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Revalidatie na beroerte: quo vadis?

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Editor-in-Chief, *Physiotherapy Research International*

Waar gaan we het vanavond over hebben?

Waar gaan we het vanavond ook over hebben?

Recovery

Probleem?

Stroke Care 2

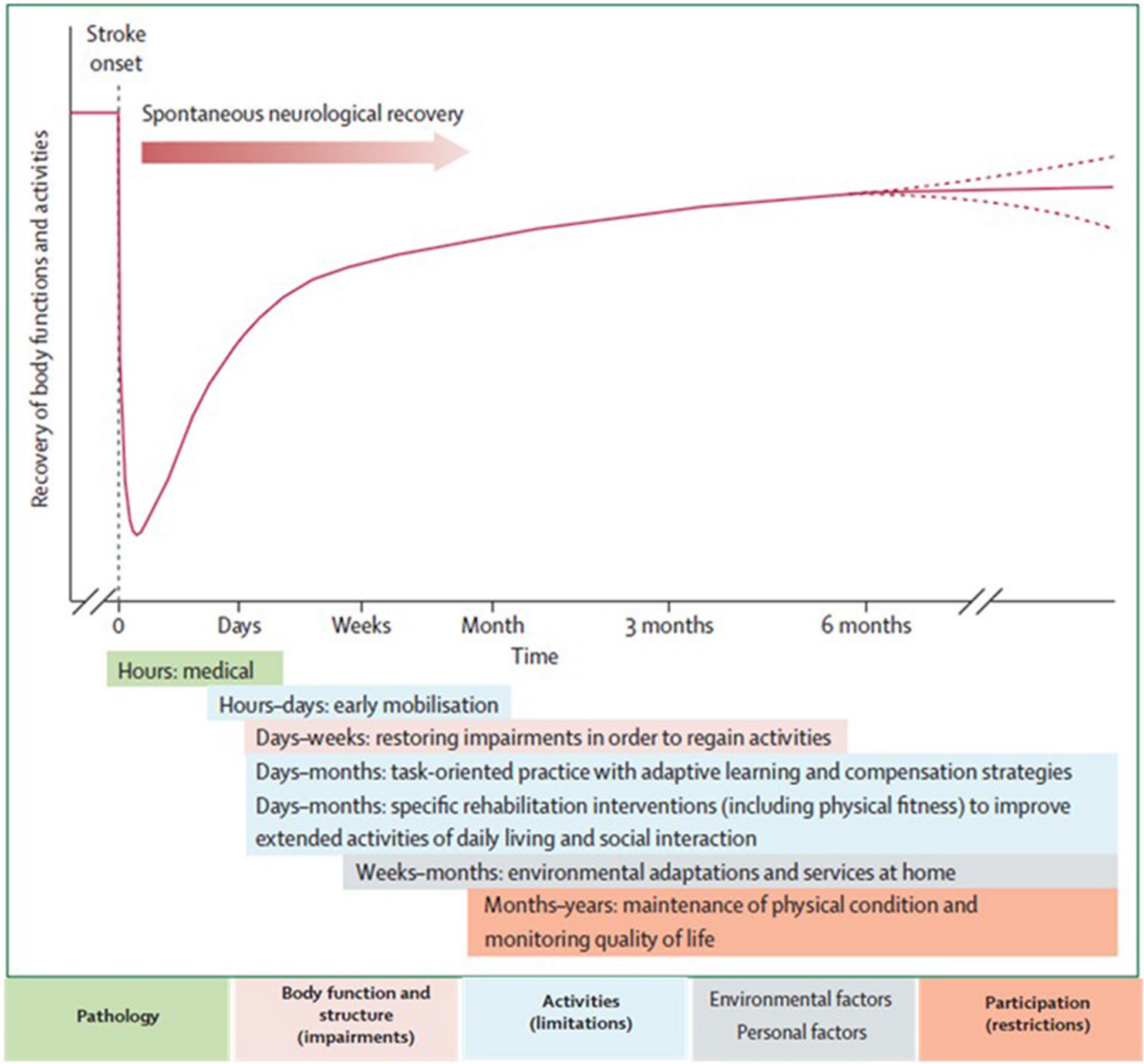
Stroke rehabilitation

Peter Langhorne, Julie Bernhardt, Gert Kwakkel

Stroke is a common, serious, and disabling global health-care problem, and rehabilitation is a major part of patient care. There is evidence to support rehabilitation in well coordinated multidisciplinary stroke units or through provision of early supported provision of discharge teams. Potentially beneficial treatment options for motor recovery of the arm include constraint-induced movement therapy and robotics. Promising interventions that could be beneficial to improve aspects of gait include fitness training, high-intensity therapy, and repetitive-task training. Repetitive-task training might also improve transfer functions. Occupational therapy can improve activities of daily living; however, information about the clinical effect of various strategies of cognitive rehabilitation and strategies for aphasia and dysarthria is scarce. Several large trials of rehabilitation practice and of novel therapies (eg, stem-cell therapy, repetitive transcranial magnetic stimulation, virtual reality, robotic therapies, and drug augmentation) are underway to inform future practice.

The Lancet 2011

Aim of stroke rehab (research)?



Langhorne et al. Lancet 2011

Motor and functional recovery

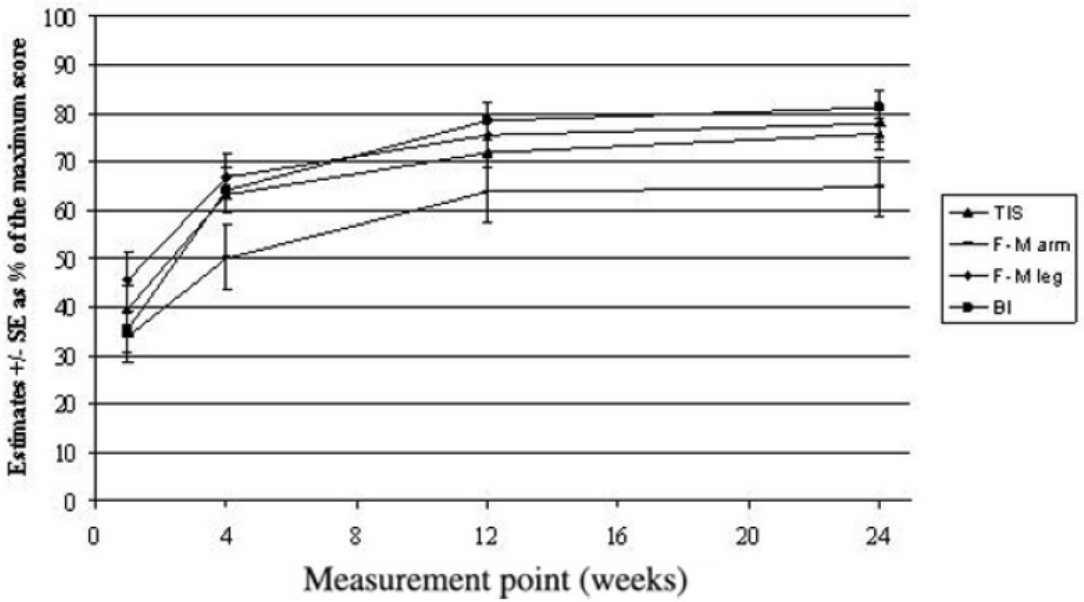


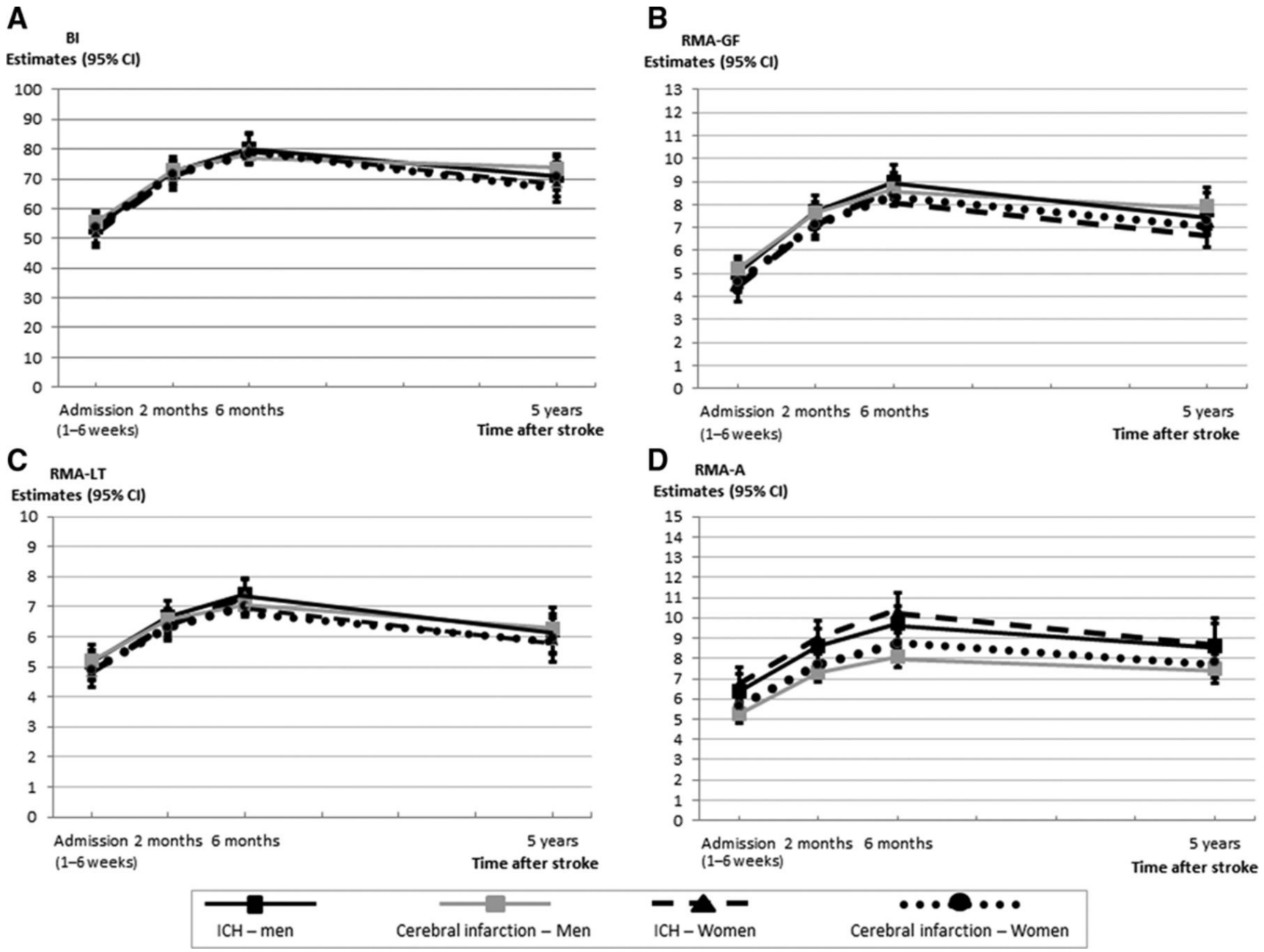
Figure 2. Recovery pattern of estimates ± standard errors (expressed in percentage of maximum score) for trunk (TIS), arm (F-M arm), leg (F-M leg), and functional performance (BI) for 32 ischemic stroke patients. Repeated measures analysis revealed no significant difference between recovery patterns ($P = .2565$).

Verheyden et al. NNR 2008

Functional and Motor Outcome 5 Years After Stroke Is Equivalent to Outcome at 2 Months

Follow-Up of the Collaborative Evaluation of Rehabilitation in Stroke Across Europe

Sarah Meyer, MSc; Geert Verheyden, PhD; Nadine Brinkmann, BSc; Eddy Dejaeger, PhD; Willy De Weerdt, PhD; Hilde Feys, PhD; Andreas R. Gantenbein, MD; Walter Jenni, MD; Annouschka Laenen, PhD; Nadina Lincoln, PhD; Koen Putman, PhD; Birgit Schuback, MSc; Wilfried Schupp, MD; Vincent Thijs, PhD; Liesbet De Wit, PhD


A
BI
Estimates (95% CI)
100
90
80
70
60
50
40
30
20
10
0
Admission 2 months 6 months
(1–6 weeks)
5 years
Time after stroke
B
RMA-GF
Estimates (95% CI)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Admission 2 months 6 months
(1–6 weeks)
5 years
Time after stroke
C
RMA-LT
Estimates (95% CI)
10
9
8
7
6
5
4
3
2
1
0
Admission 2 months 6 months
(1–6 weeks)
5 years
Time after stroke
D
RMA-A
Estimates (95% CI)
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Admission 2 months 6 months
(1–6 weeks)
5 years
Time after stroke
ICH – men
Cerebral infarction – Men
ICH – Women
Cerebral infarction – Women

For example

Stroke

JOURNAL OF THE AMERICAN HEART ASSOCIATION

American Heart Association | American Stroke Association

Very Early Mobilization After Stroke Fast-Tracks Return to Walking: Further Results From the Phase II AVERT Randomized Controlled Trial

Toby B. Cumming, Amanda G. Thrift, Janice M. Collier, Leonid Churilov, Helen M. Dewey, Geoffrey A. Donnan and Julie Bernhardt

Cumming et al. Stroke 2011;42:153-8.

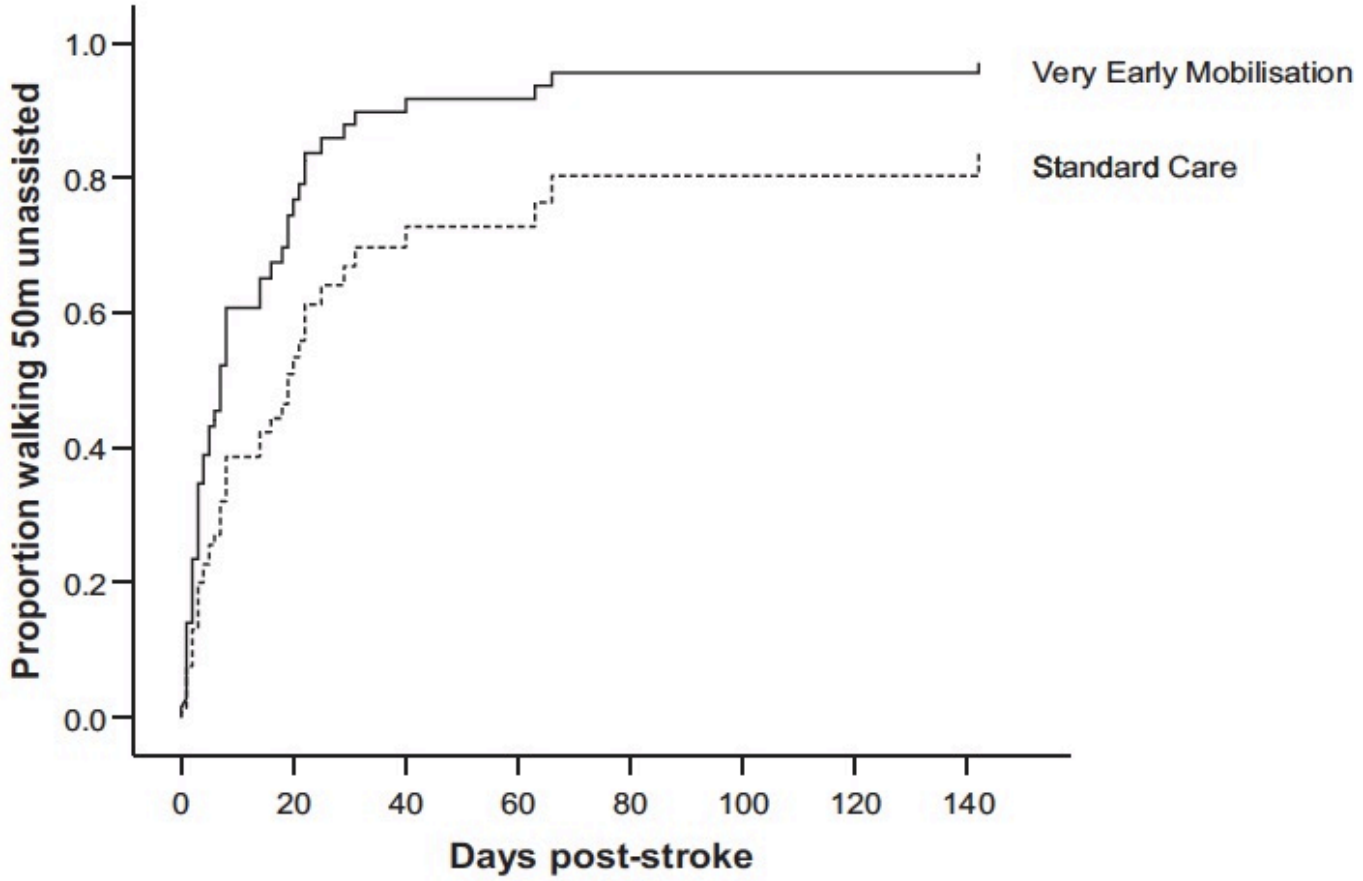


Figure 2. Number of days to walking 50 m unassisted in VEM and SC groups, adjusted for age, sex, stroke severity (NIHSS), premorbid mRS, and diabetes (N=71). Note: Of those patients who returned to walk in the 12 months after stroke, 142 days was the longest time taken.

AVERT

- A Very Early Rehabilitation Trial (AVERT)
- “Mobilisation” within the first 24h post stroke
  - Bringing patients in an upright position

- “Is safe and feasible”
- AVERT group achieved significantly faster “to walk again” than control group

- Thus, large international study warranted (>2000 patients)

AVERT: the “real” study

n=2104 from 56 acute stroke units!

Bernhardt et al. Lancet 2015;April 17.

And the results are…

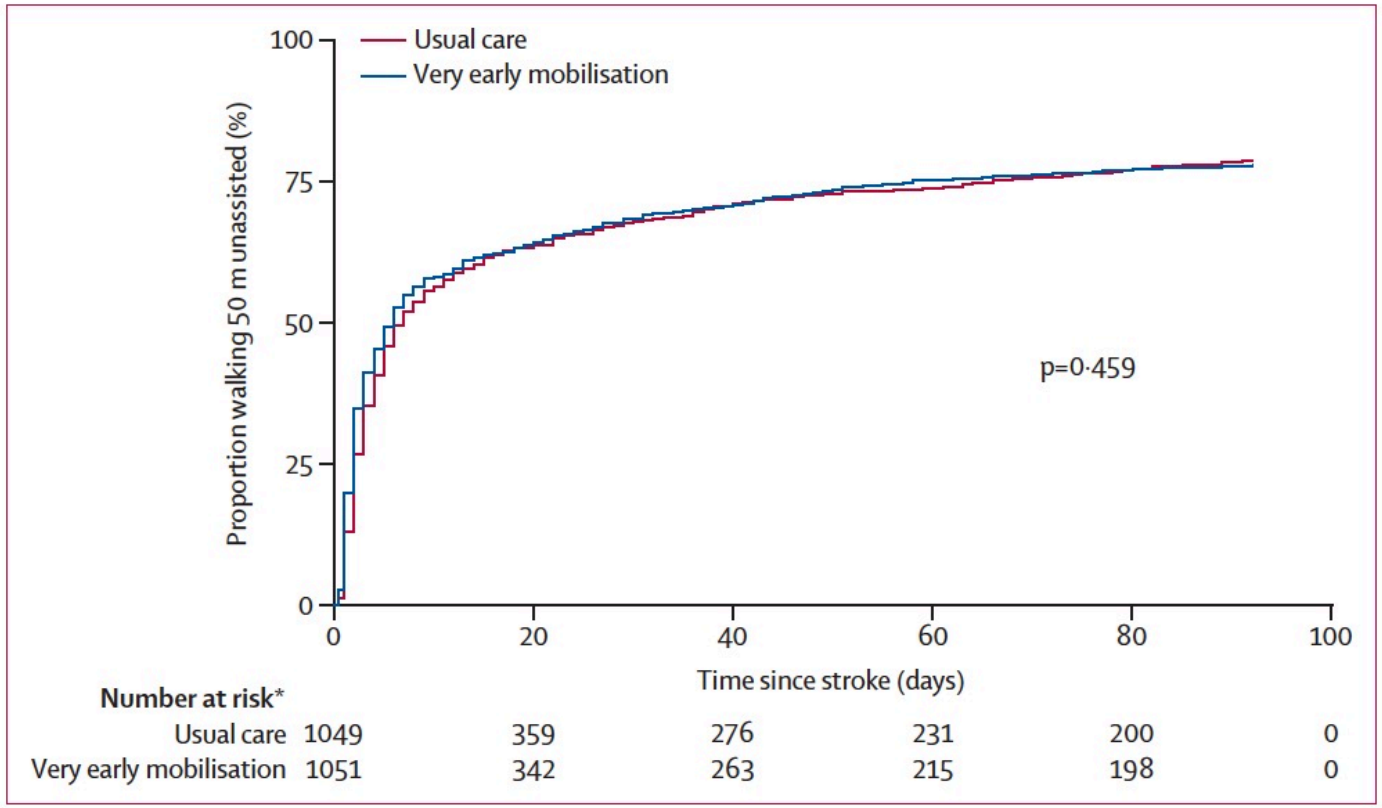


Figure 3: **Time to walking unassisted 50 m by 3 months**
*Number of patients who had not achieved walking.

In fact…

"Fewer patients in the very early mobilisation group had a favorable outcome than those in the usual care group (n=480 [46%] vs n=525 [50%]; adjusted odds ratio [OR] 0·73, 95% CI 0·59-0·90; p=0·004)."

So what about VEM? Further AVERT info…

Prespecified dose-response analysis for A Very Early Rehabilitation Trial (AVERT)

OPEN

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Leonid Churilov, PhD
Fiona Ellery, BAppSci (Nurs)
Janice Collier, PhD
Jan Chamberlain, GDipEd
Peter Langhorne, PhD
Richard I. Lindley, MD
Marj Moodie, DrPH
Helen Dewey, PhD
Amanda G. Thrift, PhD
Geoff Donnan, MD
On behalf of the AVERT Collaboration Group

Correspondence to Dr. Bernhardt: julie.bernhardt@florey.edu.au

ABSTRACT

Objective: Our prespecified dose-response analyses of A Very Early Rehabilitation Trial (AVERT) aim to provide practical guidance for clinicians on the timing, frequency, and amount of mobilization following acute stroke.

Methods: Eligible patients were aged ≥18 years, had confirmed first (or recurrent) stroke, and were admitted to a stroke unit within 24 hours of stroke onset. Patients were randomized to receive very early and frequent mobilization, commencing within 24 hours, or usual care. We used regression analyses and Classification and Regression Trees (CART) to investigate the effect of timing and dose of mobilization on efficacy and safety outcomes, irrespective of assigned treatment group.

Results: A total of 2,104 patients were enrolled, of whom 2,083 (99.0%) were followed up at 3 months. We found a consistent pattern of improved odds of favorable outcome in efficacy and safety outcomes with increased daily frequency of out-of-bed sessions (odds ratio [OR] 1.13, 95% confidence interval [CI] 1.09 to 1.18, $p < 0.001$), keeping time to first mobilization and mobilization amount constant. Increased amount (minutes per day) of mobilization reduced the odds of a good outcome (OR 0.94, 95% CI 0.91 to 0.97, $p < 0.001$). Session frequency was the most important variable in the CART analysis, after prognostic variables age and baseline stroke severity.

Conclusion: These data suggest that shorter, more frequent mobilization early after acute stroke is associated with greater odds of favorable outcome at 3 months when controlling for age and stroke severity.

Classification of evidence: This study provides Class III evidence that shorter, more frequent early mobilization improves the chance of regaining independence after stroke. *Neurology*® 2016;86:2138-2145

Bernhardt et al. Neurology 2016;86:2138-45.

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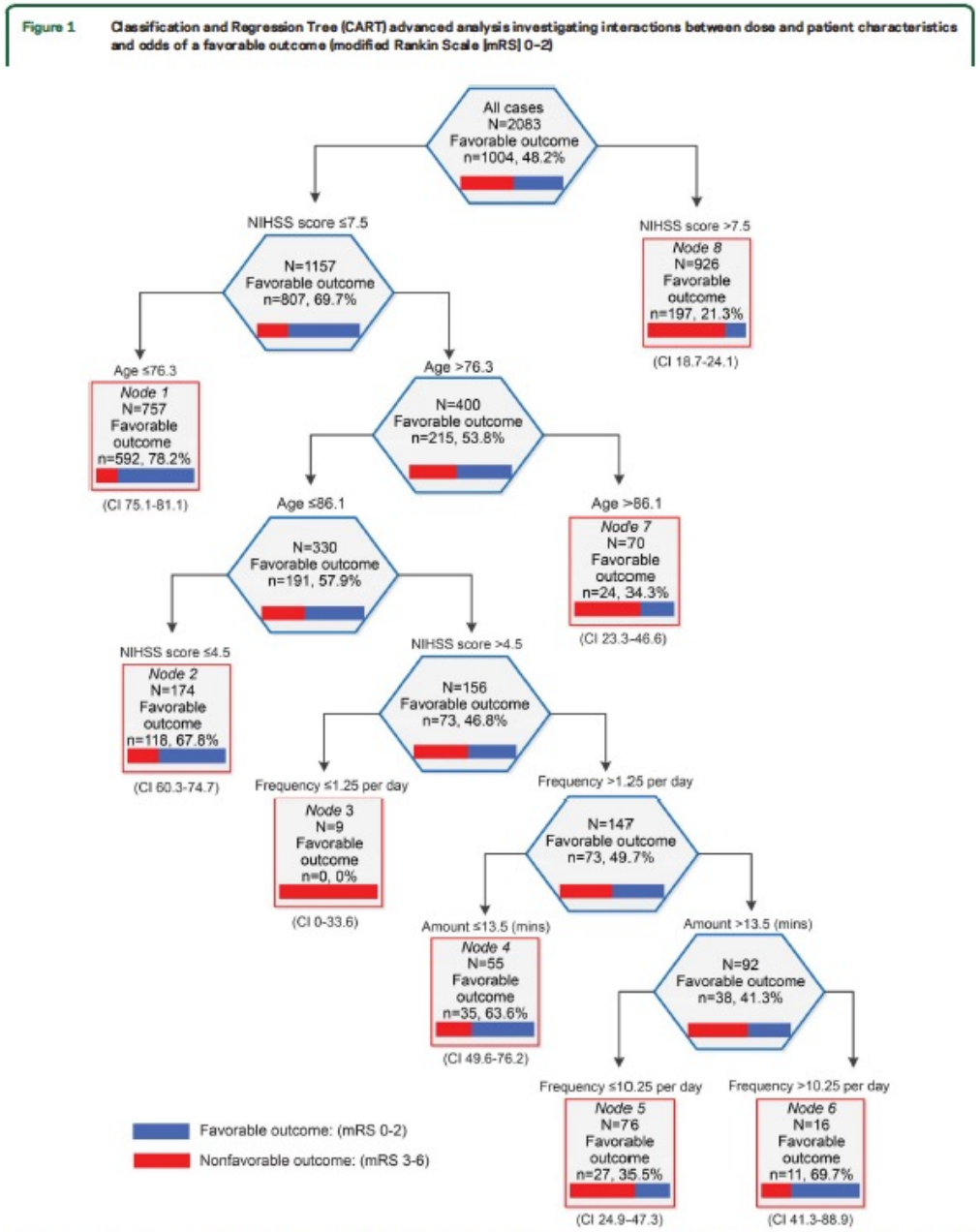
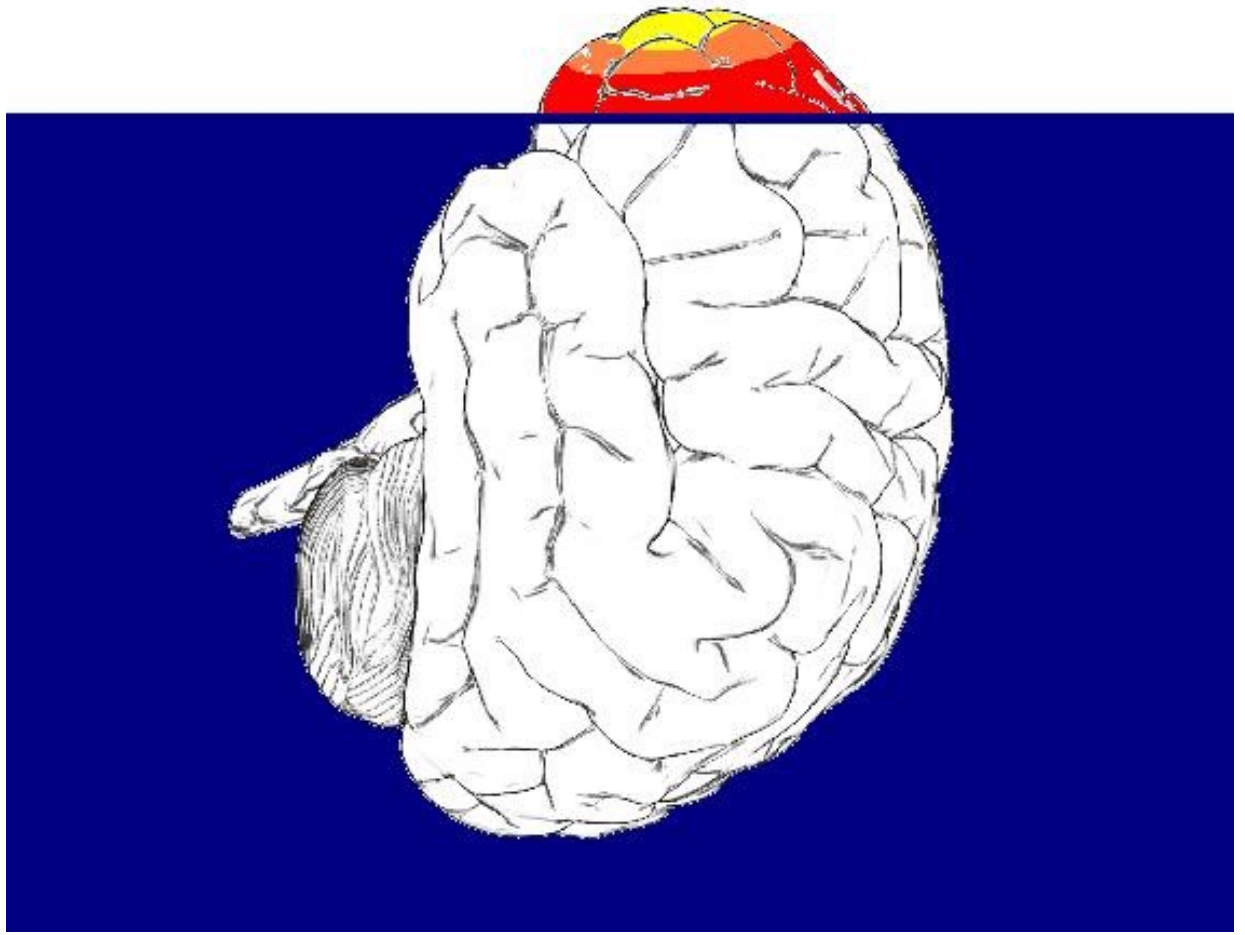


Short bouts
but
more frequent
for mild/moderate stroke
could be
more effective

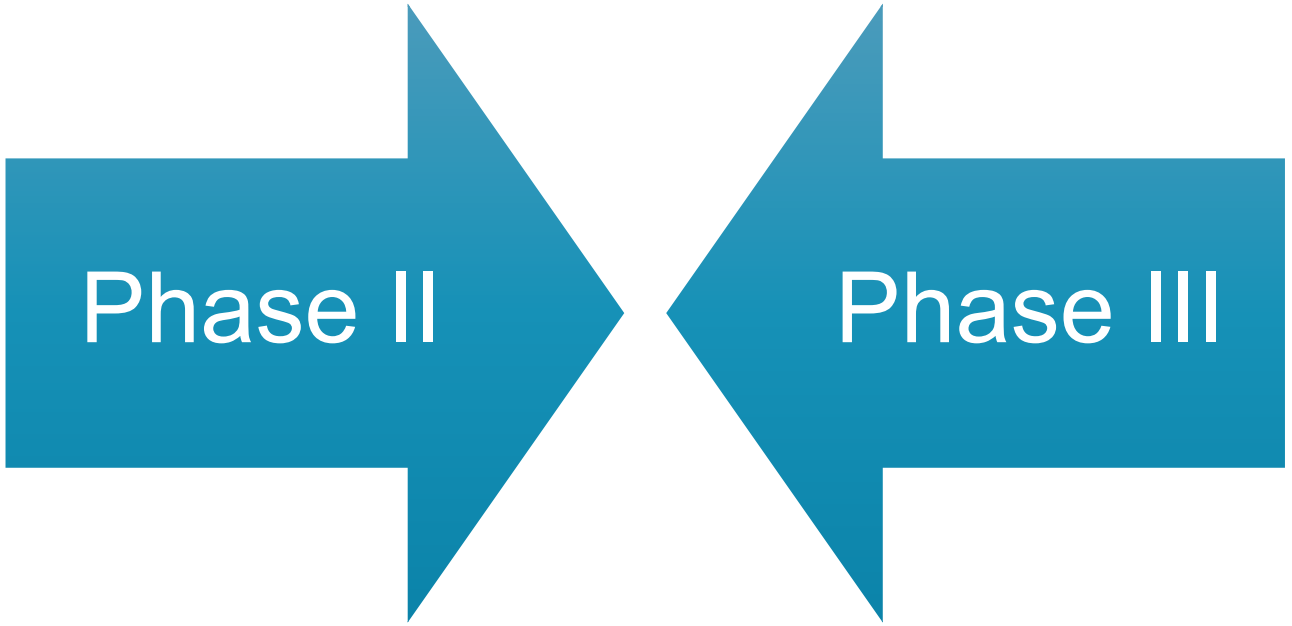
Towards subgroups!

Problem for stroke therapy...



http://blogs.discovermagazine.com/neuroskeptic/2012/03/21/brain-scanning-just-the-tip-of-the-iceberg/#.WcjgpExjKIM

How to progress stroke rehab?



- (a lot of) positive phase II trials
- But underpowered!

- Neutral phase III trials
- Patient selection!

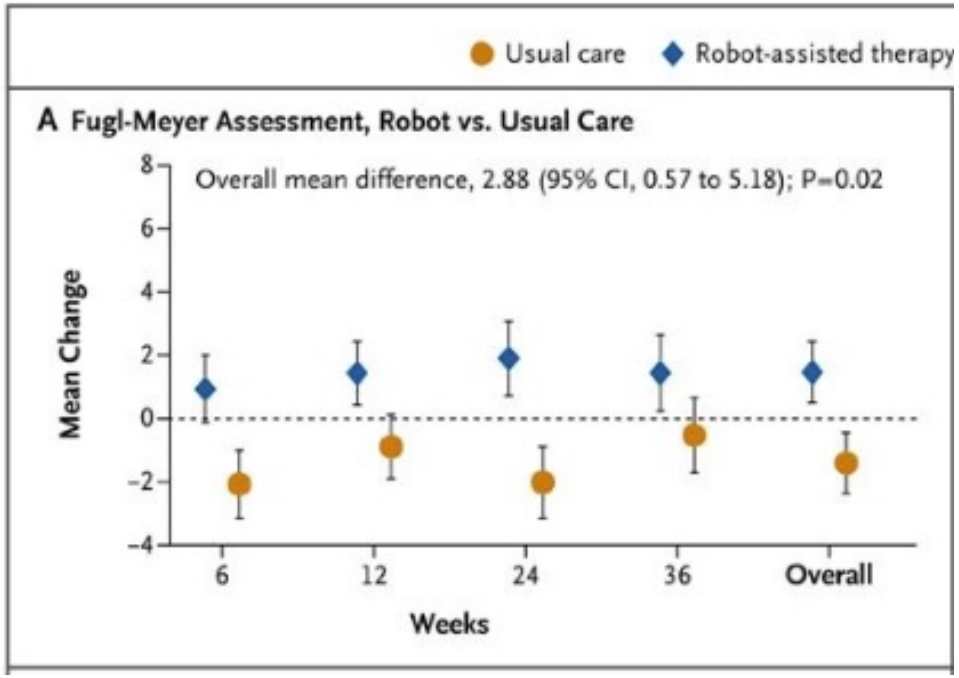
Towards subgroups

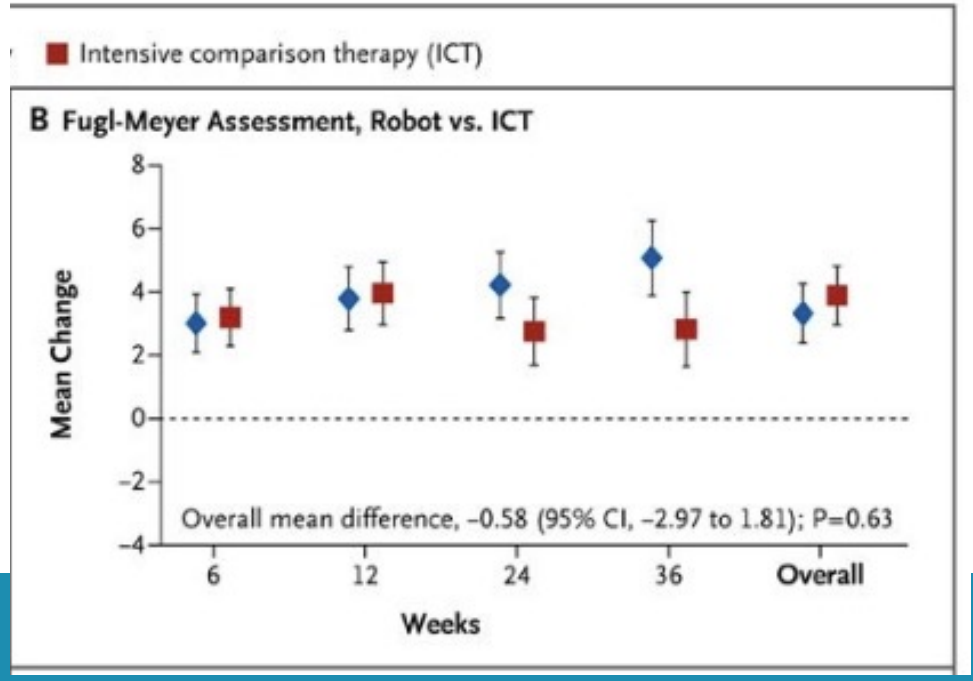
Robot-assisted therapy

N=127

Three groups:
- RAT
- Intensive CT
- Usual care

36 sessions
of 60 minutes
for 12 weeks
at 6 months or more





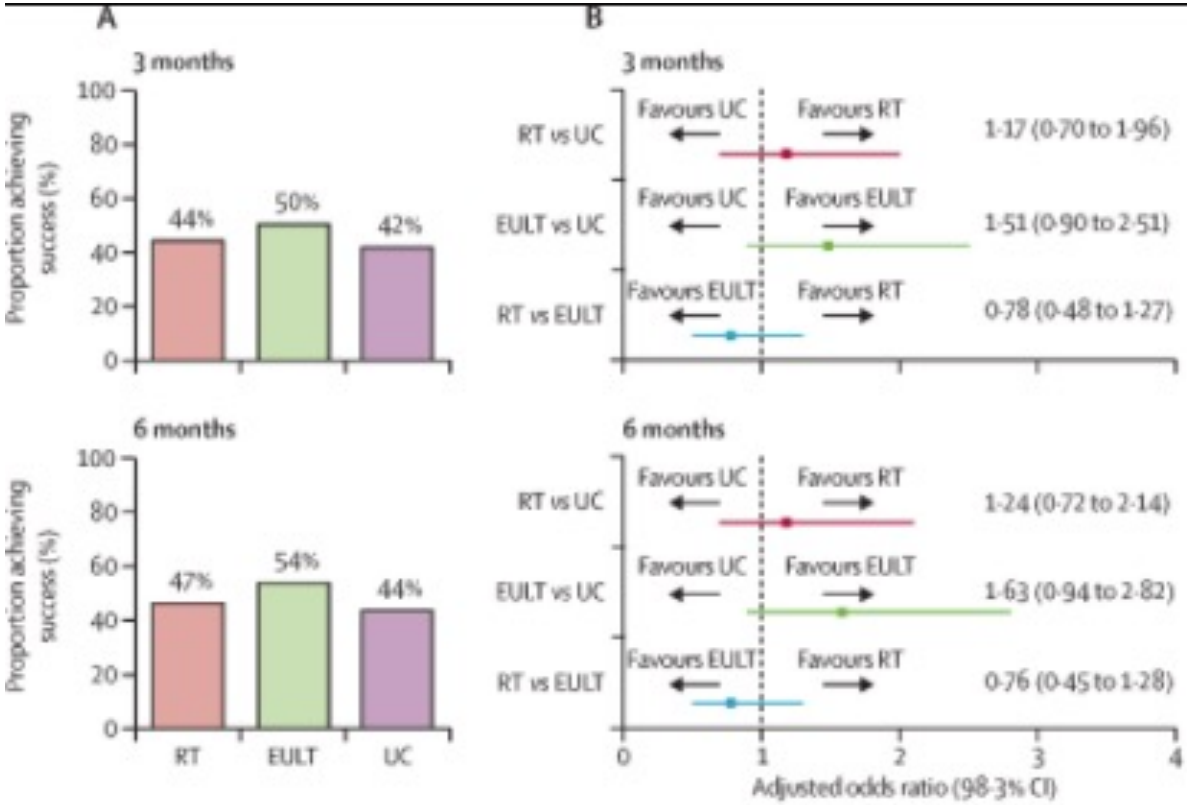
Lo et al.
NEJM 2010;362:1772-83.

RATULS trial

N=770

Three groups:
- Robot-assisted training
- Enhanced UL therapy
- Usual care

Three times/week
45 minutes
for 12 weeks
1w-5y post stroke



Rodgers et al.
Lancet 2019;394:51-62.

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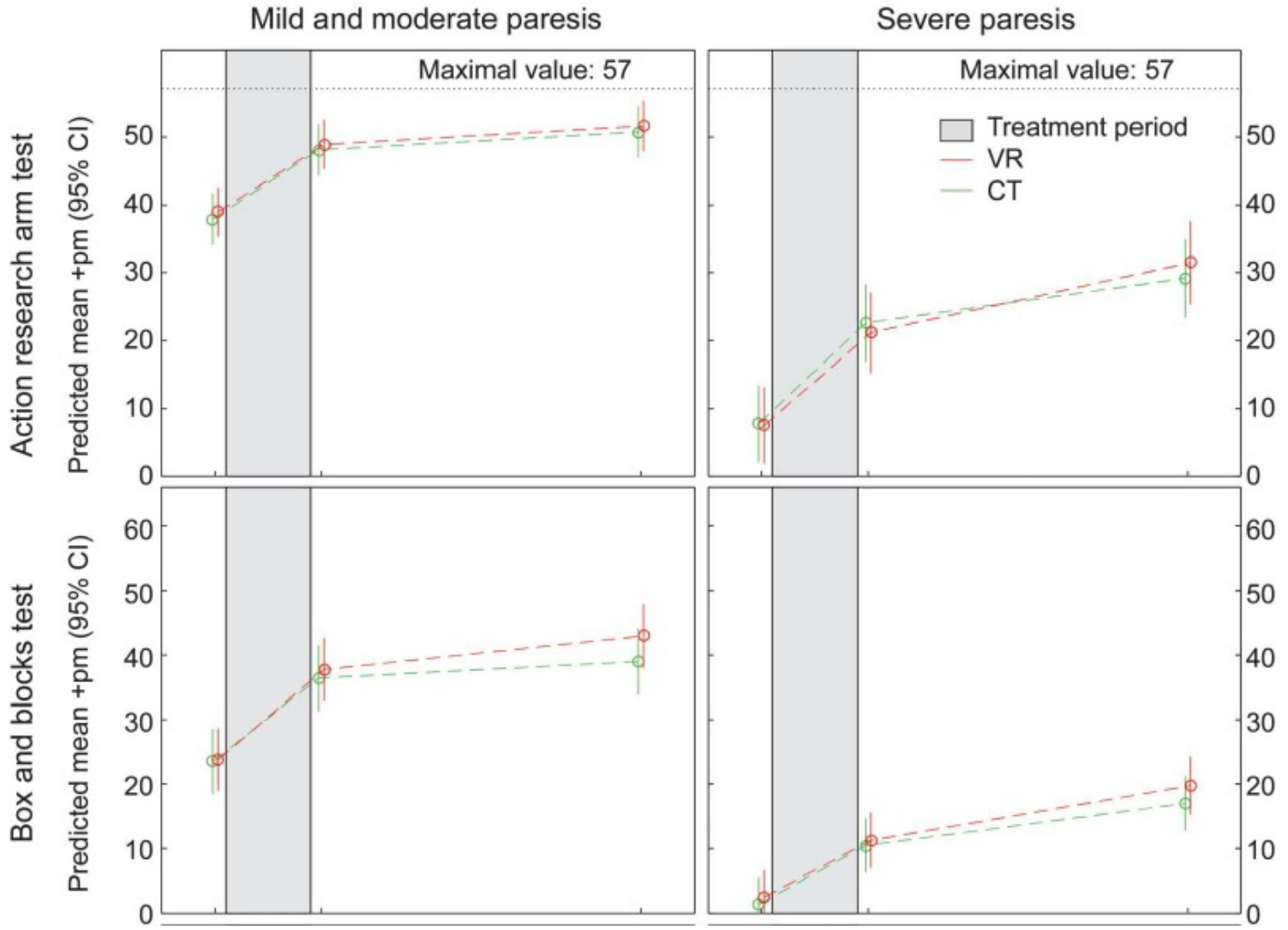
VIRTUES trial

N=120

Two groups:
- UL virtual reality
- Active control

16-20 sessions
of 60 minutes
for 4 weeks
during rehab



Brunner et al.
Neurology 2017;89:24.

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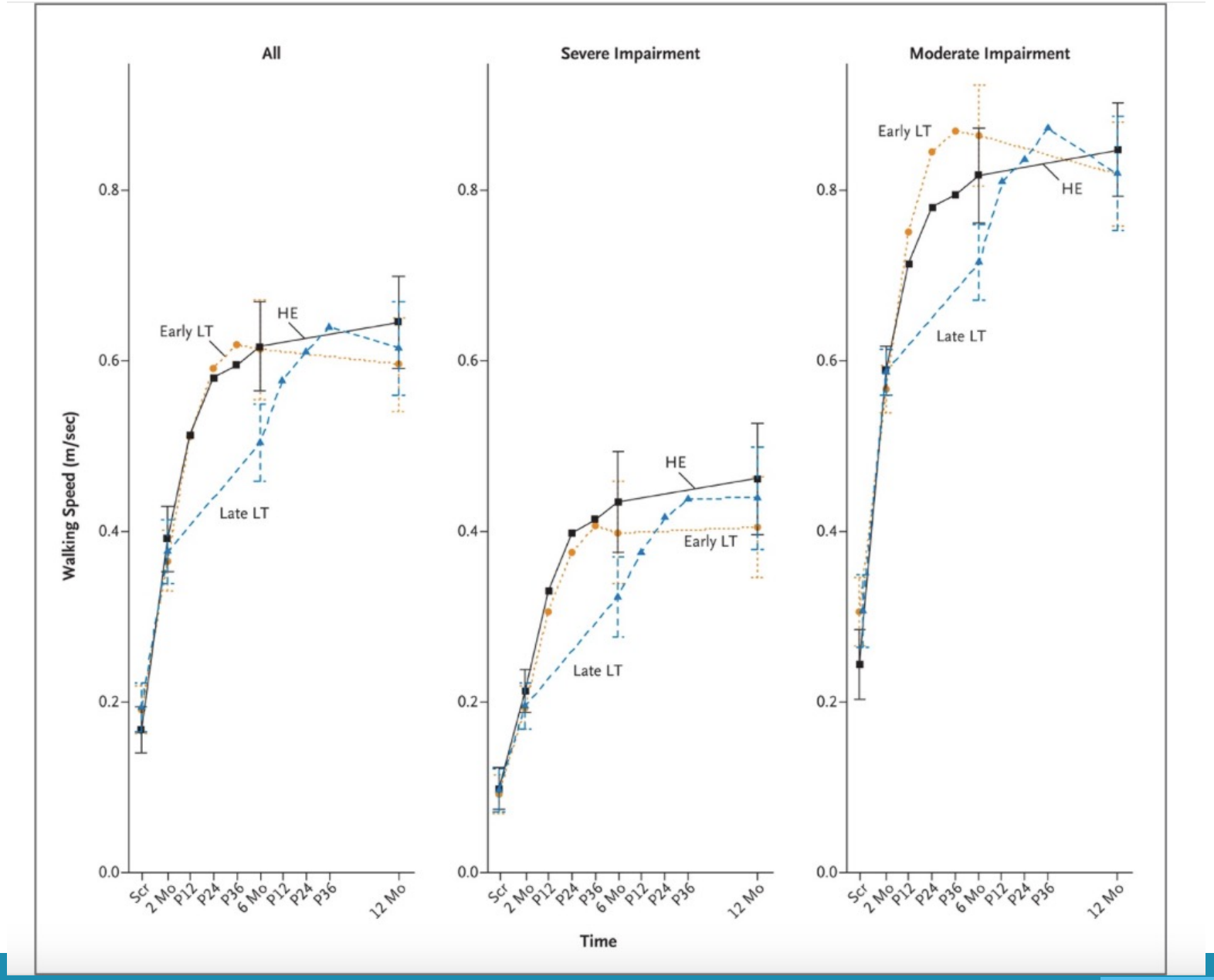
LEAPS trial

N=408

Three groups:
- Early BWSTT
- Late BWSTT
- Home ex.

30-36 sessions
of 90 minutes
for 12-16 weeks
at 2/6 months



Duncan et al.
NEJM 2011;364:2026-36.

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Dus...

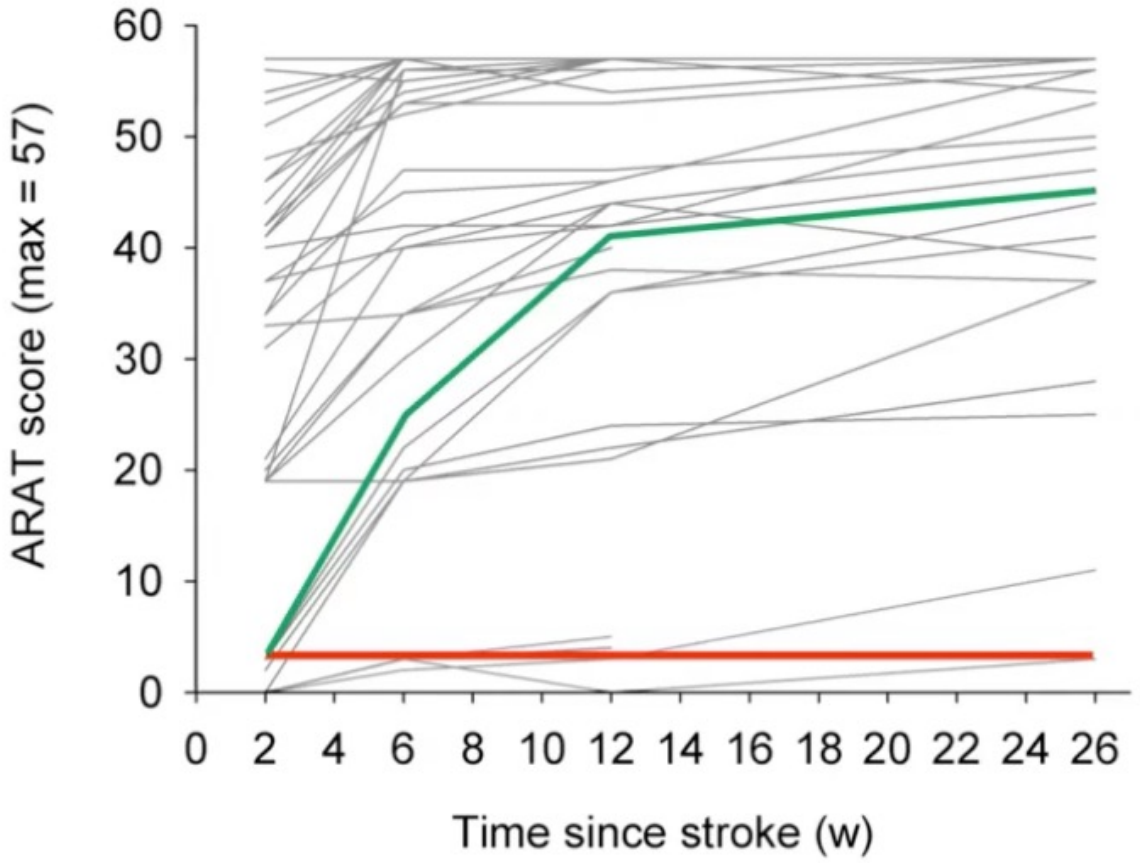
Nu	Praktijk	Toekomst
Therapie begint vroeg	Maar best hoe vroeg?	Studie van subgroepen
Fase 2 studies...	Maar geen bewijs!	Kijk naar fase 3!

When hearing/reading clinical trials, and considering (change of) practice, ask yourself:

- Phase 2 or phase 3?

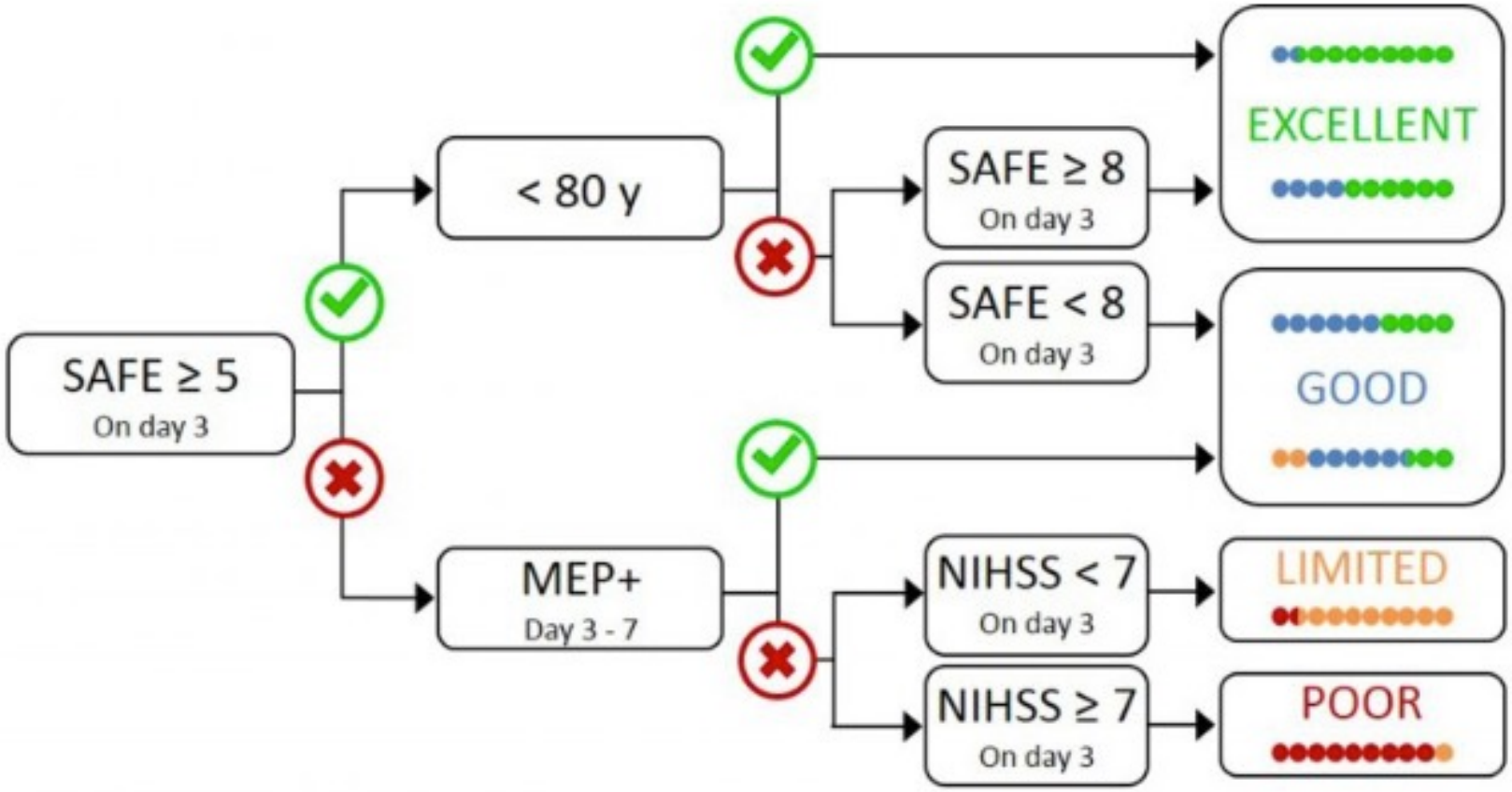
- **P**: which patients included?
- **I**: what intervention provided?
- **C**: compared with what?
- **O**: outcomes used?
  Actual between-group difference?
  (in relation to measurement error)

Prediction



Stinear et al., Brain, 2012

Thinking about ‘subgroups’ of patients: PREP2-UL



http://presto.auckland.ac.nz/prep2-overview/

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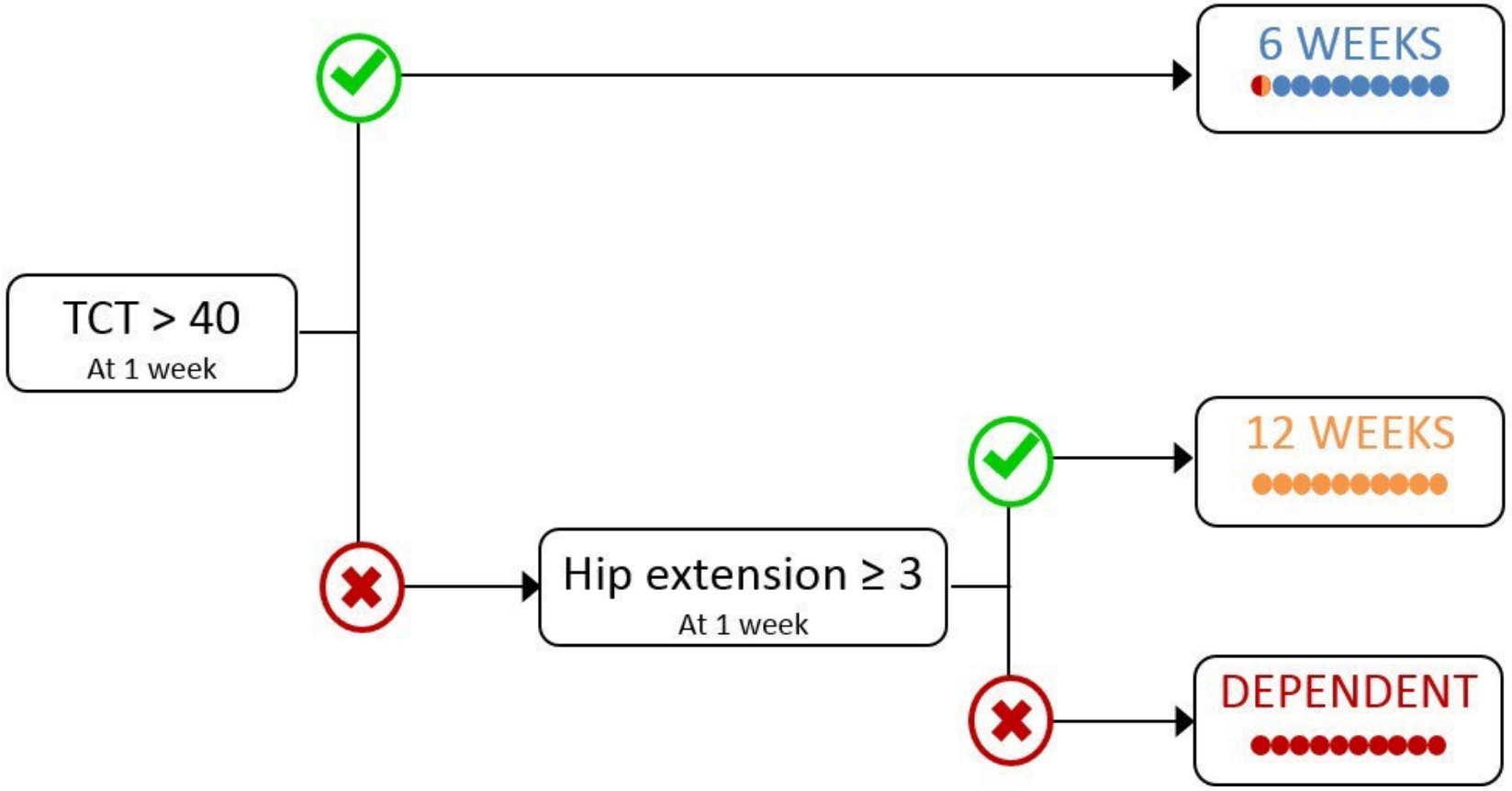
Category	Upper Limb Prediction	Upper Limb Rehabilitation Focus
Excellent	Potential to make a complete, or near-complete, recovery of hand and arm function within 3 months.	Promote normal use of the affected hand and arm with task-specific practice, while minimizing compensation with the other hand and arm.
Good	Potential to be using their affected hand and arm for most activities of daily living within 3 months, though they may continue to experience some weakness, slowness, or clumsiness.	Promote normal function of the affected hand and arm by improving strength, coordination, and fine motor control with repetitive and task-specific practice. Emphasis is placed on minimizing compensation with the other hand and arm, and the trunk.
Limited	Potential to regain movement in their hand and arm within 3 months, but daily activities are likely to require significant modification.	Promote movement and reduce impairment by improving strength and active range of motion. Promote adaptation in daily activities while incorporating the affected upper limb wherever safely possible.
None	Unlikely to regain useful movement in their hand and arm within 3 months.	Prevent secondary complications such as pain, spasticity, and shoulder instability. Reduce disability by learning to complete daily activities with the stronger hand and arm.

Thinking about ‘groups’ of patients: TWIST-LL



Smith et al. NNR 2017;31:955-64.

Dus...

Predictiemodellen !

Let op voor fout(jes)

Therapie voor subgroepen

Treatment

Balance training

- To maintain, achieve or restore a state of balance during any posture
- Post-intervention effects on balance and basic ADL regardless of timing

Wat verbetert balans post CVA?

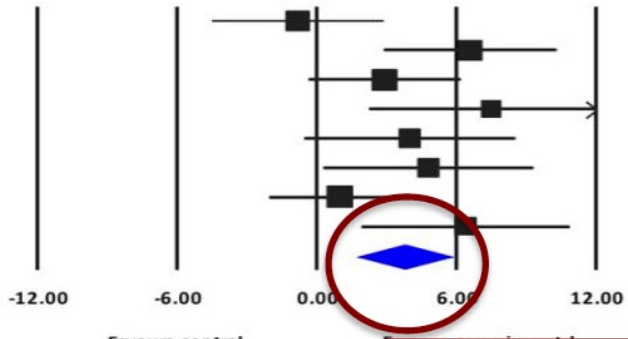
Effects of Exercise Therapy on Balance Capacity in Chronic Stroke

Systematic Review and Meta-Analysis

Hanneke J.R. van Duijnhoven, MD, MSc; Anita Heeren, MD, MSc; Marlijn A.M. Peters, MSc; Janne M. Veerbeek, PhD; Gert Kwakkel, PhD; Alexander C.H. Geurts, MD, PhD*; Vivian Weerdesteyn, PhD*

BBS post intervention | experimental: balance

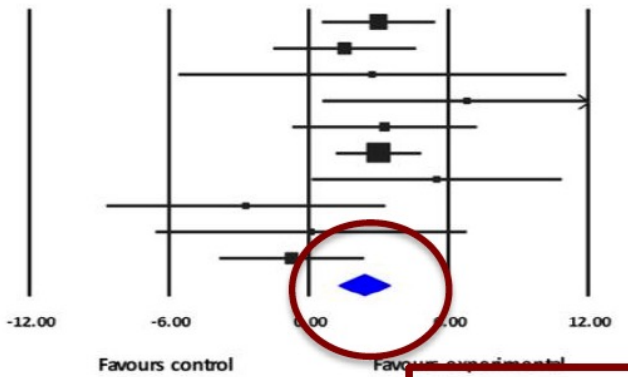
Study name	Difference in means	p-Value	Expermental	Control
Cho KH 2012	0.810	0.669	11	11
Farqalit 2013	5.600	0.001	20	20
Kim 2009	2.920	0.083	12	12
Lee 2014	7.500	0.005	10	11
Lee 2012	4.000	0.086	20	20
Llorens 2014	4.800	0.038	10	10
Marigold 2005	1.000	0.522	22	26
Noh 2008	5.400	0.005	10	10
	3.747	0.000	115	120



+ 3.75 points

BBS post intervention | experimental: gait

Study name	Difference in means	Standard	Lower	Upper	p-Value	Expermental	Control
Chen 2014					0.017	15	15
Cho 2014					0.329	15	15
Dias 2007					0.522	20	20
Globas 2012					0.033	18	18
Middleton 2014					0.109	19	19
Page 2008					0.002	4	3
Wang 2015					0.046	25	26
Westlake 2009					0.379	8	8
Wu 2014					0.977	14	14
Yen 2008					0.648	7	7
					0.000	145	145

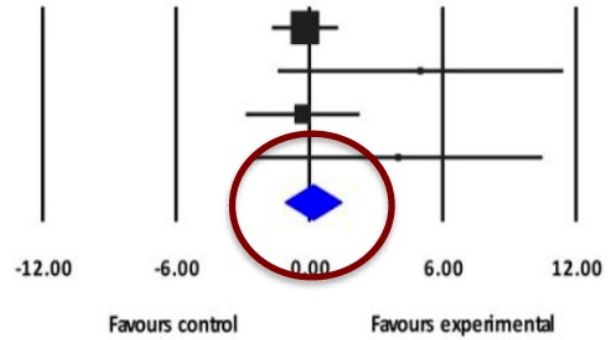


+ 2.26 points

BBS post intervention | experimental: multisensory

Study name	Upper limit	Z-Value	p-Value	Experimental	Control
Brogardh 2012	1.315	-0.259	0.796	16	15
Cha 2014	11.450	1.519	0.129	10	10
Lau 2012	2.284	-0.228	0.820	41	41
Marin 2013	10.515	1.203	0.229	11	9
	1.386	0.203	0.839	78	75

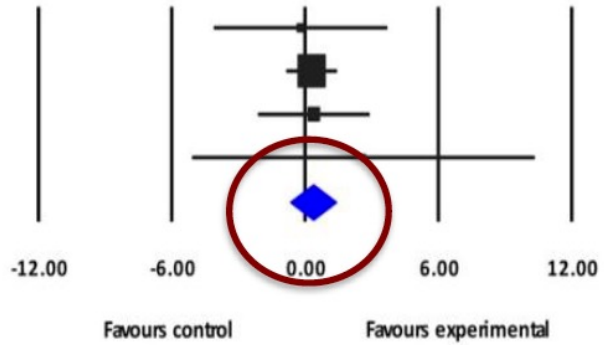
Statistics for each study | Sample size | Difference in means and 95% CI



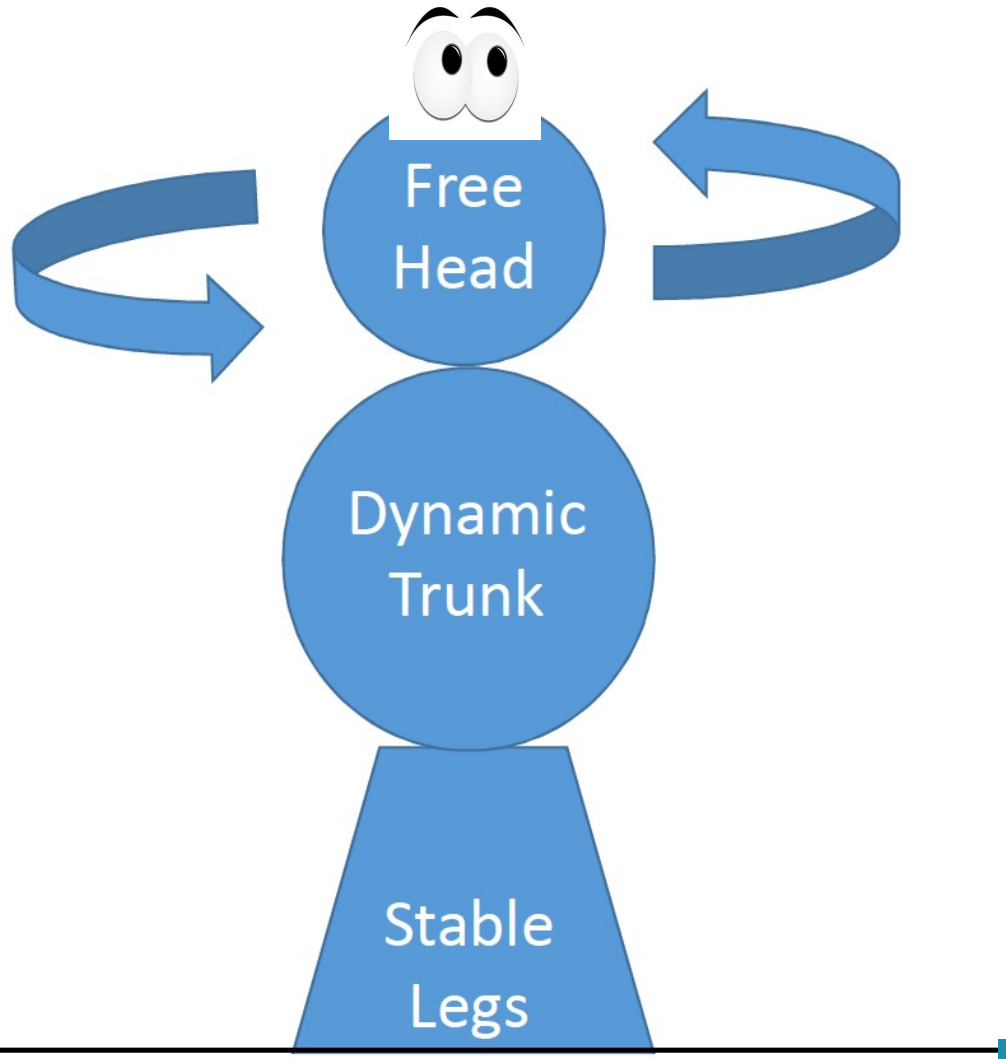
BBS post intervention | experimental: aerobic

Study name	Diff in	Upper limit	Z-Value	p-Value	Experimental	Control
Chu 2004		.729	-0.100	0.921	7	5
Jin 2012		.465	0.505	0.614	68	65
Pang 2005		.937	0.309	0.757	32	31
Quaney 2009		.368	0.666	0.505	19	19
		.336	0.624	0.533	126	120

Statistics for each study | Sample size | Difference in means and 95% CI



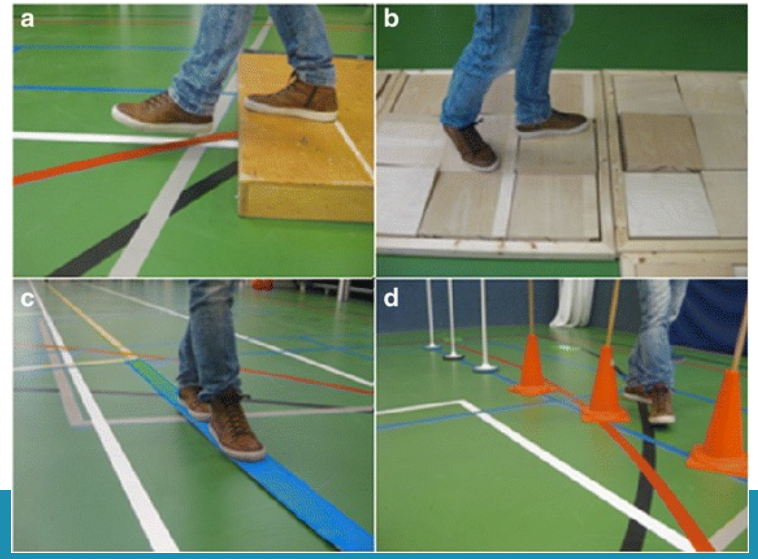
Waaruit bestaat een patiënt?



Gait training

Overground walking

- Post-intervention effects in chronic phase for **gait speed and distance**



Speed-dependent TT

- Post-intervention effects for **gait speed and width** compared with overground walking
- FAC ≥ 3

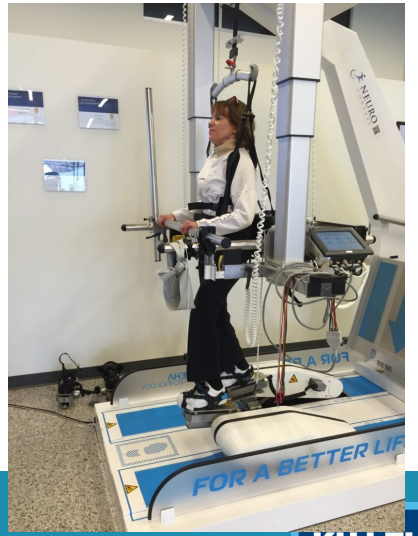
Gait training

Body-weight supported treadmill training

- Post-intervention effects for **gait speed and distance**
- Better early (<3M) and for patients who cannot walk

Robot-assisted gait training

- Post-intervention effects for **gait speed, distance, ability, HR, balance, basic ADL**
- RAGT+PT for FAC ≤ 3!



Circuit class training

- Supervised CCT
- 2 or more patients
- Workstations circuit

- Post-intervention effects for **gait speed, distance, ability, balance, PA**
- FAC ≥ 3

- Task-specificity!

Dus...

Gangtraining !

Voor subgroepen !

Dose-response?

Thinking outside the box for upper limb?

- https://www.youtube.com/watch?v=I2Gr2Ts48e8

- It’s a hypothesis…

But results are out!

Comparing a novel neuroanimation experience to conventional therapy for high-dose, intensive upper-limb training in subacute stroke: The SMARTS2 randomized trial

John W. Krakauer, M.D.[1,2,3], Tomoko Kitago, M.D.[4,5,6]; Jeff Goldsmith, Ph.D.[7]; Omar Ahmad, Ph.D.[1]; Promit Roy[1], Joel Stein, M.D.[8]; Lauri Bishop, Ph.D., D.P.T.[8], Kelly Casey, O.T.D.[3], Belen Valladares, M.P.H.[9,11], Michelle D. Harran[5], Juan Camilo Cortés, M.D.[1,5]; Alexander Forrence[1], Jing Xu, Ph.D.[1]; Sandra DeLuzio[3], Jeremia P. Held, Ph.D.[11], Anne Schwarz, M.Sc.[11], Levke Steiner, M.D.[11], Mario Widmer, Ph.D.[9], Kelly Jordan[3]; Daniel Ludwig, D.P.T.[3], Meghan Moore, D.P.T.[3], Marlena Barbera[3], Isha Vora[3], Rachel Stockley, Ph.D.[10], Pablo Celnik, M.D.[3], Steven Zeiler, M.D., Ph.D.[1]; Meret Branscheidt, M.D.[11], Gert Kwakkel, Ph.D.[12,13], Andreas R. Luft, M.D.[9,11]

Methods: Twenty-four patients were randomized to NAT or COT and underwent 30 sessions of 60 minutes time-on-task in addition to standard care. The primary outcome was the Fugl-Meyer Upper Extremity motor score (FM-UE). Secondary outcomes included: Action Research Arm Test (ARAT), grip strength, Stroke Impact Scale (SIS) hand domain, and upper-limb kinematics. Outcomes were assessed at baseline, and days 3, 90, and 180 post-training. Both groups were compared to a matched historical cohort (HC), which received only 30 minutes of upper limb therapy per day.

Results: There were no significant between-group differences in FM-UE change or any of the secondary outcomes at any timepoint. Both high-dose groups showed greater recovery on the ARAT (7.3 ±2.9 pts, p=0.011), but not the FM-UE (1.4 ±2.6 pts, p =0.564) when compared to the HC.

https://www.medrxiv.org/node/92952.external-links.html and Krakauer et al. NNR 2021

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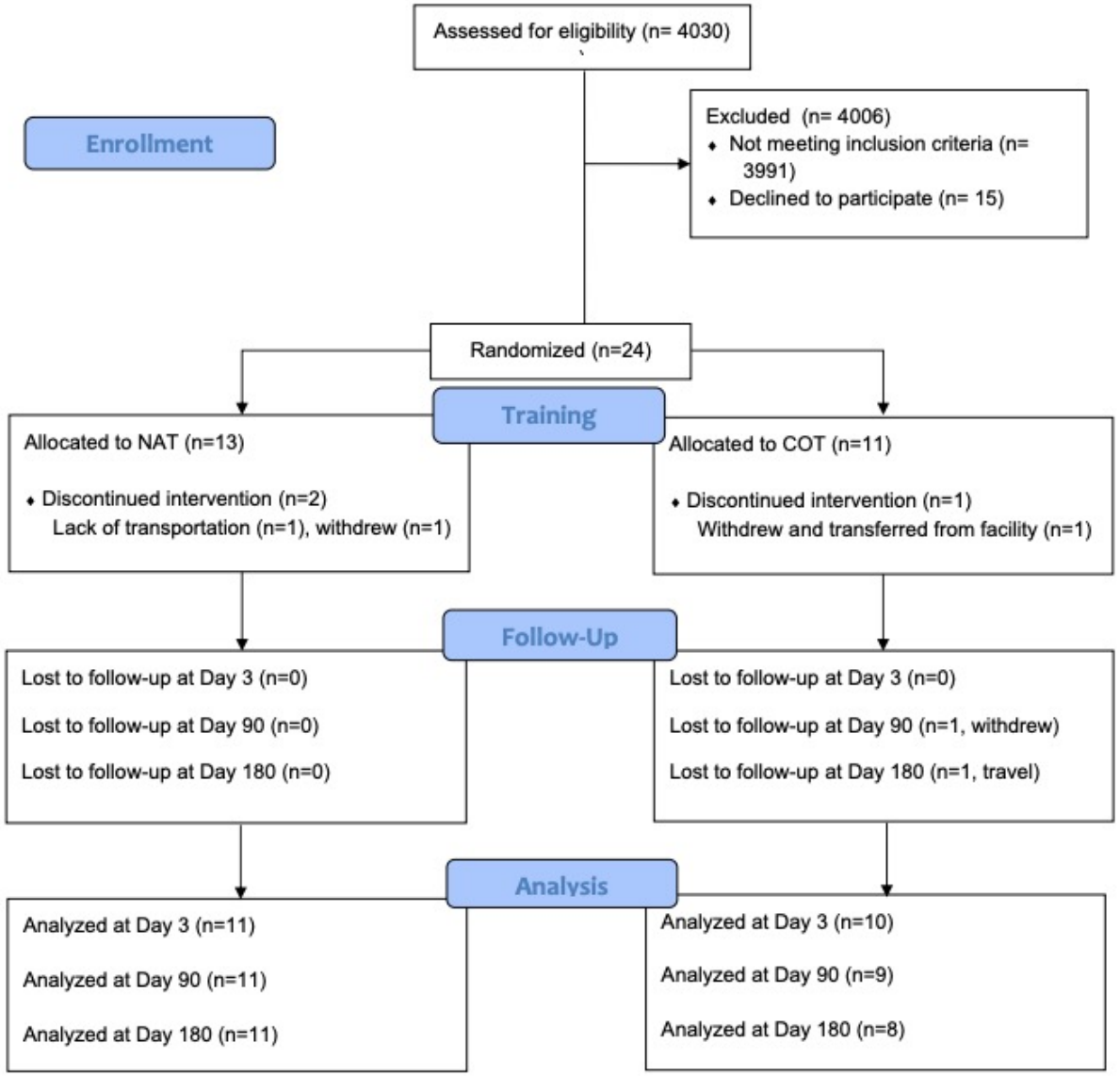
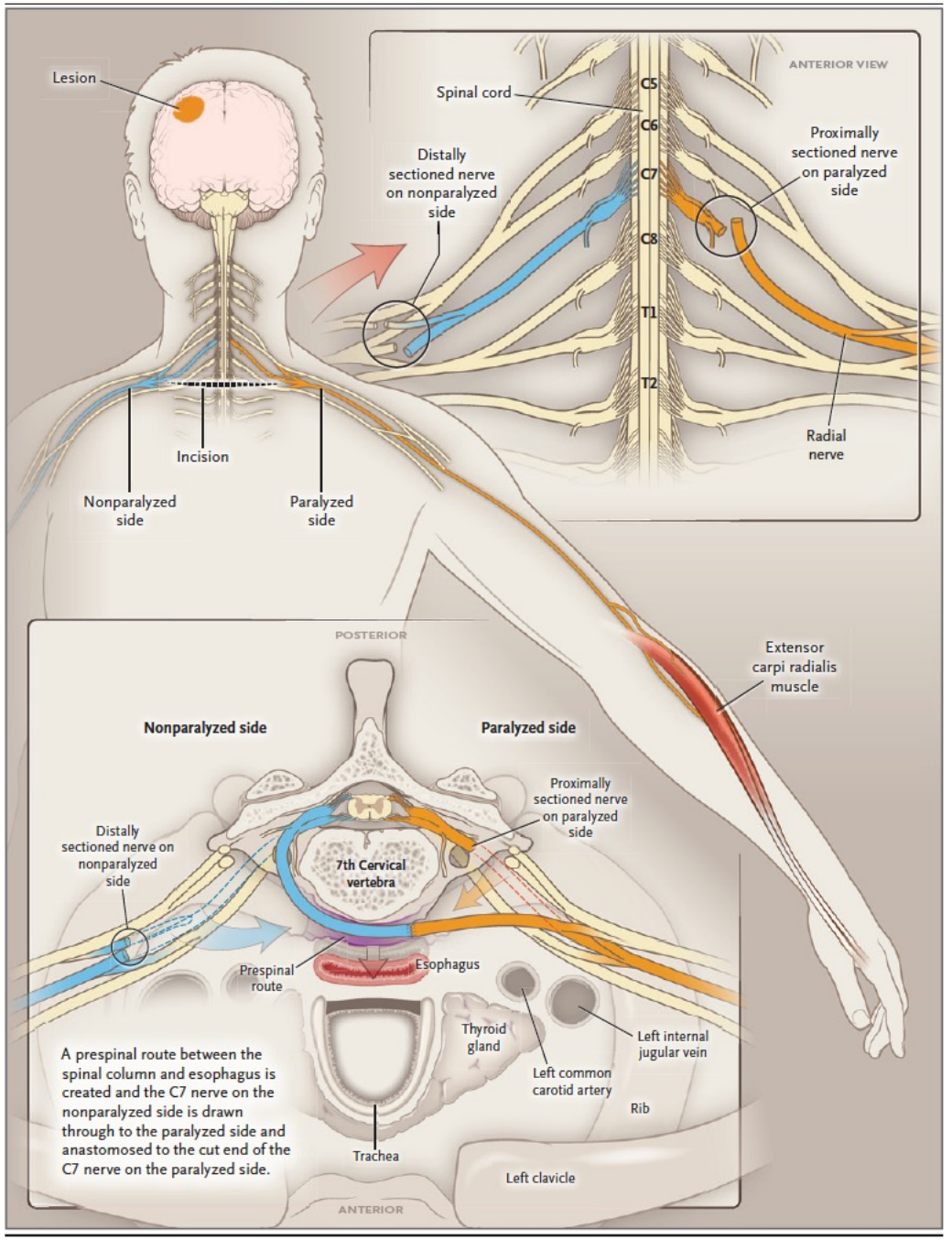
Figure 2. Participant flow through the study.



NAT = neuroanimation therapy. COT = conventional occupational therapy.

Or…



Zheng MX et al.
NEJM 2018;378:22-34.

Table 2. Primary and Secondary Outcomes at Baseline and Month 12.*

Outcome	Surgery Group (N = 18)	Control Group (N = 18)	Mean Difference (95% CI)	P Value
Primary outcome				
Change in total Fugl–Meyer score from baseline to month 12†	17.7±5.6	2.6±2.0	15.1 (12.2 to 17.9)	<0.001
Change in total Fugl–Meyer score according to cause of paralysis				
Stroke	18.4±2.9	3.3±1.1	15.2 (7.2 to 23.1)	0.004
Traumatic brain injury	18.8±2.1	3.2±1.0	15.7 (10.2 to 21.1)	<0.001
Cerebral palsy	17.0±2.9	1.9±0.5	15.1 (7.2 to 23.1)	0.006

Phase III !

Lancet 2021;397:1545-53

Vagus nerve stimulation paired with rehabilitation for upper limb motor function after ischaemic stroke (VNS-REHAB): a randomised, blinded, pivotal, device trial

Jesse Dawson, Charles Y Liu, Gerard E Francisco, Steven C Cramer, Steven L Wolf, Anand Dixit, Jen Alexander, Rushna Ali, Benjamin L Brown, Wuwei Feng, Louis DeMark, Leigh R Hochberg, Steven A Kautz, Arshad Majid, Michael W O'Dell, David Pierce, Cecília N Prudente, Jessica Redgrave, Duncan L Turner, Navzer D Engineer, Teresa J Kimberley

Summary

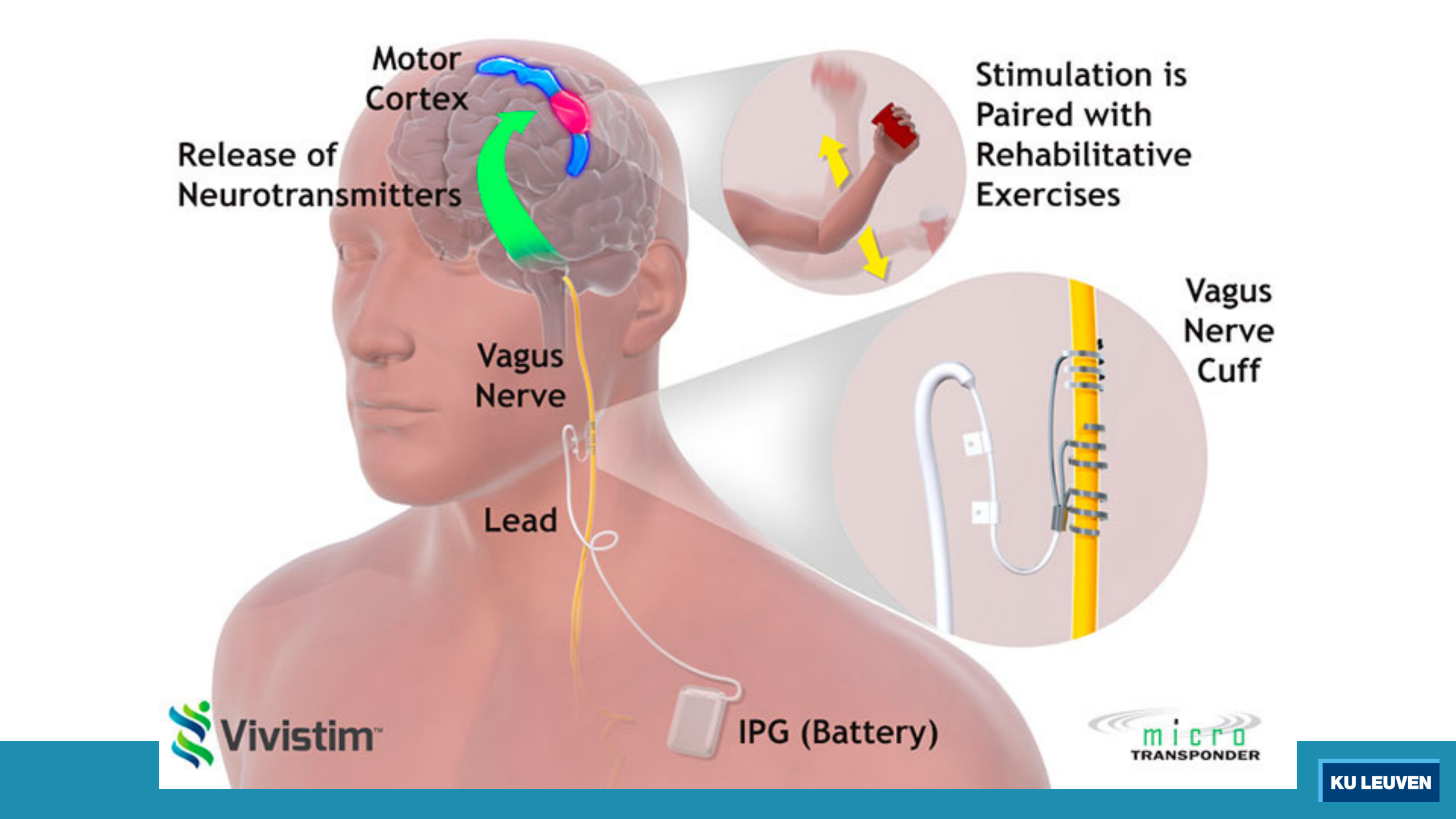
Background Long-term loss of arm function after ischaemic stroke is common and might be improved by vagus nerve stimulation paired with rehabilitation. We aimed to determine whether this strategy is a safe and effective treatment for improving arm function after stroke.

Methods In this pivotal, randomised, triple-blind, sham-controlled trial, done in 19 stroke rehabilitation services in the UK and the USA, participants with moderate-to-severe arm weakness, at least 9 months after ischaemic stroke, were randomly assigned (1:1) to either rehabilitation paired with active vagus nerve stimulation (VNS group) or rehabilitation paired with sham stimulation (control group). Randomisation was done by ResearchPoint Global (Austin, TX, USA) using SAS PROC PLAN (SAS Institute Software, Cary, NC, USA), with stratification by region (USA *vs* UK), age (≤30 years *vs* >30 years), and baseline Fugl-Meyer Assessment-Upper Extremity (FMA-UE) score (20–35 *vs* 36–50). Participants, outcomes assessors, and treating therapists were masked to group assignment. All participants were implanted with a vagus nerve stimulation device. The VNS group received 0·8 mA, 100 μs, 30 Hz stimulation pulses, lasting 0·5 s. The control group received 0 mA pulses. Participants received 6 weeks of in-clinic therapy (three times per week; total of 18 sessions) followed by a home exercise programme. The primary outcome was the change in impairment measured by the FMA-UE score on the first day after completion of in-clinic therapy. FMA-UE response rates were also assessed at 90 days after in-clinic therapy (secondary endpoint). All analyses were by intention to treat. This trial is registered at ClinicalTrials.gov, NCT03131960.

Findings Between Oct 2, 2017, and Sept 12, 2019, 108 participants were randomly assigned to treatment (53 to the VNS group and 55 to the control group). 106 completed the study (one patient for each group did not complete the study). On the first day after completion of in-clinic therapy, the mean FMA-UE score increased by 5·0 points (SD 4·4) in the VNS group and by 2·4 points (3·8) in the control group (between group difference 2·6, 95% CI 1·0–4·2, p=0·0014). 90 days after in-clinic therapy, a clinically meaningful response on the FMA-UE score was achieved in 23 (47%) of 53 patients in the VNS group versus 13 (24%) of 55 patients in the control group (between group difference 24%, 6–41; p=0·0098). There was one serious adverse event related to surgery (vocal cord paresis) in the control group.

Interpretation Vagus nerve stimulation paired with rehabilitation is a novel potential treatment option for people with long-term moderate-to-severe arm impairment after ischaemic stroke.

Funding MicroTransponder.


Motor Cortex
Release of Neurotransmitters
Stimulation is Paired with Rehabilitative Exercises
Vagus Nerve
Vagus Nerve Cuff
Lead
IPG (Battery)
Vivistim
micro TRANSPONDER

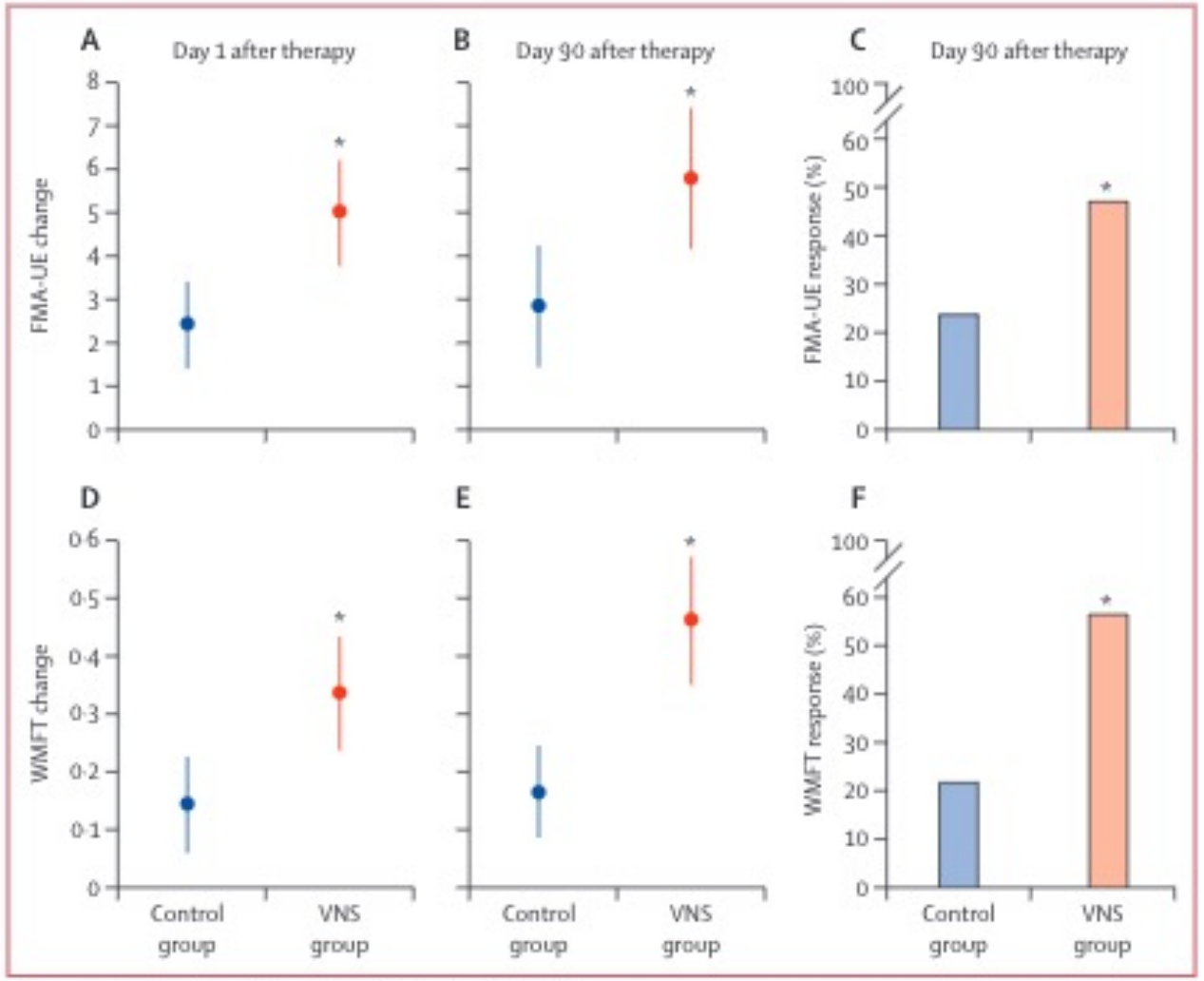


***Figure 2*: Response and change in FMA-UE and WMFT scores**

(A) Change in FMA-UE score between baseline and day 1 after completion of in-clinic therapy (primary endpoint). (B) Change in FMA-UE score between baseline and day 90 after completion of in-clinic therapy (secondary endpoint). (C) FMA-UE response rate (≥6-point change from baseline) at day 90 after completion of in-clinic therapy (secondary endpoint). (D) Change in WMFT score between baseline and day 1 after completion of in-clinic therapy. (E) Change in WMFT score between baseline and day 90 after completion of in-clinic therapy (secondary endpoint). (F) WMFT response rate (≥0·4-point change from baseline) at day 90 post completion of in-clinic therapy (post-hoc outcome). The circle is the mean group value and the vertical lines denote 95% CIs. FMA-UE=Fugl-Meyer Assessment-Upper Extremity. WMFT= Wolf Motor Function Test-Functional. VNS=vagus nerve stimulation. *p<0·05 for the between group difference.

Early rehab in mice…

Zeiler et al. NNR 2016;30:794-800.

KU LEUVEN

Critical Period After Stroke Study (CPASS): A phase II clinical trial testing an optimal time for motor recovery after stroke in humans

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PNAS 2021

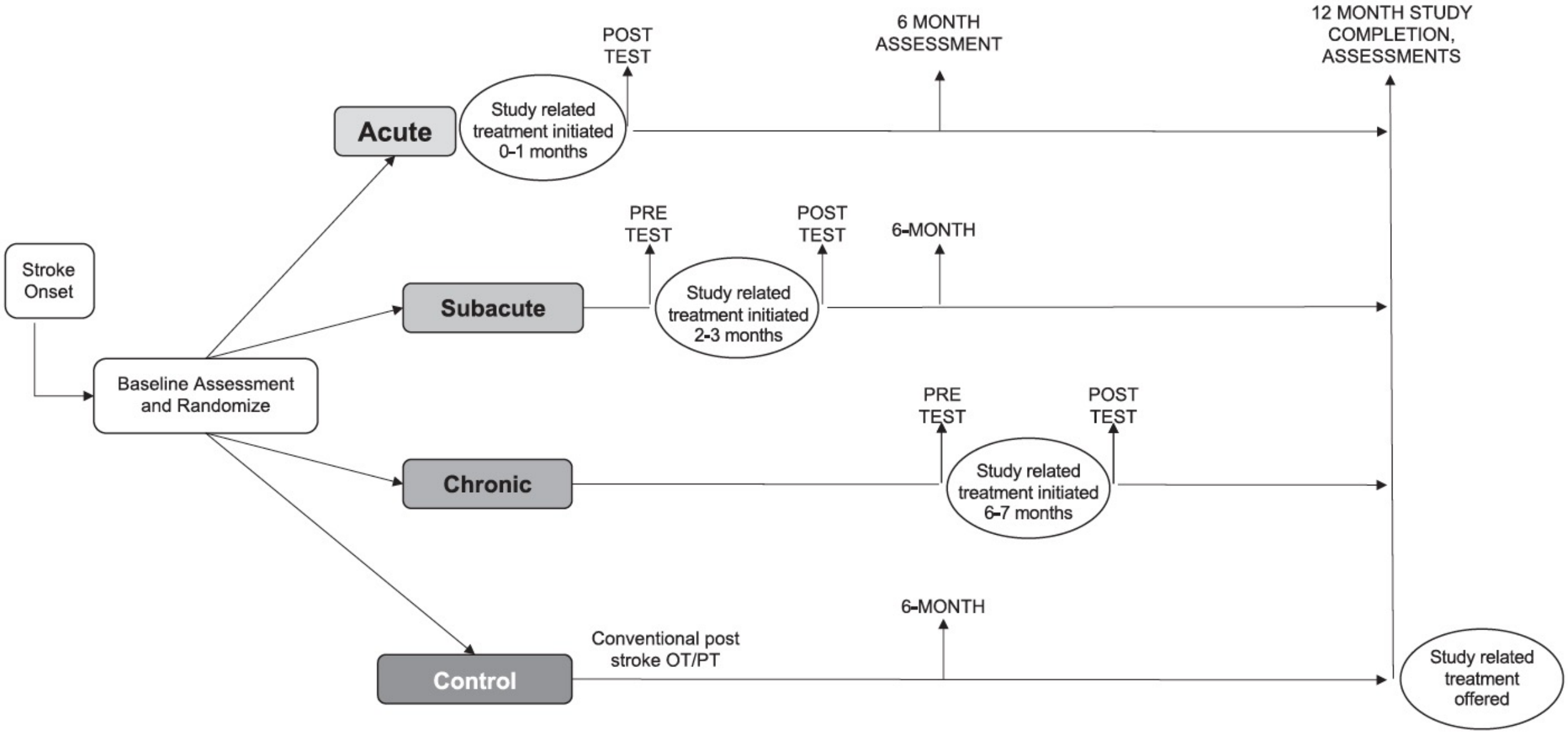
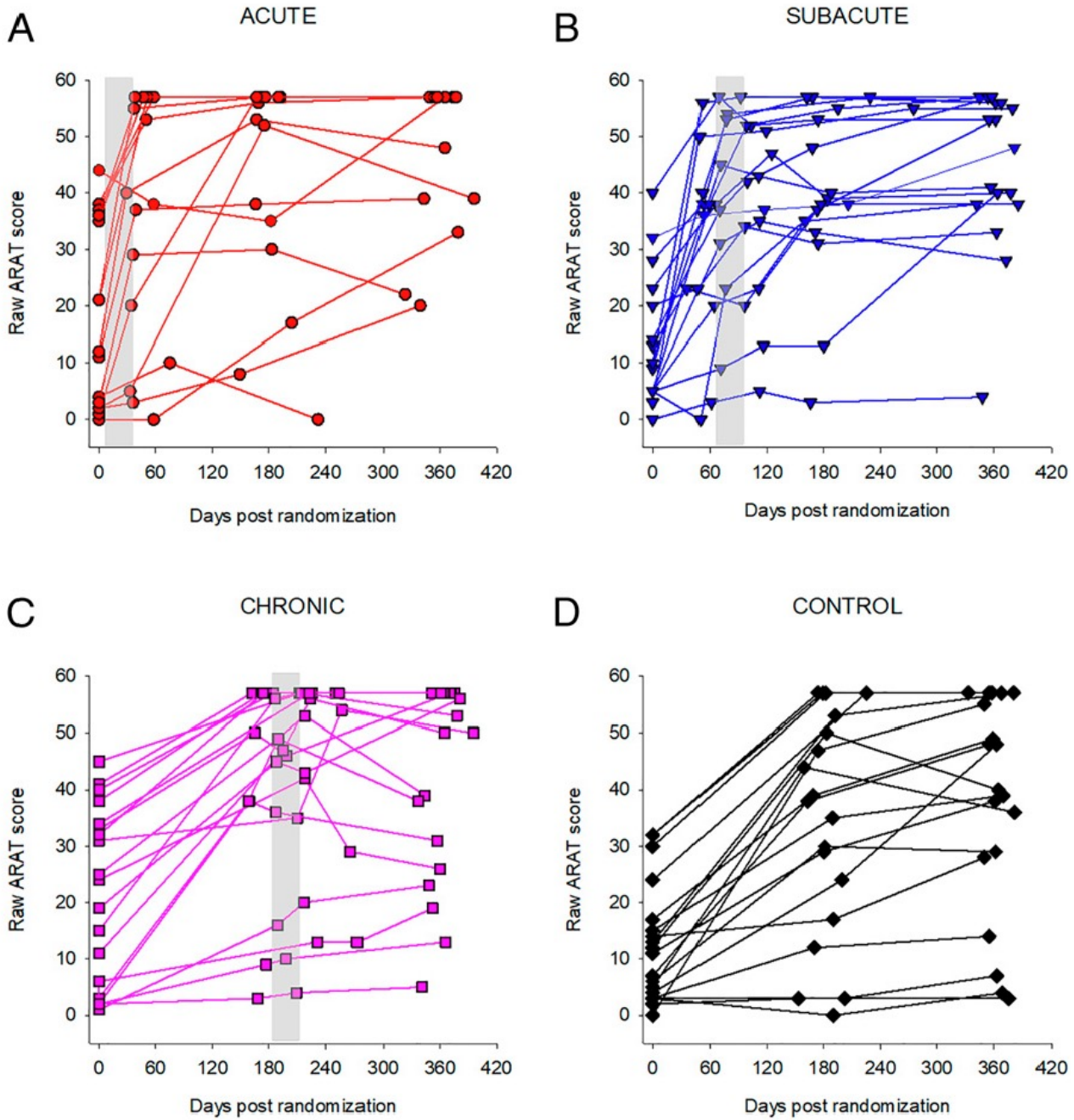


Fig. 2. Study design. Baseline assessment occurred <30 d from stroke onset, and participants were randomized to one of four groups: acute, received additional 20 h of therapy initiated within 30 d from stroke onset; subacute, received additional 20 h initiated within 2 to 3 mo from stroke onset; chronic, received additional 20 h 6 to 7 mo after onset; controls, received standard rehabilitation. Adapted from ref. 100, which is licensed under CC BY 4.0.



Restoration of human brain function after injury is a signal challenge for translational neuroscience. Rodent stroke recovery studies identify an optimal or sensitive period for intensive motor training after stroke: near-full recovery is attained if task-specific motor training occurs during this sensitive window. We extended these findings to adult humans with stroke in a randomized controlled trial applying the essential elements of rodent motor training paradigms to humans. Stroke patients were adaptively randomized to begin 20 extra hours of self-selected, task-specific motor therapy at ≤30 d (acute), 2 to 3 mo (subacute), or ≥6 mo (chronic) after stroke, compared with controls receiving standard motor rehabilitation. Upper extremity (UE) impairment assessed by the Action Research Arm Test (ARAT) was measured at up to five time points. The primary outcome measure was ARAT recovery over 1 y after stroke. By 1 y we found significantly increased UE motor function in the subacute group compared with controls (ARAT difference = +6.87 ± 2.63, $P = 0.009$). The acute group compared with controls showed smaller but significant improvement (ARAT difference = +5.25 ± 2.59 points, $P = 0.043$). The chronic group showed no significant improvement compared with controls (ARAT = +2.41 ± 2.25, $P = 0.29$). Thus task-specific motor intervention was most effective within the first 2 to 3 mo after stroke. The similarity to rodent model treatment outcomes suggests that other rodent findings may be translatable to human brain recovery. These results provide empirical evidence of a sensitive period for motor recovery in humans.

Fig. 3. (*A–D*) Individual trajectories of raw ARAT scores posttroke, by treatment group. Vertical gray bars show average timing of the intervention in each group.

frontiers in Neurology

ORIGINAL RESEARCH
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Arm-Hand Boost Therapy During Inpatient Stroke Rehabilitation: A Pilot Randomized Controlled Trial

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[1] *Jessa Hospital, Rehabilitation Centre, Campus Sint-Ursula, Herk-de-Stad, Belgium,* [2] *Department of Rehabilitation Sciences, KU Leuven-University of Leuven, Leuven, Belgium*

Boost

The specific intensive boost program for the upper limb (BOOST) is focused around five topics: scapula-setting, core-stability training in relation to reaching, training of external shoulder rotation and elbow extension (movements with 30–60° flexion/abduction in shoulder), fine manipulation or dexterity training and integration in complex ADL tasks. For each of those topics, a list of example exercises was created that could be used depending on the individual abilities of the patient, including a gradual increase in levels of difficulty. Each of the interventions is tailored to the individual patient, based upon the ongoing assessment using the Model of Bobath Clinical Practice (11), discussion within the group of therapists and individual treatment goals of the patient.

+24 hours in 4 weeks

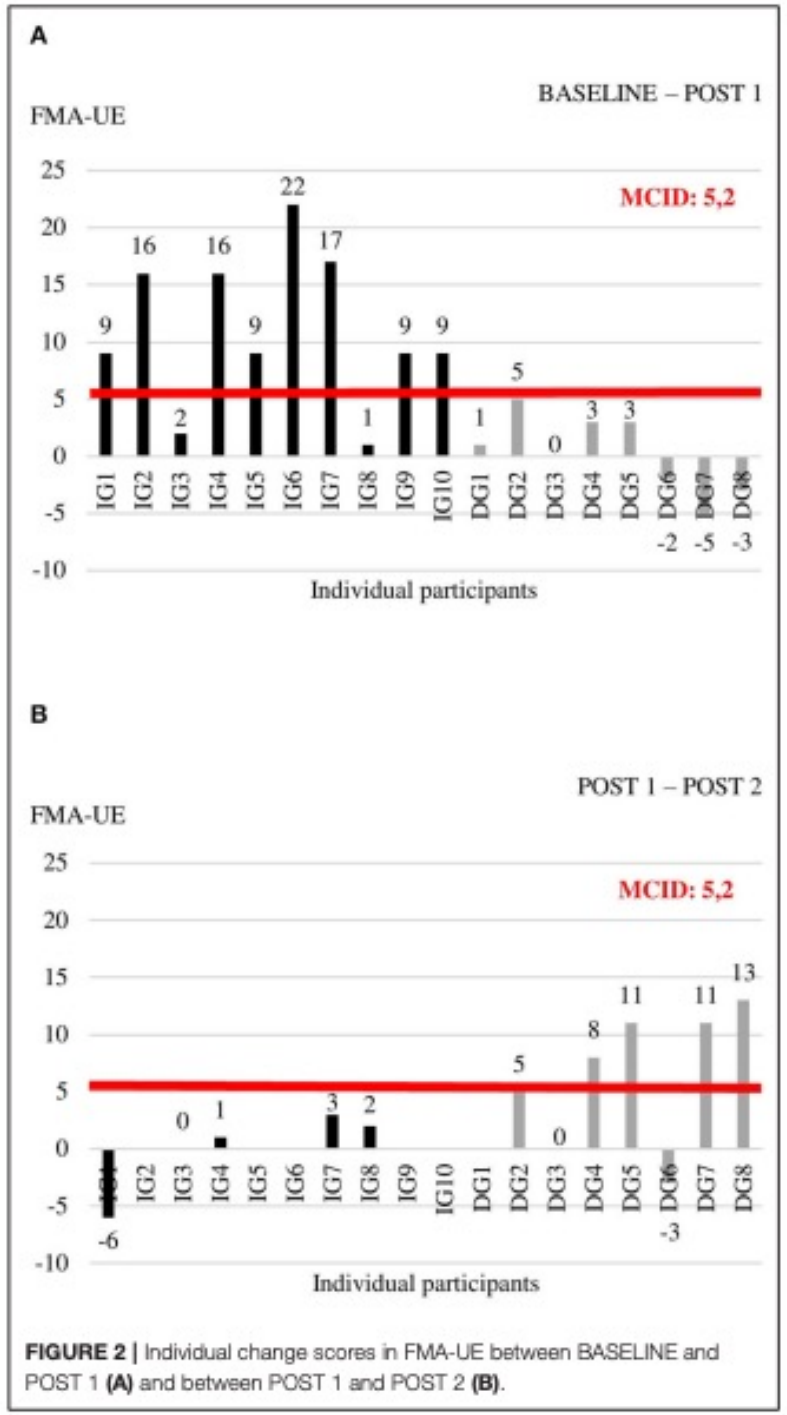


FIGURE 2 | Individual change scores in FMA-UE between BASELINE and POST 1 **(A)** and between POST 1 and POST 2 **(B)**.

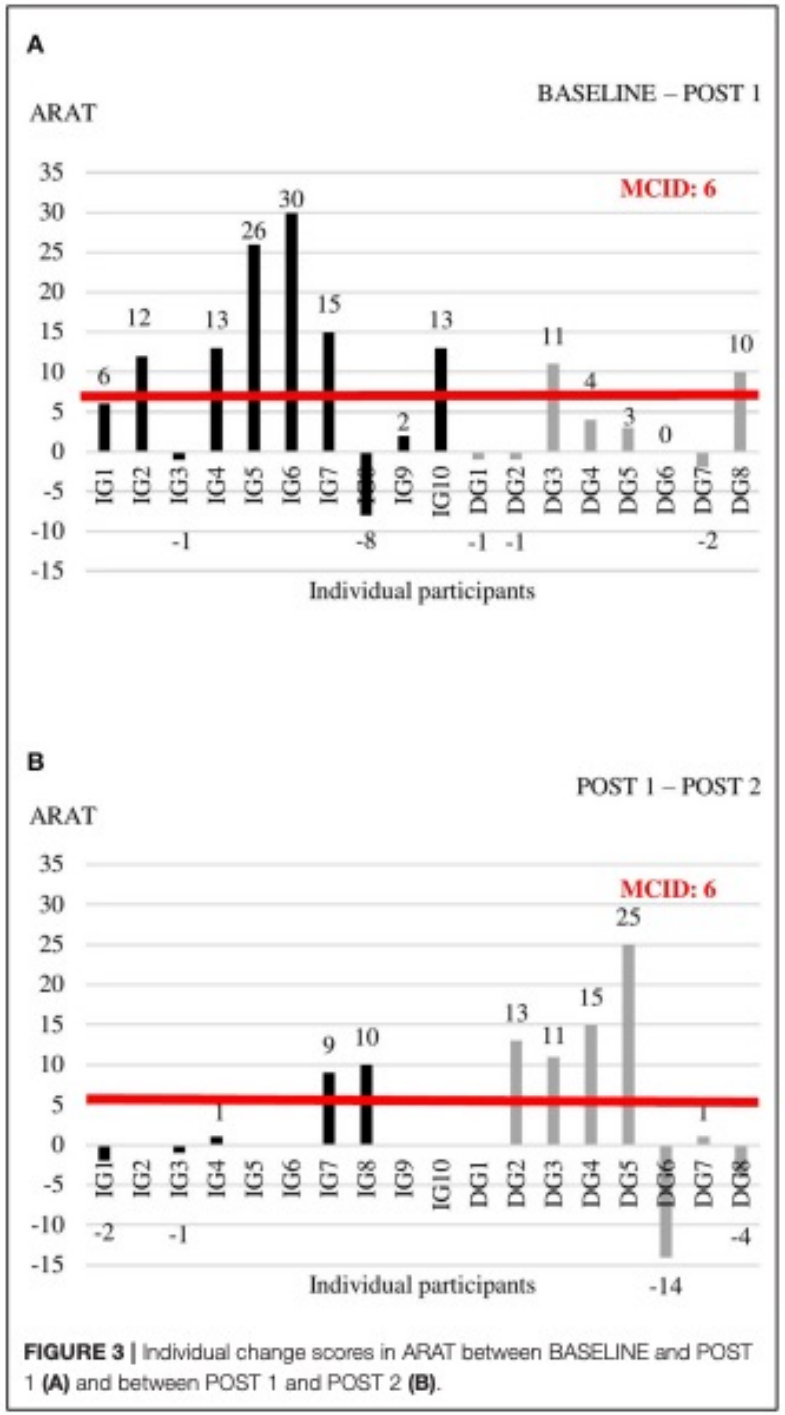


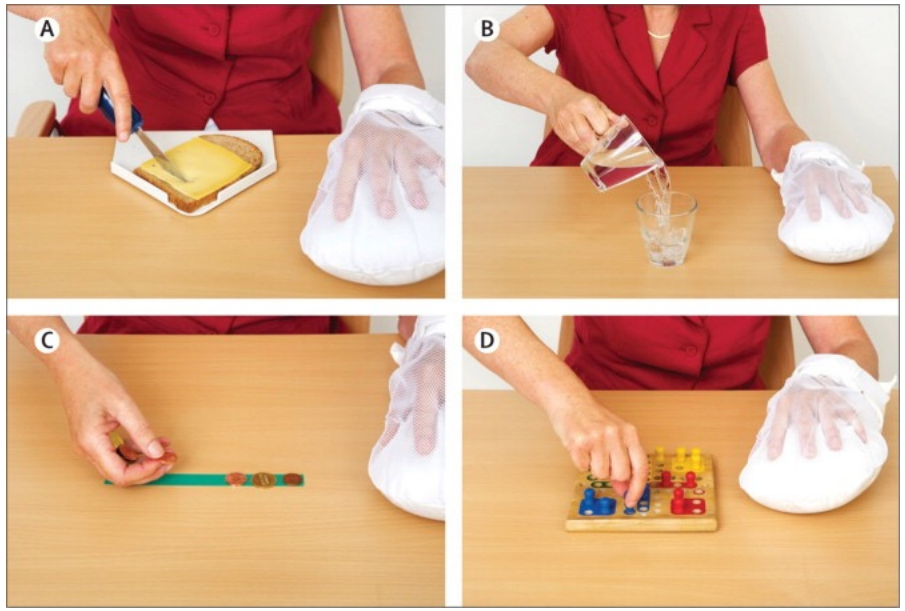
FIGURE 3 | Individual change scores in ARAT between BASELINE and POST 1 **(A)** and between POST 1 and POST 2 **(B)**.

Participants

Participants were recruited consecutively from the inpatient rehabilitation unit of Jessa Hospital, Rehabilitation Campus Sint-Ursula in Belgium between May 2019 and March 2020. patients were eligible for the study if they (1) experienced a first-ever unilateral, supra-tentorial stroke as defined by the World Health Organization (36), (2) were minimally 18 years old, (3) had a residual inpatient stay of minimally 4 weeks, (4) had the ability to sit independently, as defined as a maximal score of 25 on item 3 of the trunk control test (37), and (5) experienced motor impairment in the upper limb, as defined, based on the JSU diagram (10), as a score of 8–17 on stage 2 (synergies) of the FMA-UE (38), or a score of <8 on stage 2 of the FMA-UE, combined with a score of >6 on stage 5 (hand) of the FMA-UE. The exclusion criteria were: (1) musculoskeletal and/or other neurological conditions with permanent damage that may interfere with the study procedures or assessments, (2) subdural hematoma, tumor, encephalitis or trauma, with stroke-like symptoms, and (3) severe communication or cognitive deficits which could hamper the assessment.

Constraint-induced movement therapy (CIMT)

- Repetitive task-oriented training (6h)
- Wearing a mitt on unaffected UL (90%)
- Transfer package



- Post-intervention and **sustained effect** on **UL activity and PROM**
- Extension needed!

Improved outcome in chronic phase?

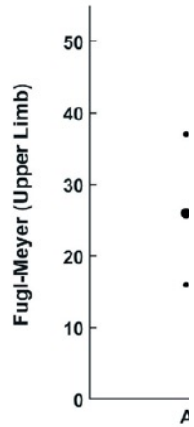
Cerebrovascular disease

RESEARCH PAPER

Intensive upper limb neurorehabilitation in chronic stroke: outcomes from the Queen Square programme

Nick S Ward,[1,2,3] Fran Brander,[2,3] Kate Kelly[2,3]

Prospective single-center cohort study
N=224
3-week UL boost
90 hours



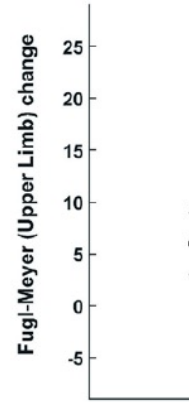


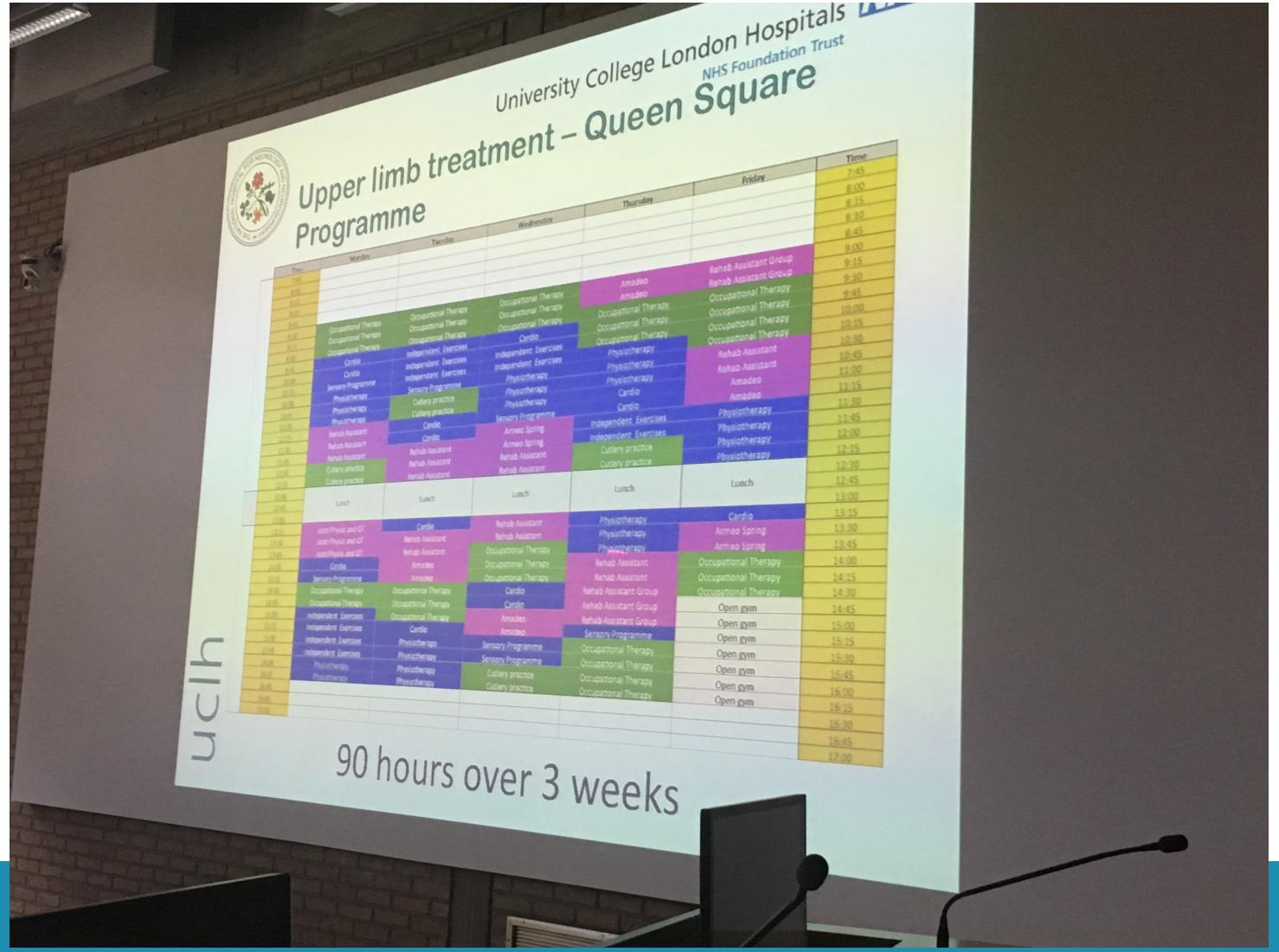
Table 3 Changes in upper limb scores

	Adm - Dis	Adm - 6 weeks	Adm - 6 months
FM-UL	6 (3 to 9)	8 (4 to 11)	9 (4 to 12)
ARAT	6 (2 to 8)	7 (2 to 10)	8 (3 to 11)
CAHAI	9 (5 to 13.5)	10 (5 to 16)	12 (6 to 17)
ArmA-A	–2 (–5 to –1)	–3 (–6 to –1)	–4 (–8 to –1)
ArmA-B	–7 (–14 to –3)	–10 (–17 to –4)	–11 (–19 to –5)

All scores given as median (IQR).
ARAT, Action Research Arm Test; ArmA-A, Arm Activity Measure A; ArmA-B, Arm Activity Measure B; CAHAI, Chedoke Arm and Hand Activity Inventory; FM-UL, Fugl-Meyer (upper limb).

Figure 1 (weeks and 6 month nd admission to 6 months postdischarge. Scores are shown for modified FM-UL, ARAT and CAHAI. Median (solid line) and upper and lower quartiles (dotted lines) are shown. ARAT, Action Research Arm Test; CAHAI, Chedoke Arm and Hand Activity Inventory; FM-UL, Fugl-Meyer (upper limb).

Content of the program?



Ward et al.
ULSRSS
Leuven
Sep 2018

“Black box” of UL stroke therapy

Nick Ward
NNR congress
Maastricht
May 2019

Dus...

Bovenste lidmaat

Intense en brede aanpak (hele arm)

Fase 3 studies

Take home messages

- Er zijn subgroepen van patiënten; bepaalde patiënten (met dezelfde karateristieken) voor wie een bepaalde therapie (het best) werkt

- We mogen ons niet laten (mis)leiden door fase 2 studies: ze zijn van belang maar niet om te bewijzen dat een therapie werkt

- Neurorevalidatie ondersteunt het individu in het bereiken van patiënt-gerelateerde doelen door intense therapie, coaching en zelf-management

KU LEUVEN

Revalidatie na beroerte: quo vadis?

Geert.Verheyden@kuleuven.be