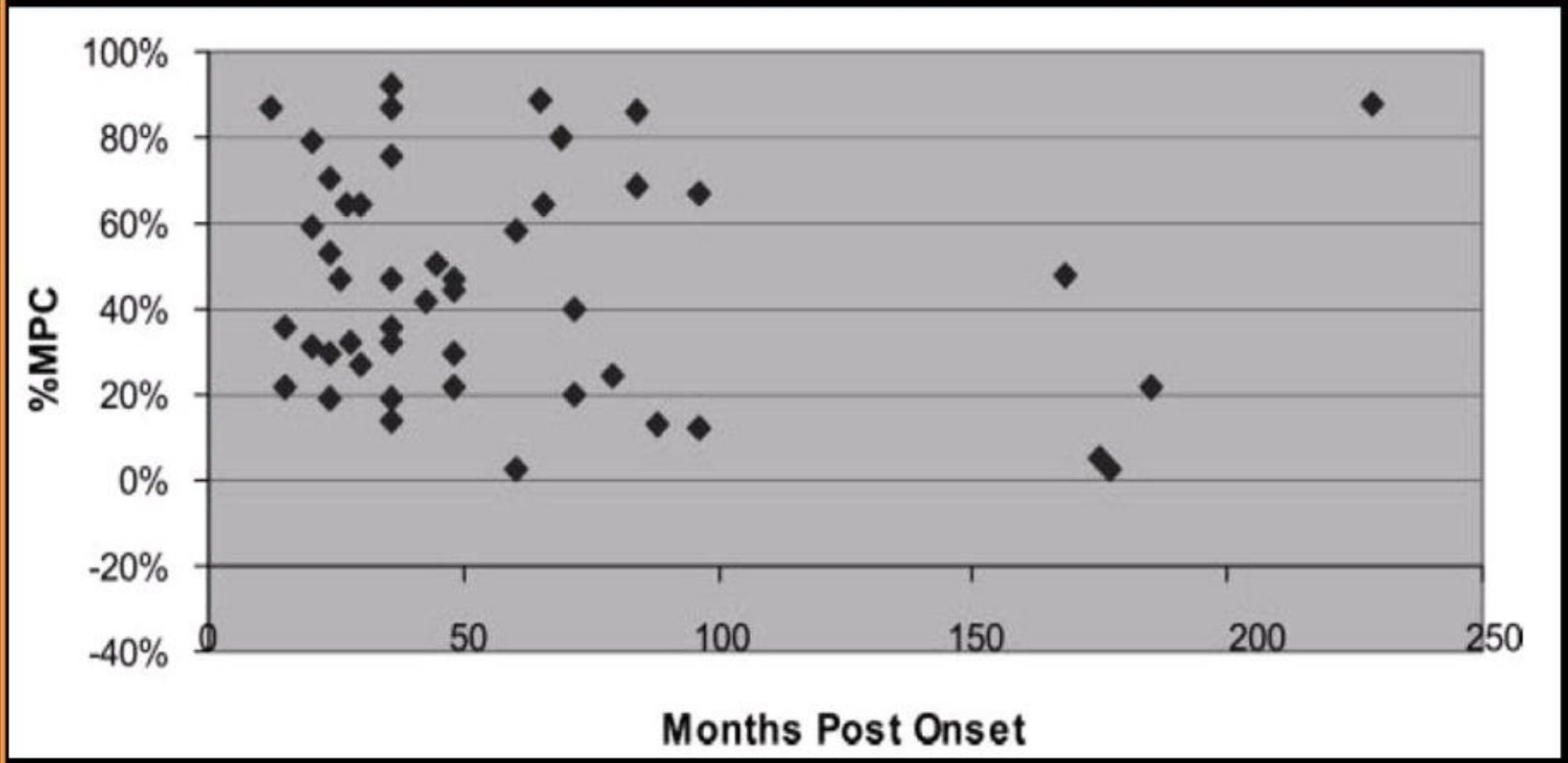
Conclusions—Time postonset is not related to response to treatment for aphasia in patients >1 year postonset of aphasia.
(*Stroke*. 2006;37:3043-3051.)

When is it too late?



MPC = maximum possible change

When is it too late?



Never

Summary

1. Evidence base for speech therapy: it works. The main issue is dose.
2. “Practice makes perfect”: many of the seemingly thorny issues in rehabilitation have their answers in the expert performance literature.
3. As therapists' time is more limited than patients capacity to improve, carefully designed, web-based resources like Read-Right represent a realistic way of delivering a sufficient therapy dose to patients so they can obtain clinically meaningful improvements

Conclusions

COUNTIES MANUKAU HEALTH

1. Speech therapy for aphasia works. The main issue is dose. Web-based therapies might be a good way to deal with this issue.
2. Many of the questions that neurological rehabilitation faces can be answered from the human expert performance literature: rehabilitation = learning.
3. Stroke lesion information is important but needs to be integrated into prediction models in more sophisticated ways.

Cognitive rehab

- Evidence based, evidence generated?
- Safety net
- Assessment tools, MMSE, MoCA, ACER, RUDAS
- Longitudinal assessment
- Risk of Cognitive impairment/Dementia[31,32,33]
- Caregiver burden/burnout

Post Stroke Issues

- Depression[29,30]
- Behavioral issues
- Residual deficits/burden
- Feeding/Non oral
- Sexuality
- Finance
- Advanced Directives/EPOA

Stroke -FAQS

- Driving, ever?, never??[23]
- Vocational driving[23]
- **Flying
- Phasing back to work[26]
- Sexuality, meds
- Recurrent risk
- Persisting deficits, Visual, other

Future outlook

- Tele rehab[27], web-based
- Robotics, assistive devices
- Targeted therapy
- Group, circuit training, “milk it to the max” Maximising efficiency, minimising cost
- Utilising /training rehab assistants/equivalents –family/caregivers

Outcome
Power of many

- Work together – multipronged approach , harmoniously in sync, dynamic scenario with flexibility for adjustments to tackle this ugly beast!
- To get the best and minimize deficits

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32 .John T et al Lancet Neurology 2003;2:89-98
33. Sarah T et al Lancet Neurology 2009:1006-18

Rehab Philosophy
Together we can make the difference
The power of many

- Working together- in sync, harmoniously to tackle this beast
- Yes? - We can do
- No? - Is not an option!
- Thank you for your attention

Post-Stroke Dementia and Cognitive Impairment

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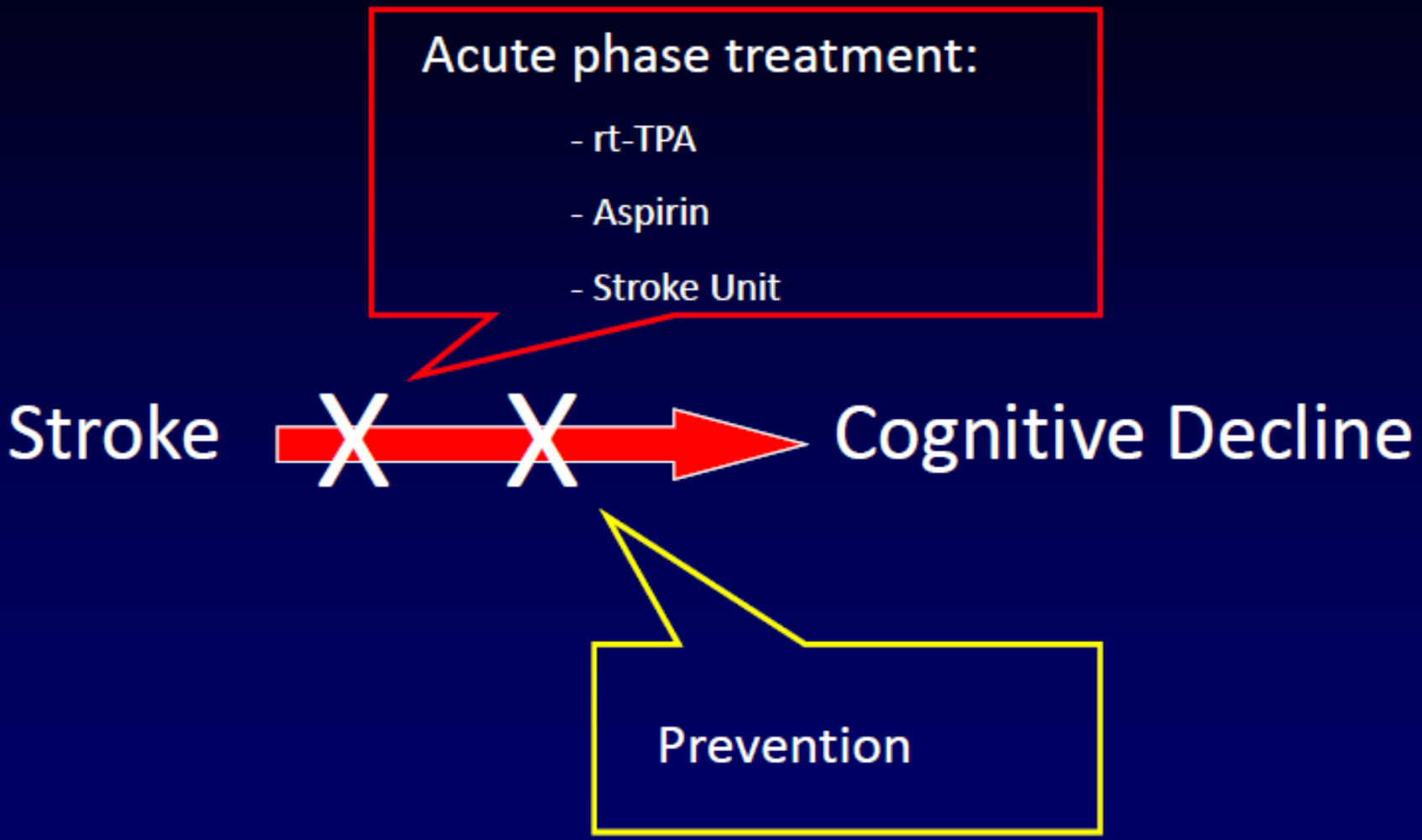
Table 1. Prevalence of PSD in different stroke cohorts

Reference (first author)	Months from stroke onset	n	Population	Diagnostic criteria	Prevalence %
Pohjasvaara 1998 [8]	3	337	ischemic stoke	DSM III	31.8
Censori 1996 [9]	3	110	first-ever ischemic stroke	NINDS-AIREN	13.6
Desmond 2000 [10]	3	453	ischemic stroke	DSM III R	26.3
Lin 2003 [11]	3	283	ischemic stroke, no previous TIA	ICD-10	9.2
Klimkowicz-Mrowiec 2006 [12]	3	190	stroke	DSM IV	22.6
Zhou 2004 [13]	3	434	ischemic stroke	DSM IV	27.2
Andersen 1996 [14]	6	220	first ever stroke	Mattis Dementia Rating Scale	26.0
Hénon 2001 [15]	6	202	stroke	ICD-10	22.8
Inzitari 1998 [16]	12	339	stroke	Proxy-informant interview based on ICD-10	16.8
Hénon 2001 [15]	12	202	stroke	ICD-10	21.4
Hénon 2001 [15]	24	202	stroke	ICD-10	21.6

Front Neurol Neurosci. Basel, Karger, 2012, vol 30, pp 1–5

"Less stroke, better cognition"



Take home messages - 1

1. PSD is a clinical, not strictly pathophysiological, definition (emphasis on stroke)
2. PSD is heterogeneous in terms of mechanisms (SVD, large vessel, strategic sites, multiple lesions)
3. PSD is frequent (a major consequence of stroke)
4. A history of stroke doubles the risk of incident dementia

Take home messages - 2

1. A number of risk factors for PSD exists
2. Dementia is only part of the spectrum of the cognitive consequences of stroke (consider also mild cognitive impairment-MCI)
3. Need of identifying and harmonizing instruments for detecting post-stroke MCI as early as possible in the disease course

Suggested Readings

Hénon H, Pasquier F, Durieu I, Godefroy O, Lucas C, Lebert F, Leys D. Preexisting dementia in stroke patients. Baseline frequency, associated factors, and outcome. Stroke 1997;28:2429-36.

Leys D, Hénon H, Mackowiak-Cordoliani MA, Pasquier F. Poststroke dementia. Lancet Neurol 2005;4:752-9.

Pasquier F, Leys D. Why are stroke patients prone to develop dementia? J Neurol 1997;244:135-42.

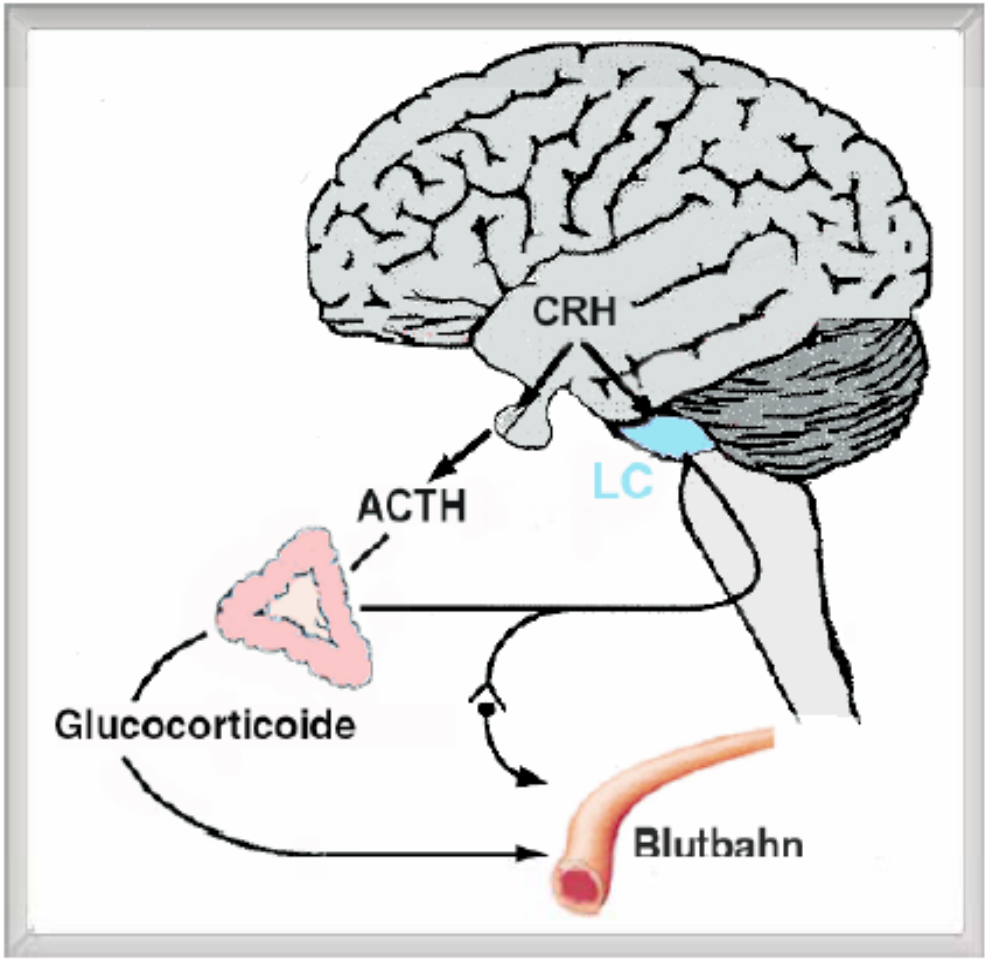
Pendlebury ST, Rothwell PM. Prevalence, incidence, and factors associated with pre-stroke and post-stroke dementia: a systematic review and meta-analysis. Lancet Neurol 2009;8:1006-18.

Savva GM, Stephan BC; Alzheimer's Society Vascular Dementia Systematic Review Group. Epidemiological studies of the effect of stroke on incident dementia: a systematic review. Stroke 2010;41:e41-6.

HPA axis

Stress leads to chronic over-activation of HPA-axis

Depression correlates with chronic overactivation of HPA-axis



Stroke and depression

Individuals with depression have a higher risk for stroke and vascular disease

Stroke patients have a high risk for developing post-stroke depression

Post stroke depression is a predictor for poor outcome

Jiang et al. Am Heart J 2005; 56:54-78
Rozanski et al. J Am Coll Cardiol 2005; 45:637-651

Poststroke Depression

- Prevalence approximately 30%
- Typical time-course post stroke
- Lasts on average 6 months (up to 2 years)
- Is associated with morbidity & mortality

Robinson et al.,
Stroke 1982; 13:635-641
Br J Psychiatry 1984; 144:256-262
Stroke 1983; 14:736-741

Antidepressive therapy and long-term survival

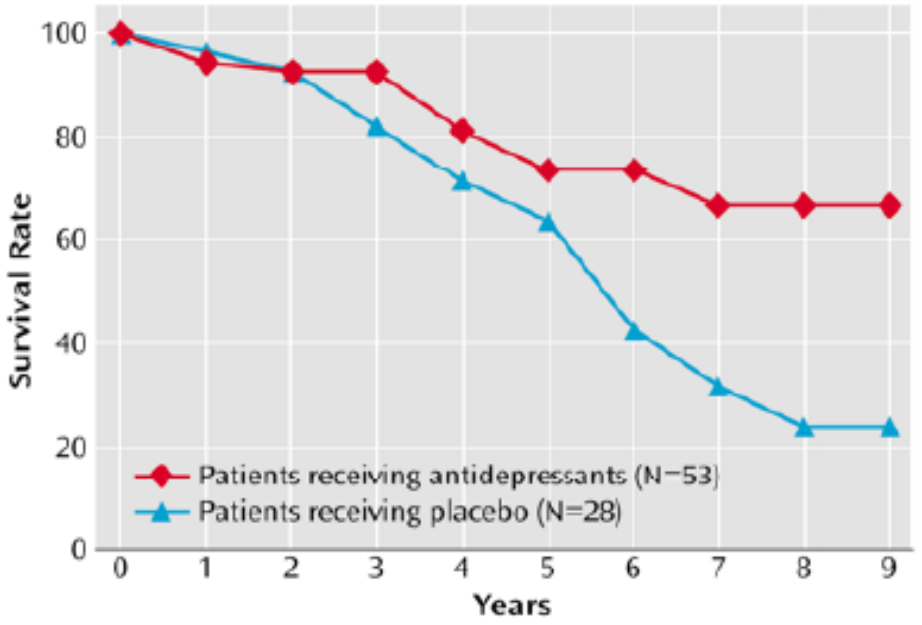
Robinson-Studie (AD vs. Plazebo über 3 Monate post stroke) (n=104) Follow-up-Studie nach 9 Jahren

Mortalitätsrate nach 9a: 48,1%

- Überleben in **Antidepressivagruppe** (PSD&Non-PSD): 42/71: 59,2%
- Überleben in **Plazebogruppe** (PSD&Non-PSD): 10/28: 35,7%

Chi^2=4,7, p=0,03

Anzahl der kardiovaskulären Todesursachen in Plazebogruppe signifikant höher (kein Unterschied bzgl. internist. Medikation)



Jorge et al. 2003, Am J Psychiatry