



Concise Arm and Hand Rehabilitation in Stroke **CARAS**

A practical and evidence-based framework
for
arm-hand rehabilitation management

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Introduction



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Field of interest: clinical management of arm-hand rehabilitation in stroke with a special interest in stroke survivors suffering from a moderately to severely impaired arm and hand in sub-acute stroke phase.



impaired arm hand in post-stroke rehabilitation


Practical considerations

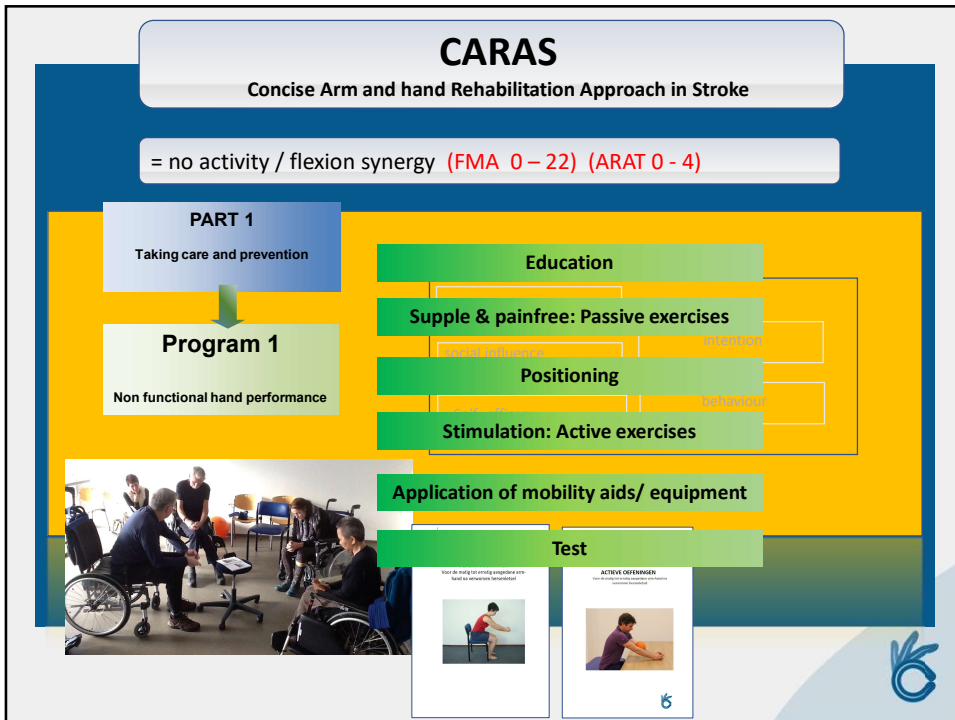
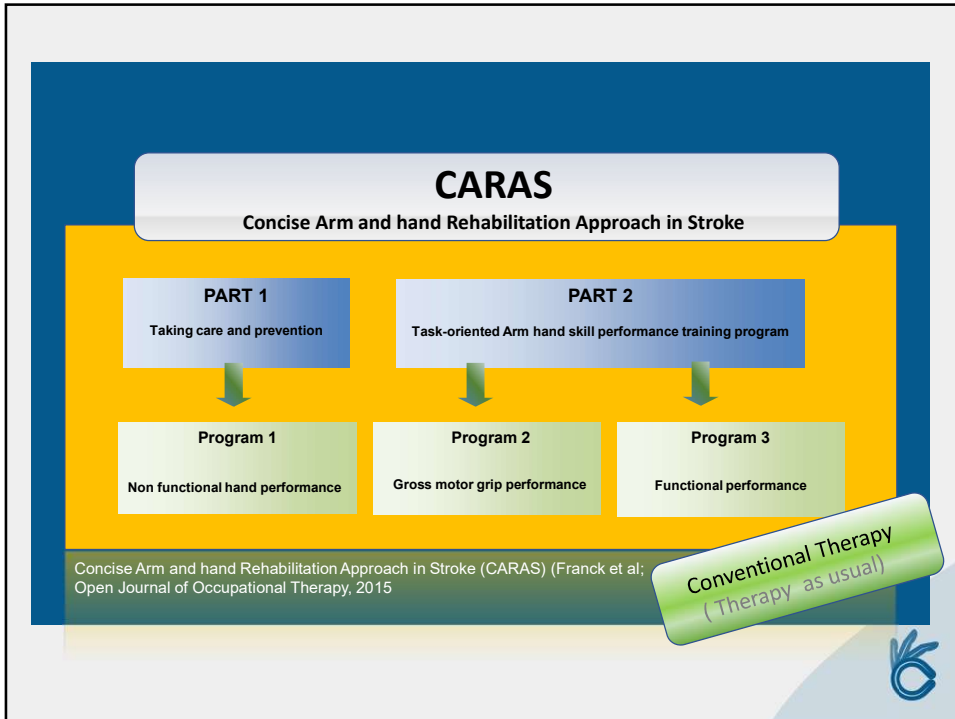
1. **Heterogeneity** population and associated patterns of recovery of arm-hand skill performance
2. **Lack of the patient's involvement** in arm and hand training
3. **Difficulties to implement** new developments swiftly in daily practice
4. The **lack of adequate description** and adaptation of arm hand rehabilitation paradigms for stroke survivors



4 solutions

1. **Stratify** patients with an impaired arm and hand into **different levels of dexterity**
2. Using **self-efficacy principles to overcome the lack of** the patient's **engagement towards** arm-hand treatment and **arm-hand performance**
3. **Easy to replace** modularly-built trainings schedules fitted in time blocks **to adopt new insights** into clinical practice
4. **Well-described** (no protocolled) program containing **stepwise, comprehensible procedures**, fitting 80% of the stroke rehabilitation population






CARAS
Concise Arm and hand Rehabilitation Approach in Stroke


PART 2
Task-oriented Arm hand skill performance training program

Program 2
Gross motor grip performance




first distal selectivity flexion wrist / extension wrist (FMA 23 – 52) (ARAT 4 – 42)

Program 3
Functional performance



suitcase grasp/cill. grasp/tweezers grasp - clumsy hand (FMA 52 – 66)(ARAT 42 – 57)



CARAS
Concise Arm and hand Rehabilitation Approach in Stroke

Patients perspective:


Program 2
Gross motor grip performance

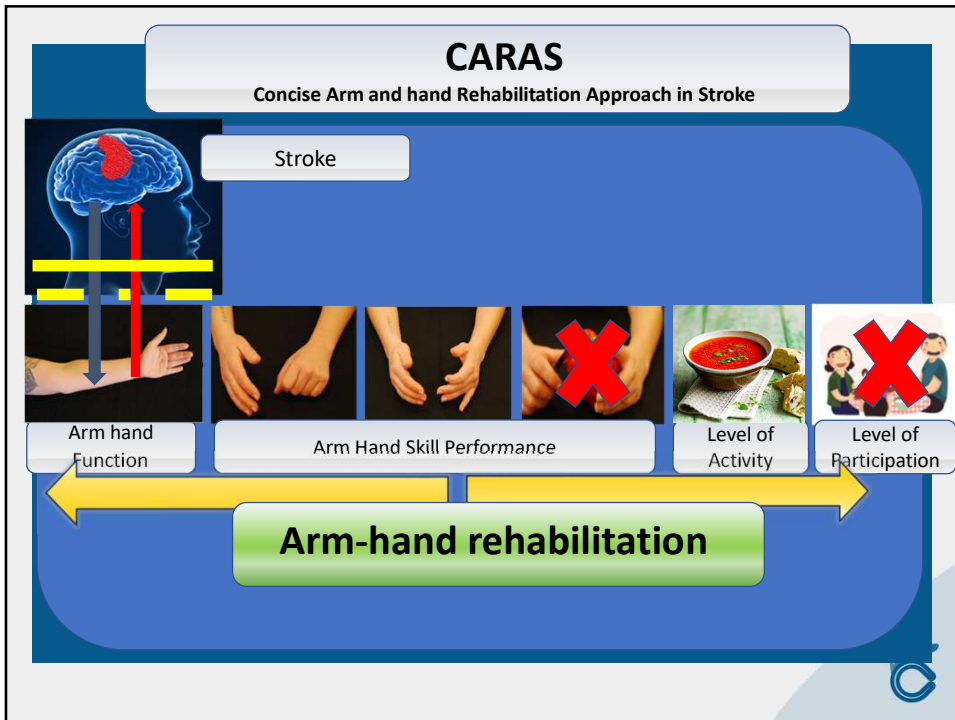
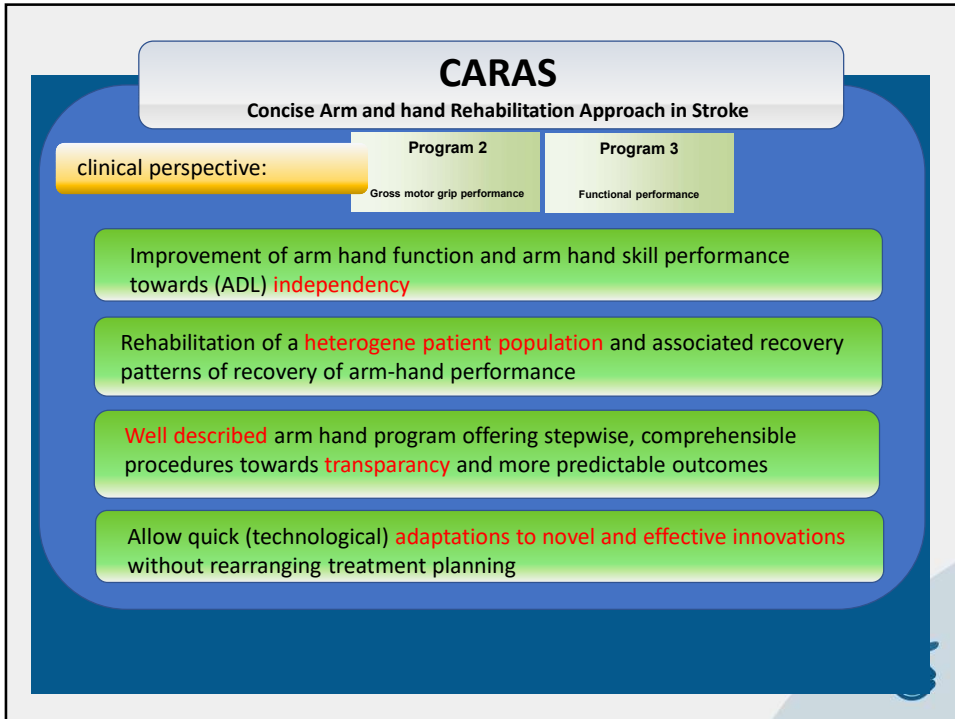
Program 3
Functional performance

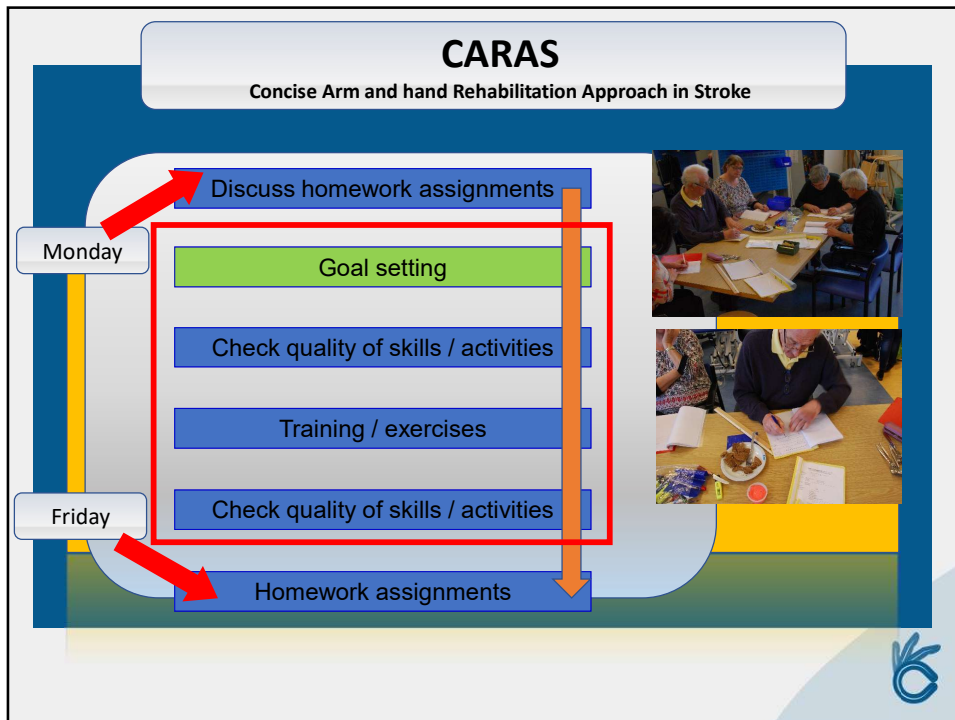
Improvement of arm hand function and arm hand skill performance towards (ADL) **independency**

Increase of **self-perceived** arm-hand **skill performance** in daily tasks outside clinical setting

Participate in society and fulfill sociale roles as needed







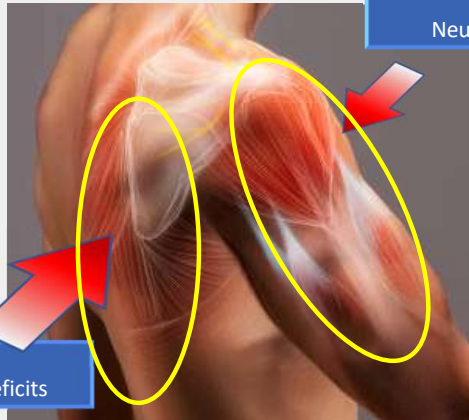
Example CARAS program 3 / pulling blankets

Program 3

Functional performance

Monday 9:30 AM pre-session

shoulder issues **in post-stroke phase**
 primarily affected versus secondary affected



primarily
Neurologic deficits

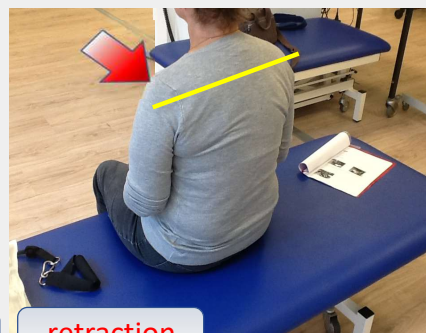
secondary
Biomechanical deficits



Optimal shoulder movements
Analysis short version/shoulder



depression



retraction



analysis shoulder in post stroke phase

Schouder revalidatie na Centraal Neurologische Aandoening
Werkblad: analyse en interventie

Skill performance

Strategies used to accomplish the task

Assessment of active range of motion


Assessment of shoulder & scapula position at rest

Scapulo-thoracic movement pattern

Limitation in passive ROM

Muscle performance deficit




Stretch exercises / manual techniques to restore shoulder adaptability



Glenohumeral muscles:
Active exercises to restore joint alignment and prevent translation of humeral head

Scapular muscles:
Active exercises to restore scapula stability, upward rotation and posterior tilt

Movement control & positioning:
Active exercises to restore stability throughout the kinematic chain

Reduced mobility in thoracic or cervical spine

Pulling blankets. Succes not +/- almost

Hyperext thoracal- handgrip --

Act antefl +/- , a abd +/- , a add +/- , exorot - ,

Elevation, Anterior tilt, inferior rotation / LSST pos

scapthor ritm -- / SAT positive


Yes, ghl: anterior side capsula, scap-thor: hyperresistance towards endorotation (subs-scap – latt dorsi)

Yes total movement chain

Stretch anterior GHL . Latt dorsi

scapular / glenohumeral exo and total movement chain training

rolstoel met > actieve zit en lumbaalsteun



CARAS workbook program 2 & 3 example

CARAS
Voorbeeld van een hand revalidatiepakket in de vorm van een workbook

PART 1

PART 2

PART 3

WORKBOOK
Arm and hand rehabilitation

Name: _____ Date of birth: _____
Patient number: _____ Start date: _____

Diagnose: ischemic infarct left side
 hemorrhagic infarct right side
 embolic other

Hemiplegic: right side left side
 other

Distance: _____
Date of injury: _____

Comorbidity: anxiety hypertension
 diabetes mellitus coronary disease
 mobility problems other

Treatment: physical therapist occupational therapist
 other

Home situation: _____

Identified to: Program 1 Program 2 Program 3

Approach: _____

CARAS arm en hand revalidatiepakket / Workbook

Week activity

Week of participation: 1 2 3 4 5 6

Activity: **Pull blankets**

Underlying (core) problem: **Strength scap/glenoh/...
Propriocepis/ bodymap/...**

Goal related exercises:
(regular exercises at page 11)

1. stretch exercise 11b
2. scapular exercise 1a
3. kinematic chain exercise 6
4. functional strength task

Goal Rating


Monday: 0 5 10

Wednesday: 0 6 10


Friday: 0 _____ 10

Oefening 7

1. Plaats de hand naast het bovenbeen en pak het lakken vast.



2. Trek het lakken naar achteren door de arm naar achteren te bewegen. Het lakken moet nu achter de achterkant van de heup zitten.



Algemene oefening
Alle rechten voorbehouden.

CARAS / program 3 / suggestions for training

Exercises (examples)

Task-specific

1 Scap_stab_ex1 2 Scap_stab_ex2 3 Glenohum_ex1 4 Glenohum_ex2

5 Functional_ex1 6 Functional_ex2 7 Functional_ex3 8 Task-specific

Optimal shoulder movements
suggestions for **Training at function level**

Exercises (examples in workbook)

Stretch exercises

Oefening 1a

1. Laat met beide armen in voorste zijde positie staan. Houdzijde naar achteren.
2. Probeer tijdens het inademen de borst naar voren te bewegen (verwijdt de handvaten deels/fully naar buitenwaarts-rijzen).

Oefening 1b

1. Zet de handen tegen de lenden of heupen.
2. Beweeg het hoofd vóórwaarts. Laat de romp inelkaar hangen. Zet het hoofd naar het achteren. De nek mag (aanvullend) van de schouder en de rug worden losgemaakt.

Oefening 1c

1. Laat de arm en hand hangen. De nek mag worden losgemaakt aan de achter- en voorzijde van de schouder.
2. Laat de arm en hand hangen en neem het gewicht over. De nek mag worden losgemaakt aan de achter- en voorzijde van de schouder.

Alternatieve oefening: Plaats een voet aan kussende onder de borstspaan.

Scapulothoracal exercises

Oefening 1a

1. Doe van hand richting voor vast.
2. Druk tijdens deze beweging uw hand naar buiten. Het is deze positie 2 seconden vast.

Oefening 1b

1. Sta rechtop, en zo recht mogelijk.
2. Doe rug met beide armen het vlak naar voren.
3. Trek met beide armen het vlak naar u toe. Blijf ontspannenrecht staan.

Oefening 1c

1. Plaats de hand in het handvat van de kastrol. Streef vervolgens de arm naar voren.
2. Streef vervolgens de arm zo ver mogelijk uit, door met de hand naar de binnenkant.
3. Indien mogelijk, draai de hand naar buiten tenzij de arm gestrekt is.

Optimal shoulder movements

suggestions for **Training at function level**

Exercises (examples in workbook)

Glenohum exercises

Oefening 7b

- Laat de hand (met licht gewicht) rusten op de bank. Beweeg de hand in beide richtingen naar de bank. Beide schouders die de aflechting vormen houden met de ondergrond tijdens de oefening.

Oefening 4b

- Zit rechtop. Laat de boedem van de fles (dwaelt gevuld) rusten op de anti-slip mat. Beweeg de fles vervolgens van links naar rechts.

Kinetic chain exercises

Oefening 1a

- Hou de arm gestrekt op de tafel.
- Laat de hand langzaam over de tafel glijden.

Oefening 2

- Transporteer de ballen één voor één vanuit de dichtstbijzijnde gewaardeerde kant naar een forsetje, zonder weg te gaan van de vloer.

Oefening 3a

- Hou de wandelstok ontspannen vast.
- Strek de arm.
- Draai de arm naar buiten en naar binnen.

Oefening 8


- Pak de stok ontspannen vast.
- Til de stok op plaats deze over het gewricht. Herhaal deze beweging tot het einde van de stok is bereikt.

Alternatieve oefening:


Example CARAS program 3 / pulling blankets

Monday, 45 minutes post- session


11




Example CARAS program 3 / pulling blankets



Friday morning 10.30 AM post session





CARAS module based group training (generalisation towards other, untrained tasks)

Program 2
Gross motor grip performance

Program 3
Functional performance

Easy
Medium
Hard

50 exercises with a chair

Glass race

Build a tower with plastic coffee cups

A soft boiled egg

50 exercises with a towel

Tax
Rebate or debt

Fold an airplane

Having lunch
During flight

Hooverball


Packing presents

Groceries

Handle
A coffee cup

Handle
A cardboard box

Have a drink
In the pub



CARAS module based group training
(generalisation towards other, untrained tasks)

	Program 2	Program 3
Have a drink In the pub		
Handle A cardboard box		
Lunch During the flight		

(based on analogy learning principles)




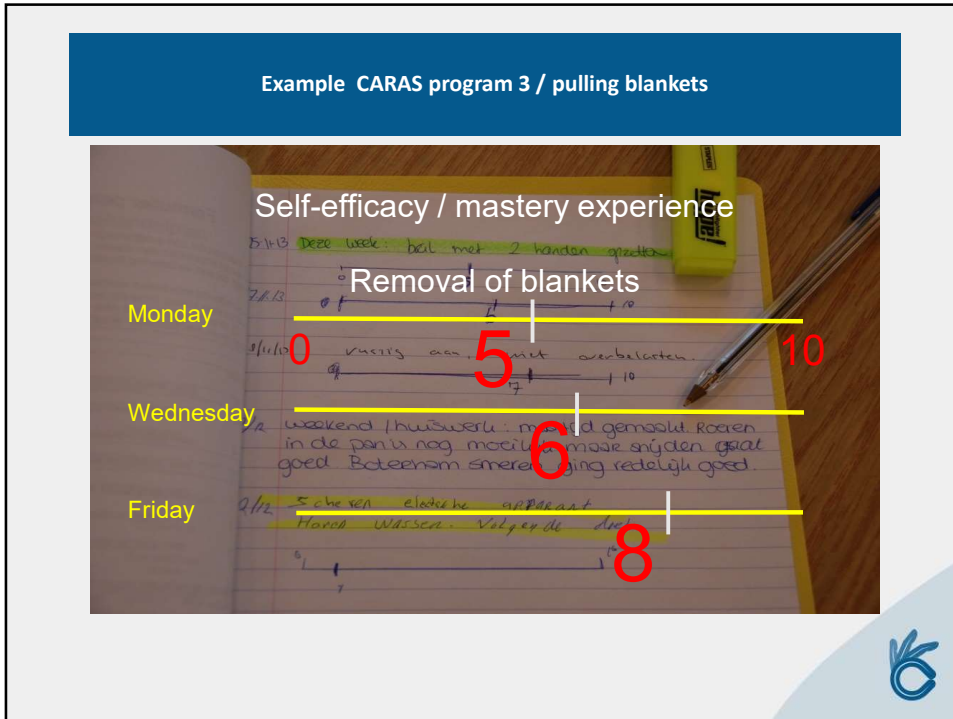
Principles of Self-Efficacy

empowering stroke patients in regaining full potential of their affected hand

1. Recognize improvements in task performance; (mastery experience)
2. Observe and learn from improvements made by peers; (vicarious experience)
3. Being encouraged or persuaded and ignore less successful performance;
(verbal, social persuasion)
4. Experience improvements in arm hand skill performance and arm-hand
function; (changes in physiological state)

Bandura, 1994; Jones et al., 2006; Korpershoek, 2011



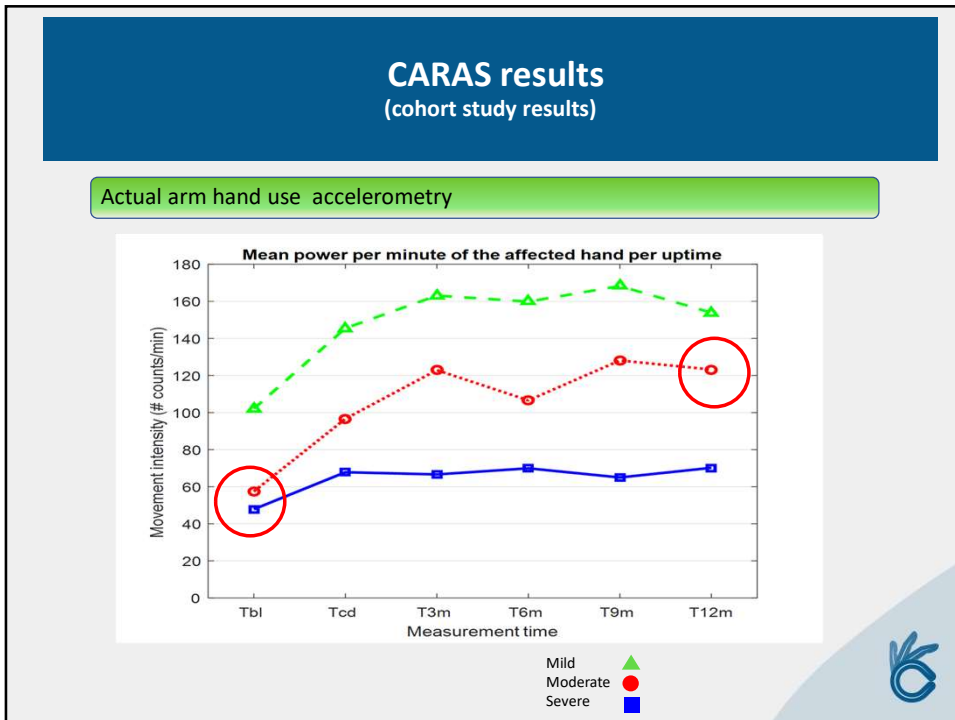
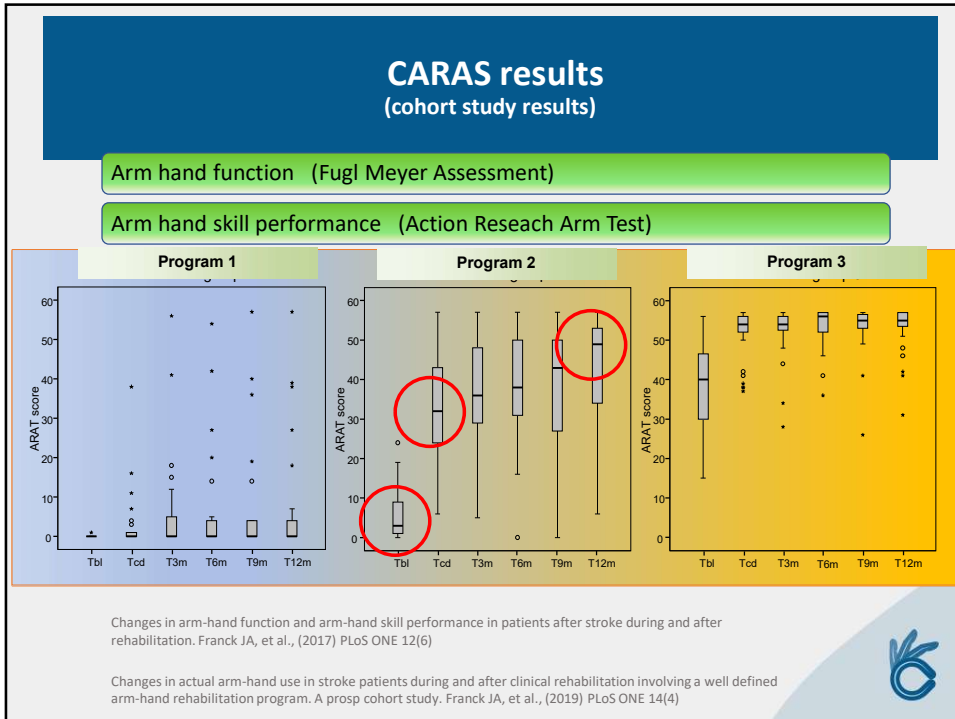


CARAS results (cohort study)

- 1
Arm hand function (AHF)
significant improvements on AHF AHSP and perceived performance in mildly and moderately impaired arm hand
- 2
Arm hand skill performance (AHSP)
significant improvements during and after (1 yr) follow-up
- 3
Self perceived performance
significant improvements on actual arm hand performance mildly and moderately impaired arm hand
- 4
Actual arm hand use
significant improvements on actual arm hand performance mildly and moderately impaired arm hand


Changes in arm-hand function and arm-hand skill performance in patients after stroke during and after rehabilitation. Franck JA, et al., (2017) PLoS ONE 12(6)

Changes in actual arm-hand use in stroke patients during and after clinical rehabilitation involving a well defined arm-hand rehabilitation program. A prosp cohort study. Franck JA, et al., (2019) PLoS ONE 14(4)



low-cost functional technology / pharmacological interventions embedded in CARAS

Hand orthoses



FES



BoNT / ESTW





Robotics integrated in CARAS

Program 2 Gross motor grip performance

Program 3 Functional performance

Analysis Content arm-hand training / example robotics

Back to task-specific training




CARAS CONSORTIUM



A collection of logos for various organizations within the CARAS Consortium, including: **Rijndam** (Revalidatie), **Amaris** (Zorggroep), **Bravis** (ziekenhuis), **norschoten** (van hart tot hart), **ZMW** (zorggroep seni & jong), **basalt** (De werks en revalidatie), **merem** (rehabilitatie), **vogellanden**, **klimmendaal** (revalidatieopstellingen), **Sint Maartenskliniek**, **De Hoogstraat** (Revalidatie), **adelante** (voel het beste uit jezelf), and **HANDSKILLS**.



Caras international




Four international locations are highlighted with maps and photos:

- India:** Shows a map of India with a photo of a group of people in front of a building. Includes the **LiveWell** logo (Enhancing Lives) and the text "Chennai" and "poovanthi".
- Italy:** Shows a map of Italy with a photo of a group of people. Includes the logo for **AZIENDA SANITARIA LOCALE N. 2 SAVONESE**.
- Nepal:** Shows a map of Nepal with a photo of a person. Includes the **NEPAL MEDICITI** logo (For a Healthy & Prosperous Nation) and the text "shoulder gousse".
- Belgium:** Shows a map of Belgium with a photo of a group of people. Includes the logo for **SAINTE-LUC UCL BRUXELLES** and the **noorder hart** logo.



CARAS versus GRASP		
	GRASP	CARAS
Level of content	<p>Improving hand function and strength</p> <p>Education towards arm hand exercises post discharge</p> <p>No technology assistive devices</p>	<p>Improving self perceived armhand skill performance and actual arm-hand performance</p> <p>education towards exercises to maintain a certain level of arm hand performance outside clinical setting</p> <p>Technology assistive devices incorporated (facultative)</p>
Organisational level	<p>Individual - independently</p> <p>3 levels (FMA 10 – 25 / 26 – 45 / 46 – 58) (wrist extension)</p> <p>Protocol-based (?) adjusted to needs</p> <p>Behavioural contract</p> <p>International operational / 2 versions Hopsital Grasp and home Grasp</p>	<p>Groupwise - individual - independently</p> <p>3 levels (FMA 0 – 22 / 23 – 42 / 46 - 66 (no wrist extension)</p> <p>Stepwise guideline adjusted to needs</p> <p>No contract</p> <p>International operational / 3 versions (hospital caras , elderly rehab caras , private practice - home based practice caras)</p>



Questions
&
thank you for your attention

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