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1

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Concise Arm and Hand Rehabilitation Approach in Stroke (CARAS)

a practical and evidence-based framework for clinical rehabilitation management

Version **7**

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volwassenenrevalidatie | kinderrevalidatie | audiologie | speciaal onderwijs | arbeidsreïntegratie

2

Goal setting

Problems experienced

Patient's goal:

'Upcoming weekend, I am capable to use the deodorant during my ADL session in a comfortable way'

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3

Monday 9:00 AM first session

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Hypothetico Deductive Examination

- Which underlying assumptions can be made about: *'why'* the activity has not been performed correctly?

She is not satisfied about the way she manipulate the deordorant because of:

1. …..coördination?
2. …..praxis?
3. …..strength?
4. …..mobility?
5. …..planning?

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Monday post session 10:00 AM

adelante

Friday week 1: 10:00 AM

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Goal setting

Problems experienced

Patient's goal:

'Next Friday, I want to remove the blanket as easy as possible using my affected hand.

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8

Monday 9:30 AM pre-session

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Hypothetico Deductive Examination

- Which underlying assumptions can be made about: *'why'* the activity has not been performed correctly?

She is not satisfied about the way she removes the blanket because of a lack of:

1. …..strength?
2. …..perception?
3. …..motor program?
4. …..coordination?
5. …..

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Monday, 45 minutes post- session

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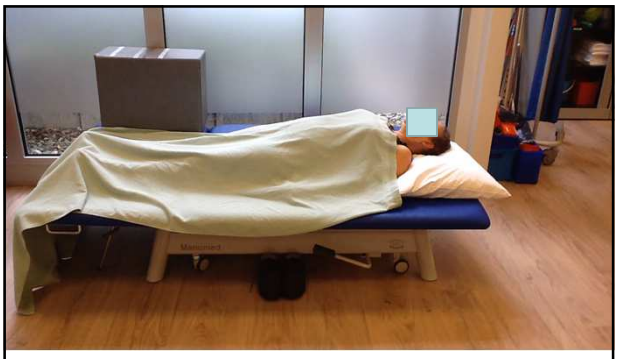
Friday morning 10.30 AM post session



Friday morning 10.30 AM post session

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Introduction

- Task-oriented train
- Intensive en re ining
- Meaningfu
- Challe
- S
- t

effective + efficient

(pt guide

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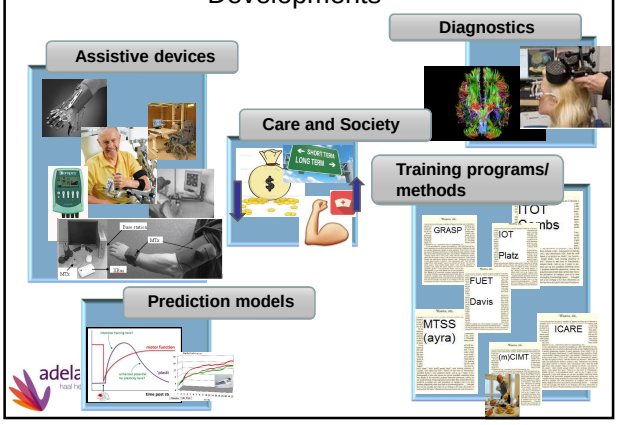
Developments



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 treatment protocols for stroke survivors experiencing a broad variety of problems in daily life related to an impaired arm-hand.

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16

4 solutions

1. Stratify patients with an impaired arm and hand into different levels of dexterity
2. Lack of the patient's engagement towards arm-hand treatment may be overcome by using self-efficacy principles
3. Easy to replace modularly-built trainings schedules fitted in time blocks
4. Well-described program containing stepwise, comprehensible procedures fitting 80% of the stroke rehabilitation population

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Concise Arm and Hand Rehabilitation Approach in Stroke

(CARAS)

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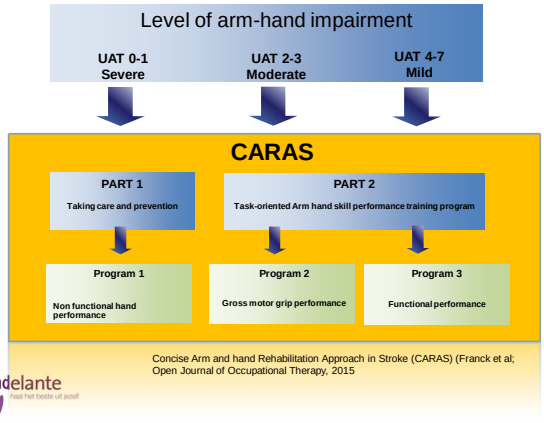

Concise Arm and hand Rehabilitation Approach in Stroke (CARAS) (Franck et al; Open Journal of Occupational Therapy, 2015

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Classification of arm-hand impairment level

Utrechtse Arm hand Test (UAT)

- Non-functional [illegible] tivity in arm and hand) (score: 0)
- Flexion [illegible] (score: 1) 20
- F[illegible] selectivity, (palmair flexion wrist) (score: 2)
- Dorsal flexion fist and wri[illegible] (score: 3) 40

No dexterity

Severely impaired
Taking care and prevention

Moderately impaired
Gross motor grip performance

- Suitcase grasp (score: 4)
- Cylinder grasp: (score: 5)
- Tweezers grasp: (score: 6)
- Clumsy hand: (score: 7) 66

Mildly impaired
Functional performance

Kruitwagen-van Reenen ET, Post MW, Mulder-Bouwens K, Visser-Meily JM. A simple bedside test for upper extremity impairment after stroke: validation of the Utrecht Arm/Hand Test. Disabil Rehabil 2009;31:1338-43

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Inclusions vs Exclusions

Inclusions:

- Clinically diagnosed with central paresis of the arm/hand at entry of the program (UAT 0 – 7)
- Ability to control sitting posture
- Medically stable

Exclusions:

- Patients with severe cognitive and/or behavioural disorders (i.e. not able to function in group-wise situations);
- Patients who are not able to control sitting posture;
- Inter-current medical problems , i.e. inflammations, open wounds;
- Patients with complex secundary arm-hand problems, like: severe edema and inflammations in shoulder region.

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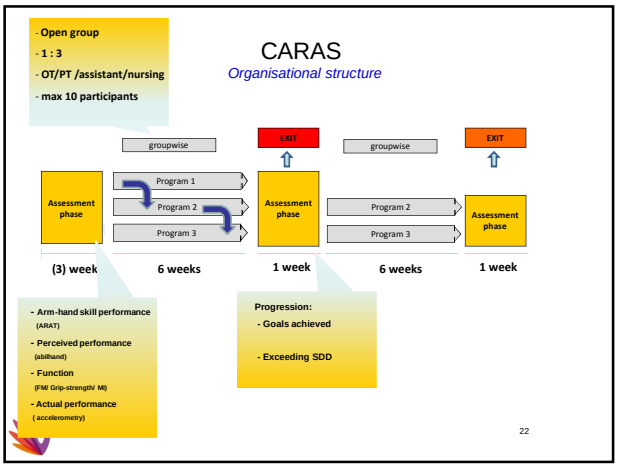
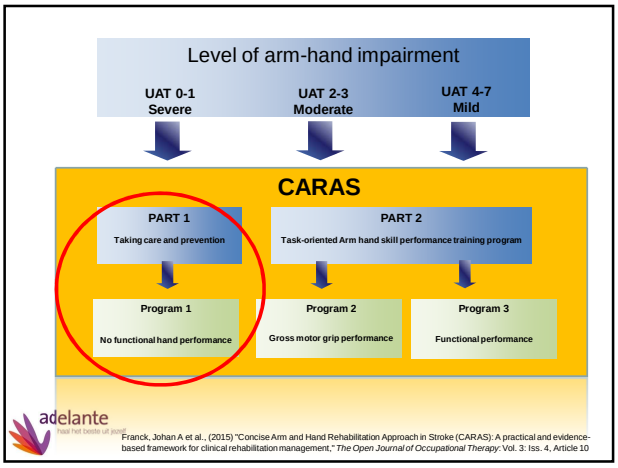

- Open group
- 1 : 3
- OT/PT /assistant/nursing
- max 10 participants
CARAS
Organisational structure
groupwise
EXIT
groupwise
EXIT
Assessment phase
Program 1
Program 2
Program 3
Assessment phase
Program 2
Program 3
Assessment phase
(3) week
6 weeks
1 week
6 weeks
1 week
- Arm-hand skill performance (ARAT)
- Perceived performance (abilhand)
- Function (FM/ Grip-strength/ MI)
- Actual performance (accelerometry)
Progression:
- Goals achieved
- Exceeding SDD
22


Level of arm-hand impairment
UAT 0-1 Severe
UAT 2-3 Moderate
UAT 4-7 Mild
CARAS
PART 1
Taking care and prevention
PART 2
Task-oriented Arm hand skill performance training program
Program 1
No functional hand performance
Program 2
Gross motor grip performance
Program 3
Functional performance
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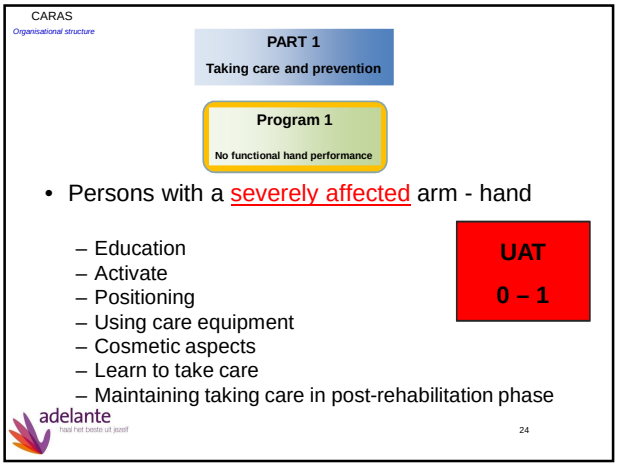
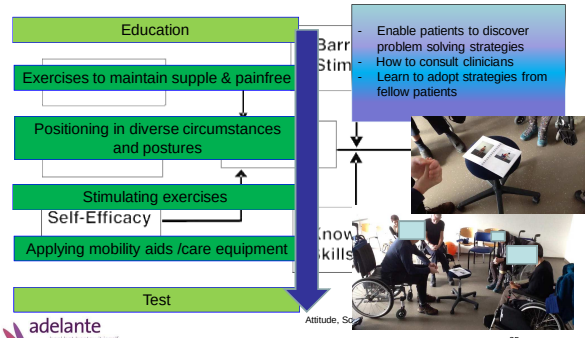
Franck, Johan A et al., (2015) "Concise Arm and Hand Rehabilitation Approach in Stroke (CARAS): A practical and evidence-based framework for clinical rehabilitation management," The Open Journal of Occupational Therapy: Vol. 3: Iss. 4, Article 10


CARAS
Organisational structure
PART 1
Taking care and prevention
Program 1
No functional hand performance
• Persons with a severely affected arm - hand
– Education
– Activate
– Positioning
– Using care equipment
– Cosmetic aspects
– Learn to take care
– Maintaining taking care in post-rehabilitation phase
UAT
0 – 1
adelante
24

program 1

organisational structure



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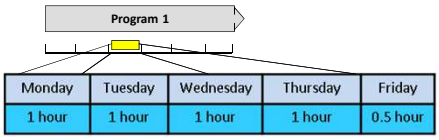
program 1

organisational structure



Frequency: 4.5 hour p/w Duration: 6 weeks

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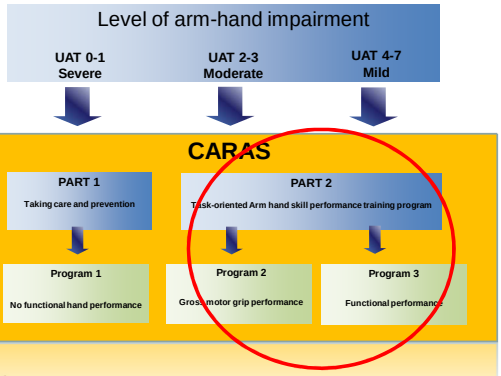

adelante

Franck, Johan A et al., (2015) "Concise Arm and Hand Rehabilitation Approach in Stroke (CARAS): A practical and evidence-based framework for clinical rehabilitation management," *The Open Journal of Occupational Therapy*: Vol. 3: Iss. 4, Article 10

CARAS
Organisational structure

Program 2
Gross motor grip performance

Program 3
Functional performance

- Participants with a moderately affected arm - hand function
  - Passive and active fixation
  - Gross motor grips
  - Simple (bi)manual activities
- Education
- Take care and positioning

UAT
2 – 3

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CARAS
Organisational structure

Program 2
Gross motor grip performance

Program 3
Functional performance

- Participants with a mildly affected arm – hand
  - Functional tasks in daily life situations in-situ
  - Manipulation
  - Complex (bi)manual activities
- Education
- Take care

UAT
4 – 7

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CARAS
Organisational structure

Program 2

Monday	Tuesday	Wednesday	Thursday	Friday
1.5 hour	1 hour	1.5 hour	1 hour	1.[illegible]

Start! **Finish!**

Frequency: **6.5** hours p/w Duration **6** weeks max: **12** weeks

Program 3

Monday	Tuesday	Wednesday	Thursday	Friday
2 hour	1 hour	2 hour	1 hour	2 hour

Frequency: **8** hours p/w Duration **6** weeks max: **6** (-12) weeks

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CARAS

program 2 + 3

Theoretical background

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Program 2

Gross motor grip performance

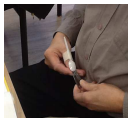
Program 3

Functional performance

Theoretical background

1. Principles of self-efficacy

2. (Intensive) task-oriented training method



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BREAK!

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CARAS
Theoretical background

Principles of Self-Efficacy

Speeding up self-efficacy to empower 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 fellow patients regarding task performance; **vicarious experience**
3. Being encouraged or persuaded and ignore less succesfull performance; **verbal, social persuasion**
4. Experience improvements in arm hand skill performance and arm-hand function; **changes in physiological state**

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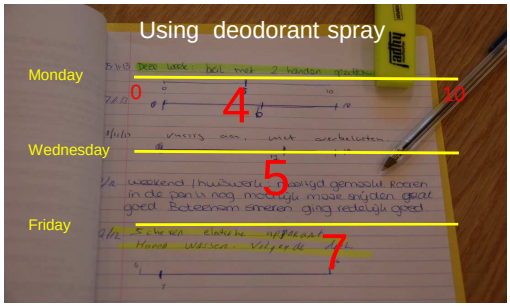
Bandura, 1994; Jones et al., 2006; Korpershoek, 2011

CARAS
Theoretical background

Mastery Experience

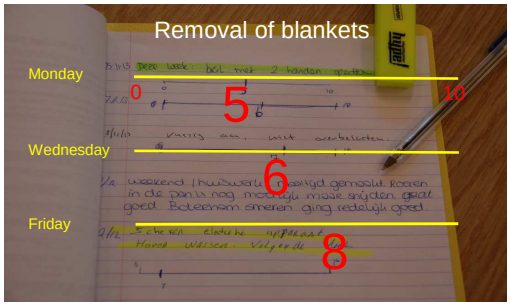


Identify small steps made towards goals. It is done by the patient herself which leads to a growing confidence and to maintain a positive trend regarding her perceived ability level.

Van Rossum, 2004

CARAS
Theoretical background

Mastery Experience



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CARAS
Theoretical background

Vicarious Experience

Observational practice can make unique and important contributions towards learning, especially when the observation is combined with physical practice.

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Shebliske et al., 1992

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CARAS
Theoretical background

PART 2

Task-oriented arm-hand skill performance training program

Program 2	**Program 3**
Gross motor grip performance	**Functional performance**

1. Individual goal setting and individual training
   towards a meaningful, attainable, functional task
2. Module-based group training
   generalisation towards other, untrained tasks

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Program 2	**Program 3**
Gross motor grip performance	**Functional performance**

Monday!

Discuss homework assignments

Goal setting

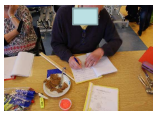
Check quality of skills / activities

Training / exercises

Check quality of skills / activities

Friday!

Homework assignments



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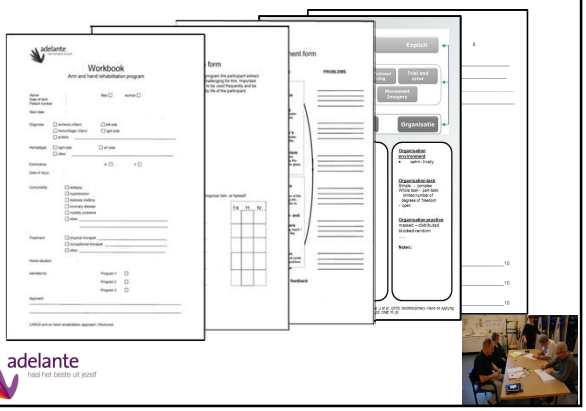
CARAS

Theoretical background

CARAS
Workbook



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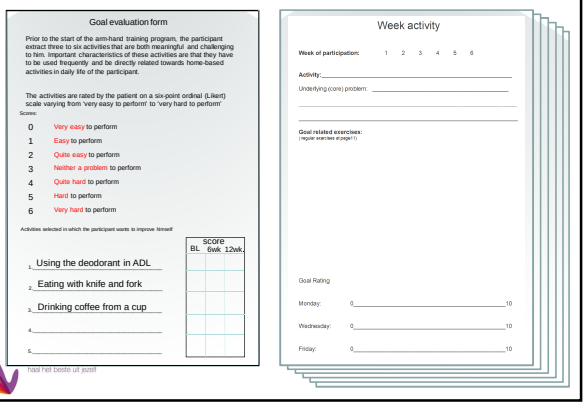
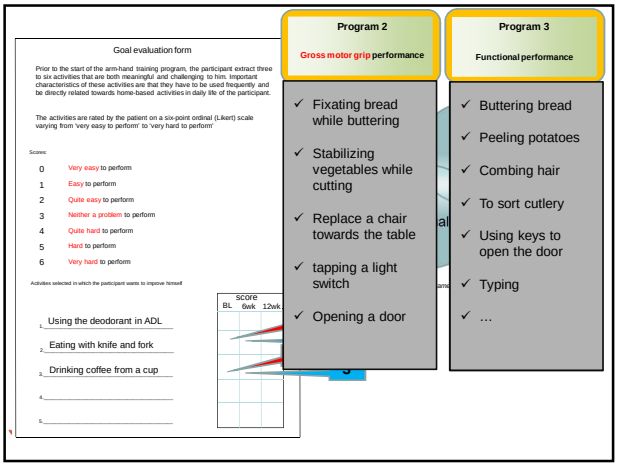
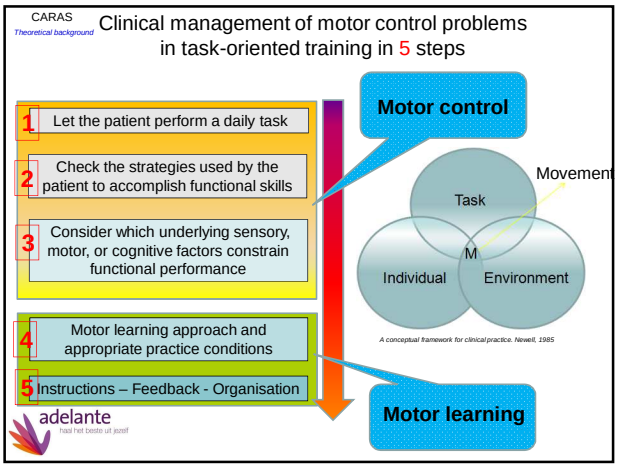
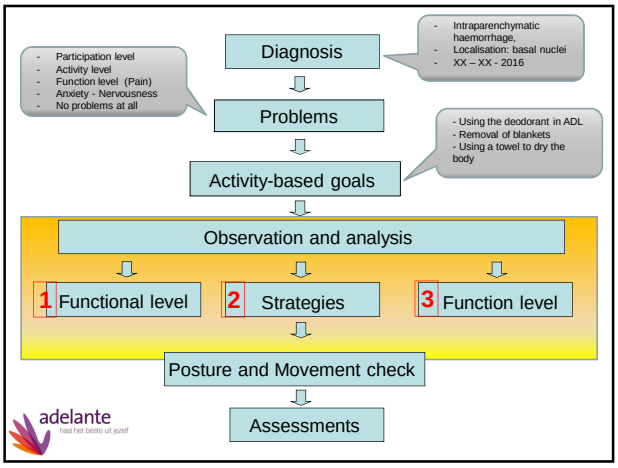
CARAS
Workbook






CARAS
Theoretical background
Clinical management of motor control problems in task-oriented training in 5 steps
1 Let the patient perform a daily task
2 Check the strategies used by the patient to accomplish functional skills
3 Consider which underlying sensory, motor, or cognitive factors constrain functional performance
4 Motor learning approach and appropriate practice conditions
5 Instructions – Feedback - Organisation
Motor control
Movement
Task
M
Individual
Environment
A conceptual framework for clinical practice. Newell, 1985
Motor learning
adelante


Diagnosis
- Intraparenchymatic haemorrhage,
- Localisation: basal nuclei
- XX – XX - 2016
- Participation level
- Activity level
- Function level (Pain)
- Anxiety - Nervousness
- No problems at all
Problems
- Using the deodorant in ADL
- Removal of blankets
- Using a towel to dry the body
Activity-based goals
Observation and analysis
1 Functional level
2 Strategies
3 Function level
Posture and Movement check
Assessments
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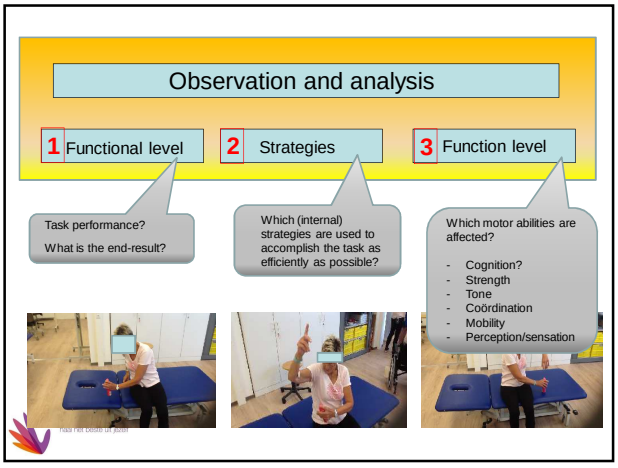
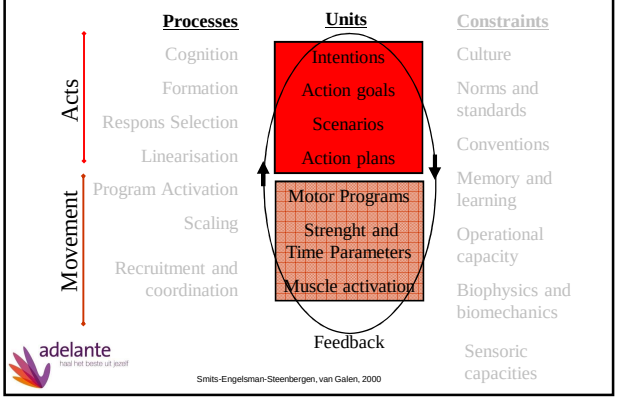
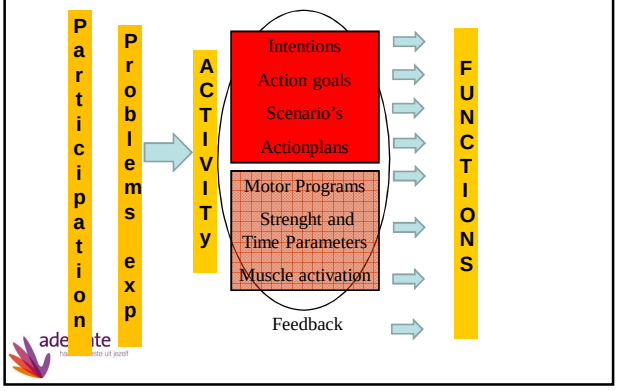

Observation and analysis
1 Functional level
2 Strategies
3 Function level
Task performance?
What is the end-result?
Which (internal) strategies are used to accomplish the task as efficiently as possible?
Which motor abilities are affected?
- Cognition?
- Strength
- Tone
- Coördination
- Mobility
- Perception/sensation

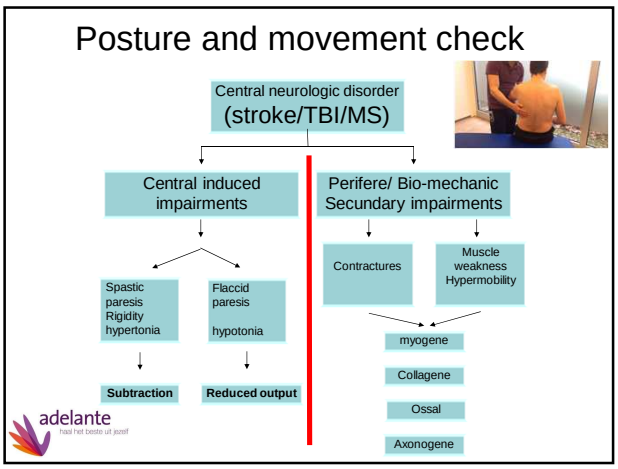
Action model of goal-directed movement

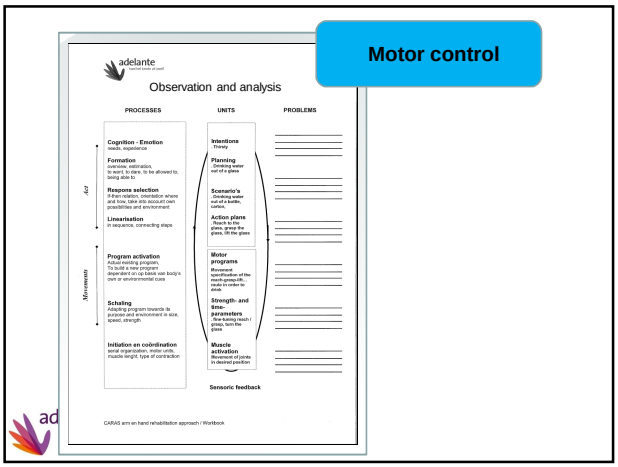


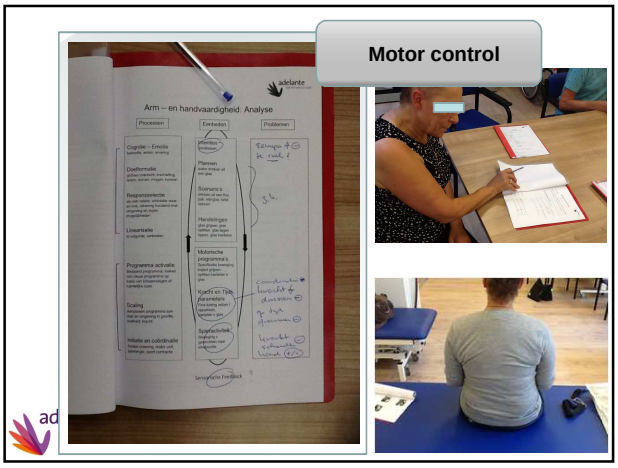
Proces-oriented movement



Posture and movement check




Motor control
adelante
Observation and analysis
PROCESSES
UNITS
PROBLEMS
Cognition - Emotion
Formation
Respons selection
Linearisation
Program activation
Schaling
Initiation en coördination
Intentions
Planning
Scenario's
Action plans
Motor programs
Strength- and time-parameters
Muscle activation
Sensoric feedback
CARAS arm en hand rehabilitation approach / Workbook


Motor control
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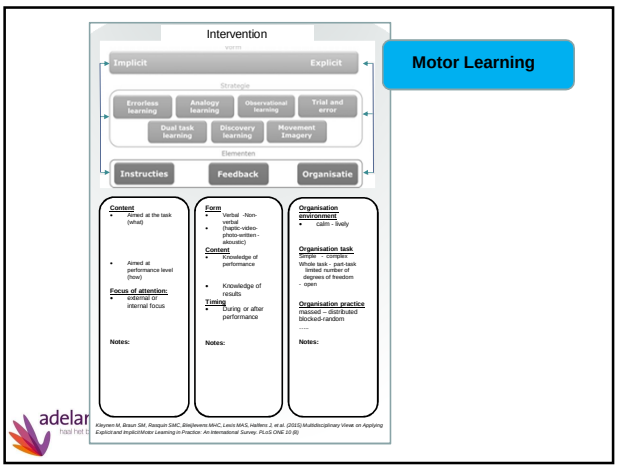
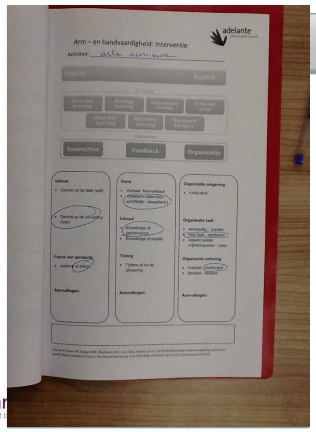
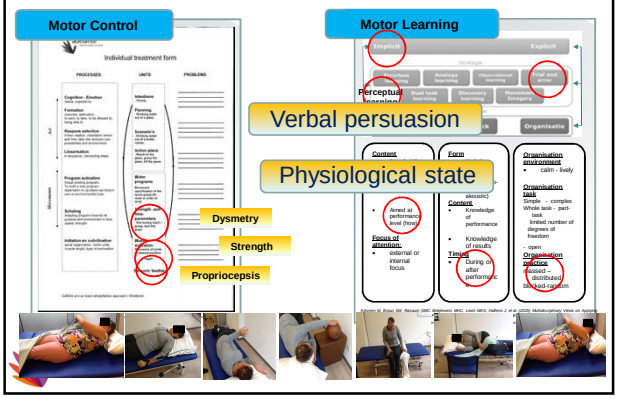
Arm – en handvaardigheid: Analyse
Processen
Eenheden
Problemen


Motor Learning
Intervention
Implicit
Explicit
Errorless learning
Analogy learning
Observational learning
Trial and error
Dual task learning
Discovery learning
Movement Imagery
Instructies
Feedback
Organisatie
Content
Focus of attention:
Notes:
Form
Content
Timing
Notes:
Organisation environment
Organisation task
Organisation practice
Notes:
Kleynen M, Braun SM, Rasquin SMC, Bleijlevens MHC, Lexis MAS, Halfens J, et al. (2015) Multidisciplinary View on Applying Explicit and Implicit Motor Learning in Practice: An International Survey. PLoS ONE 10 (8).



Motor Learning



Intervention

Example: removing blankets / week 1

Monday session

Scap_stab_ex1

Scap_stab_ex2

Glenohum_ex1

Glenohum_ex2

Functional_ex1

Functional_ex2

Functional_ex3

Task-specific

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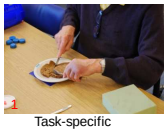
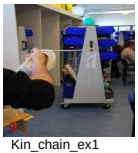
Intervention

Example: using knife and fork while eating / week 3

Monday session


Task-specific

carp_ext/fl_ex1


Kin_chain_ex1

Kin_chain_ex2

Functional_ex1

Functional_ex2

Task-specific

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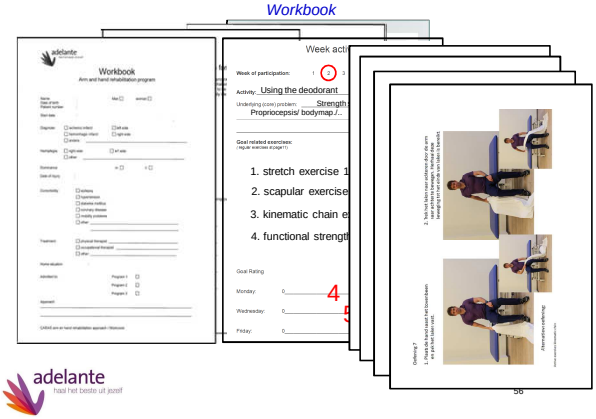
CARAS

Workbook



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CARAS

theoretical background

2. Module-based group training

generalisation towards other, untrained tasks

Program 2
Gross motor grip performance

Program 3
Functional performance

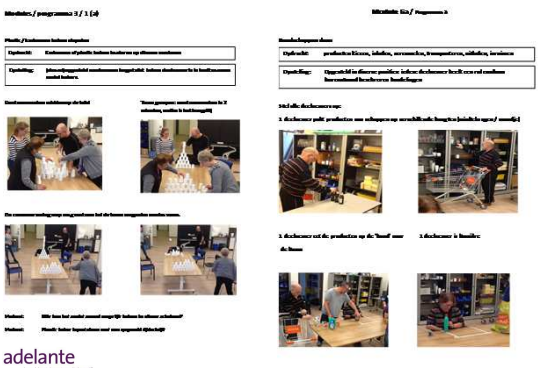
Easy — Medium — Hard

- 50 exercises with a chair
- 50 exercises with a towel
- Hooverball
- Glass race
- Tax — Rebate or debt
- Packing presents
- Fold an airplane
- Groceries
- Handle — A cardboard box
- Build a tower — with plastic coffee cups
- Handle — A coffee cup
- Have a drink — In the pub
- A soft boiled egg
- Having lunch — During flight

CARAS

theoretical background

Modules / program 3 / examples



adelante
haal het beste uit jezelf

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adelante
haal het beste uit jezelf

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haal het beste uit jezelf

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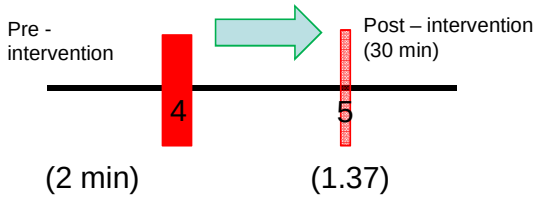
Results & Retention

adelante

Monday, 9.15 AM pre-session

Results & retention

Week 18/2016



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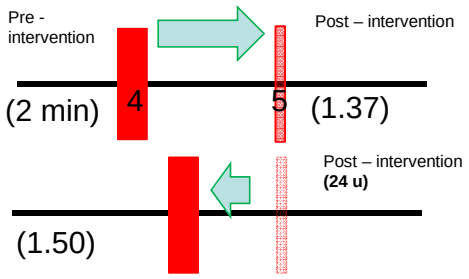
Results & Retention



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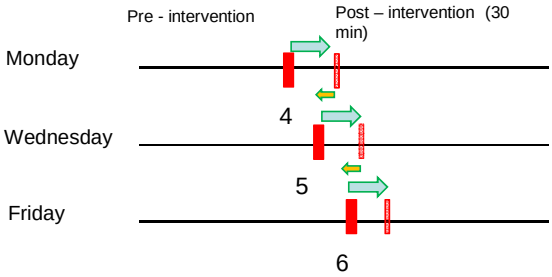
Results



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Results & Retention

adelante

Friday, 10.30 AM post-session

BREAK!

adelante

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Adoption and Implementation
of
new developments

adelante

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CARAS
adoption + implementation

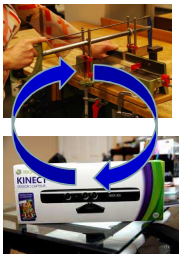
Implementation of new developments

Program 3

Monday	Tuesday	Wednesday	Thursday	Friday
2 hours	1 hour	2 hours	1 hour	2 hours

Wednesday
2 hours

60 minutes



adelante

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CARAS
adoption + implementation

(m) Constraint-induced Movement Therapy

Program 2

Monday	Tuesday	Wednesday	Thursday	Friday
1.5 hours	1 hour	1.5 hours	1 hour	1.5 hours

Program 3

Monday	Tuesday	Wednesday	Thursday	Friday
2 hours	1 hour	2 hours	1 hour	2 hours

adelante
haal het beste uit jezelf

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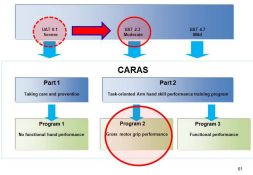
A low-cost functional hand orthosis combined with electrical stimulation in subacute stroke patients with a severely to moderately affected hand function

- CARAS' gross motor grip performance training
- Saeboglove

- Electrical Stimulation



- Stretch program combined with splinting

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Methods

Intervention

2. Electrical Stimulation (*Microstim 2V2*)

ES electrodes were placed over both finger flexors (FDS/FDP) to secure finger flexion in order to produce a grasp movement

adelante
haal het beste uit jezelf

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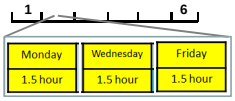
Methods

Intervention

- Patients (8) followed the CARAS gross motor grip performance program.
- 1.5 hours per day, 3 days per week for six weeks

Program 2

Gross motor grip performance



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Methods

Subjects

Patient	Gender	Age (year)	UAT	ARAT	Post-stroke time (weeks)	Dominant side	Impaired side
1	M	50	1	0	3	R	R
2	M	59	2	6	5	R	R
3	F	48	2	0	4	R	R
4	M	67	2	0	5	R	L
5	M	66	2	3	8	R	L
6	M	56	1	0	13	R	L
7	F	49	1	0	7	R	L
8	M	72	1	0	4	R	R
Mean (sd) of all 8 participants		58.4 (9.2)	1.5	1.1	6.1 (3.2)		

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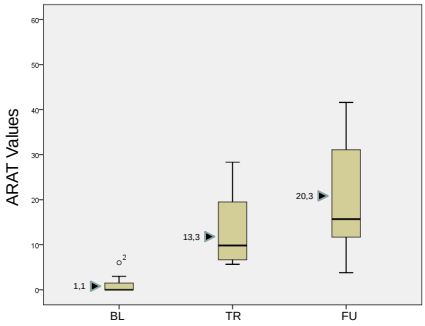
Results at the level of Capacity:

Action Research Arm Test



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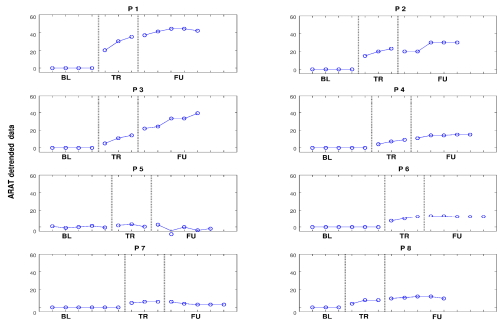


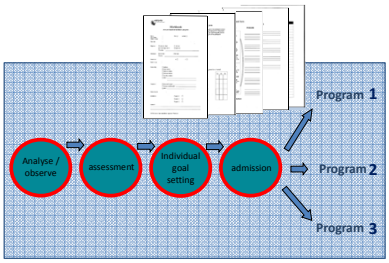
J.A Franck, et al., Evaluation of a functional hand orthosis combined with electrical stimulation adjunct to arm-hand rehabilitation in subacute stroke patients with a severely to moderately affected hand function. Disabil Rehabil 2018 Jan 9:1-9.

adelante
haal het beste uit jezelf

Responsibilities

adelante
haal het beste uit jezelf

Admission patients to CARAS



Flowchart steps to follow on forehand of admission to program 1,2 or 3

adelante
haal het beste uit jezelf

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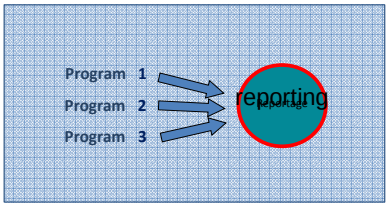
Admission patients to CARAS



Flowchart steps to secure reportage / assessments

adelante
haal het beste uit jezelf

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Scientific framework

Results of CARAS

adelante
haal het beste uit jezelf

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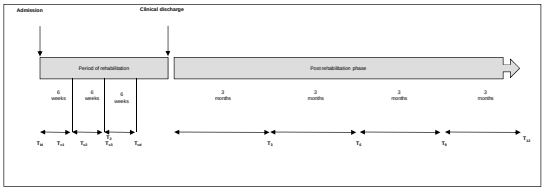
Changes in arm-hand function and arm-hand skill performance in patients after stroke during and after rehabilitation:
"Saving comparative data regarding 'evidence-based therapy-as-usual"

Subgroup following program 1	Subgroup following program 2	Subgroup following program 3
N = 28	N = 28	N = 33



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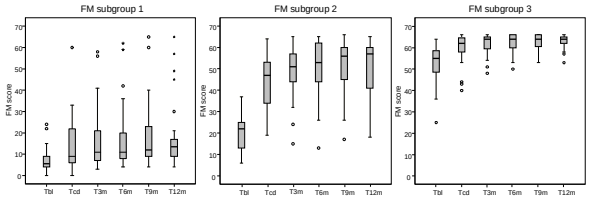
Results at the level of Function :

Fugl-Meyer Motor Assessment



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):

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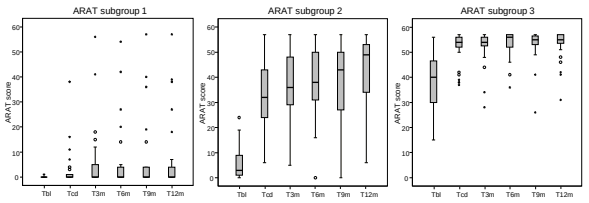
Results at the level of Capacity:

Action Research Arm Test



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):

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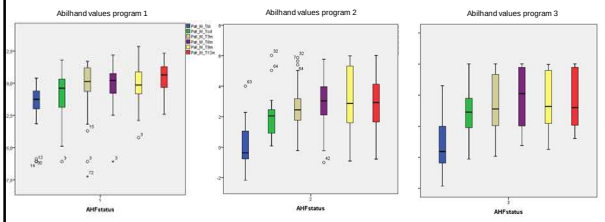
Results at the level of Perceived performance:

Abilhand



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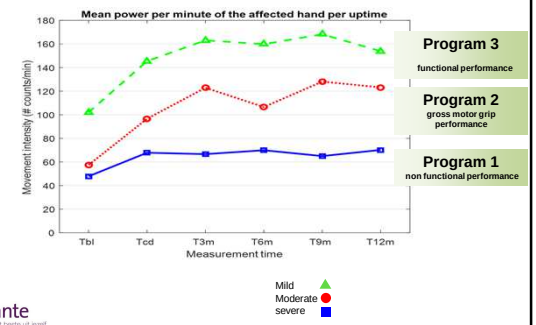
Changes in actual arm-hand use in stroke patients during and after clinical rehabilitation

Accelerometry



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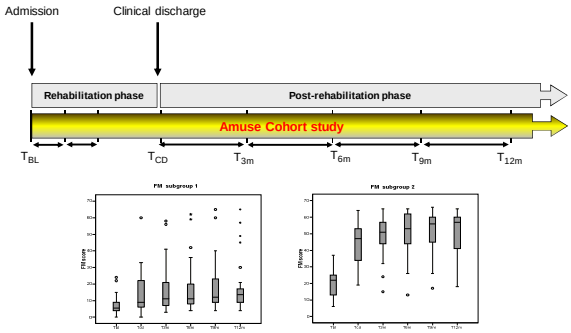
Evaluation of XXXXX adjunct to arm-hand rehabilitation in subacute stroke patients with a severely to moderately affected hand function



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

General conclusions

- Due to the small number of inclusion criteria, CARAS targets a broad range of sub-acute stroke patients admitted to a rehabilitation centre
- CARAS' explicit, practical and reproducible content may guide therapists in structuring treatment of arm-hand rehabilitation post-stroke
- CARAS is a well-described arm-hand therapy currently provided in a number of rehabilitation centres across the Netherlands.
- A comprehensive clinimetric data set is available. CARAS may serve as a 'therapy-as-usual' condition in future therapy development studies.

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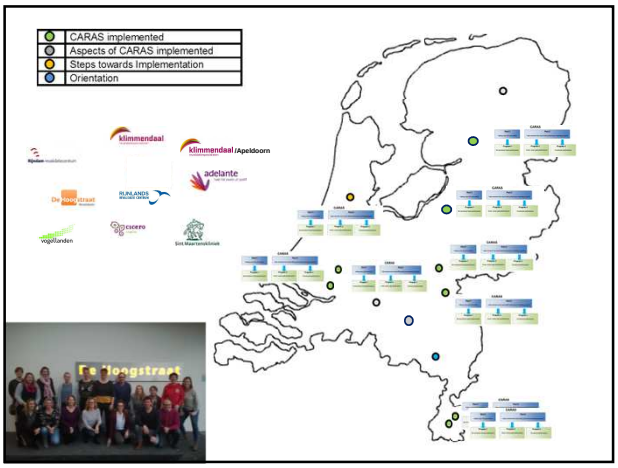

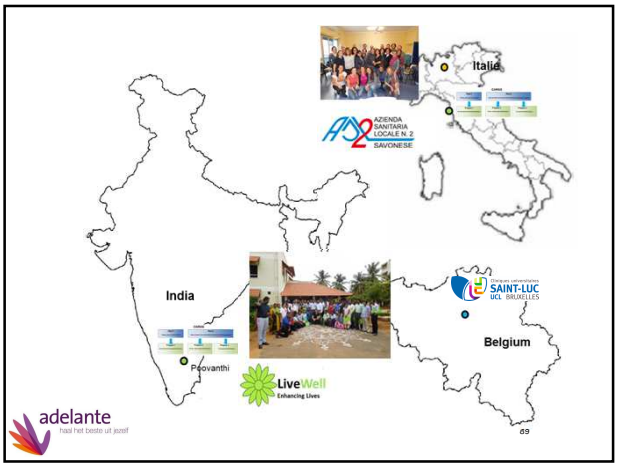

CARAS

Summarized

1. Heterogeneity and associated patterns of arm-hand recovery: stratified into **3** levels
2. Participants are enabled and have a certain locus of control concering the treatment
3. Well-documented protocol fitting in 80% of stroke survivors in sub-acute phase of rehabilitation
4. Five steps to complete a well-defined task-oriented training
5. Quick implementation of new developments
6. Scientific framework to evaluate current therapy regime

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Nr adelante

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Questions

?

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