

# *Methodological challenges in randomized controlled trials of rehabilitation interventions- examples from Traumatic brain injury (TBI)*

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# Rehabilitation interventions

Complex interventions

Extremely susceptible for biases



# Bias

Common study **biases in** rehabilitation **research** and how they may affect the results

Bias can be defined as...

“Any process at any stage of inference which tends to produce results or conclusions that differ systematically from the truth” (Sackett, 1979)

“Systematic distortion of the estimated intervention effect away from the “truth”, caused by inadequacies in the design, conduct, or analysis of a trial” (CONSORT glossary)

# Biases in evaluation of clinical trial

- Difficulties with recruitment
  - Lack of study sample descriptions
  - Lack of adequate randomization
  - Lack of intervention content descriptions
  - Lack of definition of core outcome sets
  - Lack of blinding
  - Low clinical practice applicability
- = Low methodological quality**

**How can we know if results are “real” or due to bias?**

# Challenges with focus on **outcome evaluation** examples from

A goal-oriented, individualized rehabilitation intervention in adults with traumatic brain injury – RCT protocol, goal attainment and intervention efficacy

# Traumatic brain injury

Long-lasting difficulties post traumatic brain injury (TBI)

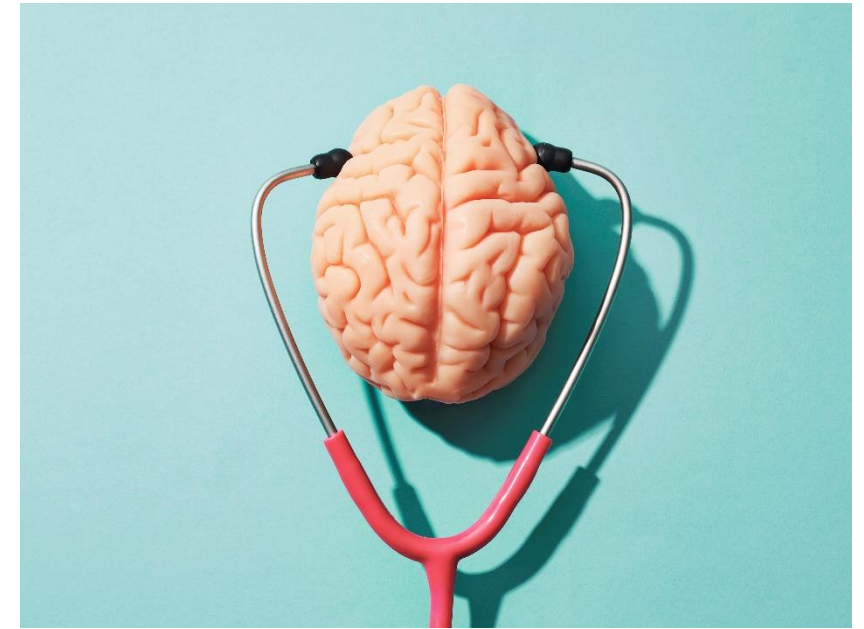
TBI = chronic disease → life-long impact on quality of life

Sequelae heterogeneous (medical, cognitive, emotional, vocational or social)

Unmet needs are common post-TBI

Often related to cognitive, vocational and emotional functioning.

**The heterogeneous difficulties necessitates individualized approaches to rehabilitation**



Andelic et al., 2014; Andelic et al., 2021; Corrigan & Hammond, 2013; Masek & DeWitt, 2010

# Goal-oriented rehabilitation provided in chronic phase after TBI

- ✓ May increase personal relevance and motivation
- ✓ Ensures everyone is working towards the same goals
- ✓ Enables measuring the rehabilitation process
- ✓ Patient involvement and collaboration is the key to successful goal setting



Chronic phase → evaluation of the patient's everyday environment may aid rehabilitation efforts

Lack of high-quality studies on the effectiveness of community-based rehabilitation in chronic ABI

Hauger et al., 2022; Levack et al., 2011; McClain et al., 2005; Wade, 2009; Wilson et al., 2008

Winter and colleagues developed home-based, goal-oriented rehabilitation program for veterans with TBI

Their RCT displayed less difficulties handling problem areas and high acceptability

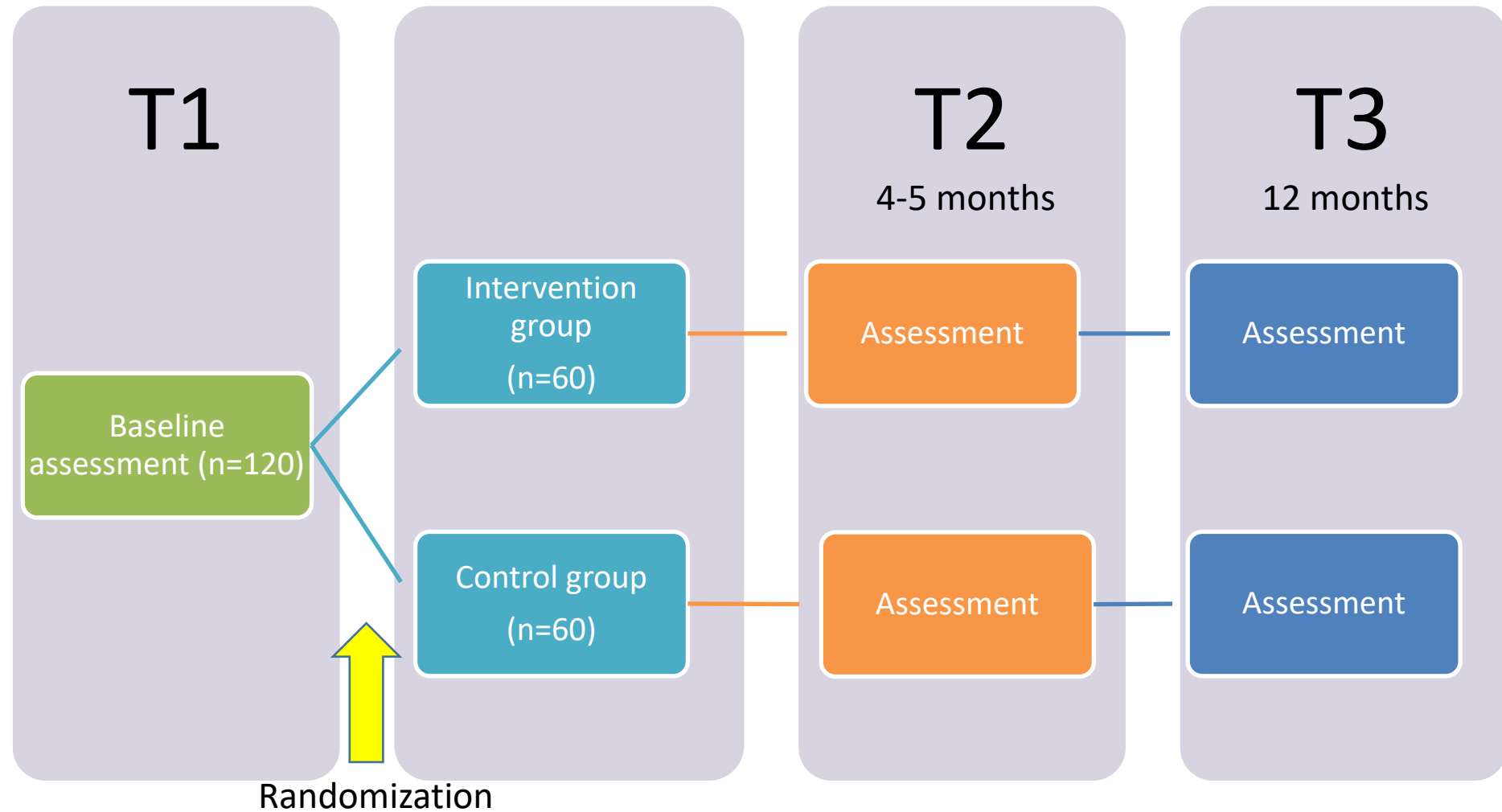
The intervention has not been tested in a universal access health care context, nor with civilian populations with more severe injuries

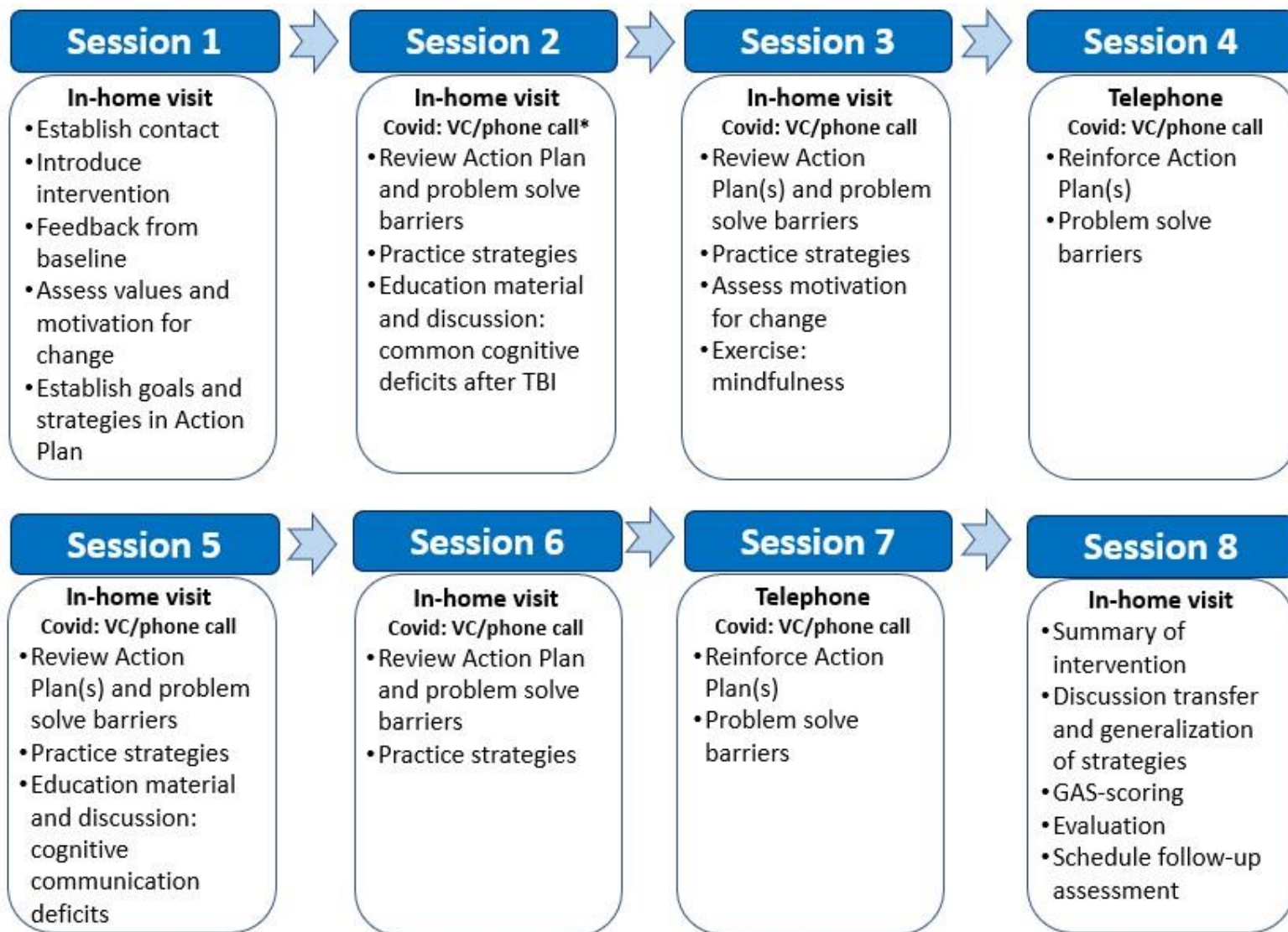


Winter et al., 2018



# Trial design





\*Delivery format was adjusted due to the Covid-19 pandemic, i.e., videoconference (VC) and phone calls replaced some home visits to reduce risk of infection.

Main approach is

- Identify main problem area(s)
- Establishing SMART goals and Goal attainment scaling (GAS)
- Establishing Action Plan that include goal, GAS and strategies
- Train strategies and problem solve barriers

Control group: Usual care in their communities

# SMART goals and Goal Attainment Scaling (GAS)

**S** – Specific  
**M** – Measurable  
**A** – Achievable  
**R** – Realistic/Relevant  
**T** – Time-bound

## Goal Attainment Scaling:

- +2 = *A lot better than expected*
- +1 = *A little better than expected*
- 0 = Expected level of achievement
- 1 = *A little less than the expected level*
- 2 = *A lot less than the expected level*



} Baseline level

Bovend'Eerd et al., 2009; Kiresuk & Sherman, 1968; Malec, 1999; Turner-Stokes, 2009



# Evidence-based strategies

REVIEW ARTICLE (META-ANALYSIS)

## Evidence-Based Cognitive Rehabilitation of the Literature From 2003 Through 2013

Keith D. Cicerone, PhD, Donna M. Langenbahn, PhD, Cynthia B. Kalmar, PhD, Michael Fraas, PhD, Thomas Felicetti, PhD, J. Preston Harley, PhD, Thomas Bergquist, PhD, Joanne Azuly, PhD, Teresa Ashman, PhD

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## INCOG Recommendations for Management of Cognition Following Traumatic Brain Injury: Executive Function and Information Processing Speed

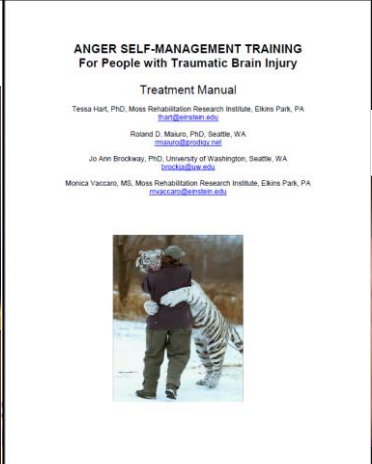
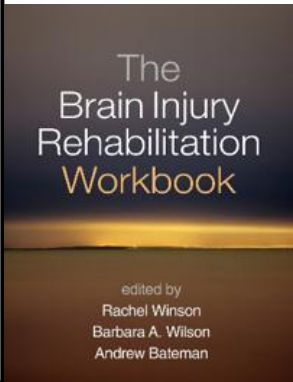
Robyn Tate, PhD; Mary Kennedy, PhD; Jennie Diana Velikonja, PhD; Mark Bayley, MD, FRCP

## INCOG Recommendations for Management of Cognition Following Traumatic Brain Injury, Part II: Attention

J Head Trauma Rehabil  
Vol. 29, No. 4, pp. 321–337  
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## INCOG Recommendations for Management of Cognition Following Traumatic Brain Injury, Part V: Memory

Diana Velikonja, PhD; Robyn Tate, PhD; Jennie Ponsford, PhD; Amanda McIntyre, MSc; Shannon Janzen, MSc; Mark Bayley, MD, FRCP, on behalf of the INCOG Expert Panel



SØK

Framsida > Nasjonal kompetansetjeneste for søvnsykdommer (SOVno)

## Nasjonal kompetansetjeneste for søvnsykdommer (SOVno)

## Behavioral Activation Treatments for Depression in Adults: A Meta-analysis and Review

Trevor Mazzucchelli, Robert Kane, and Clare Rees, School of Psychology, Curtin University of Technology

## Physiotherapy after traumatic brain injury: A systematic review of the literature

Stephanie Hellweg & Sönke Johannes

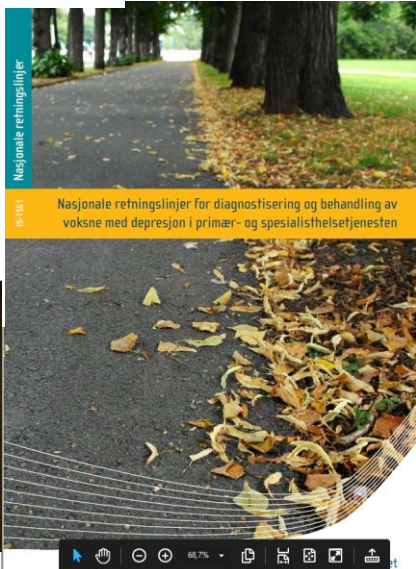
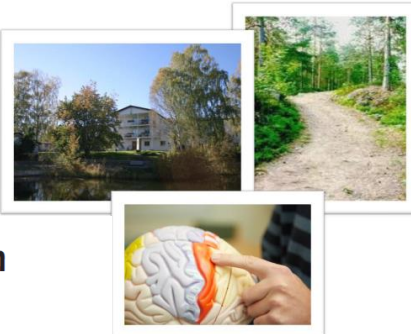


### Prinsipper for

### rehabilitering av pasienter med traumatisk hjerneskade

Sunnaas sykehus, Seksjon for hjerneskader, Team H56

Pasienter med bevissthetsforstyrrelse, posttraumatisk forvirringsstilstand eller med betydelig kognitiv og/eller fysisk funksjonsnedsettelse etter ervervet hjerneskade



# Outcome measures

Outcome area	Measures
Primary outcome measures	
Participation	Participation Assessment with Recombined Tools-Objective (PART-O)
Quality of life (brain injury specific)	Quality of Life After Brain Injury (QOLIBRI) Overall Scale
Secondary outcome measures	
Quality of life (generic)	Euroqol 5 dimensions (EQ-5D)
Difficulty managing main TBI problems	Target Outcomes (severity ratings from 0-4, 0=not difficult at all, 4=extremely difficult)
TBI symptoms	Rivermead Post-Concussion Questionnaire (RPQ)
Anxiety-related symptoms	Generalized Anxiety Disorder (GAD-7) scale
Depressive symptoms	Patients Health Questionnaire (PHQ-9)
Functional competency	Patient Competency Rating Scale (PCRS)



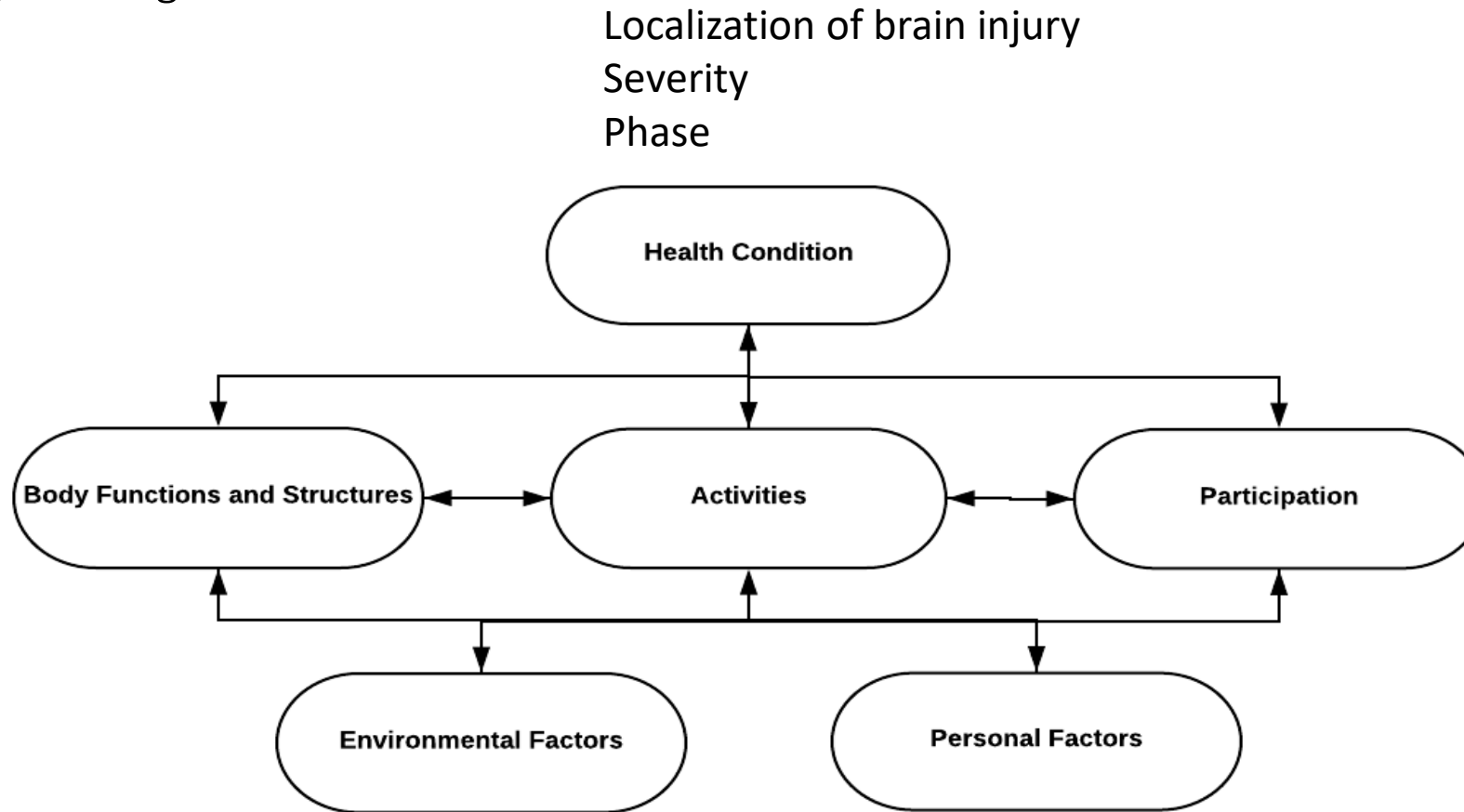
Intervention  
group: GAS and  
acceptability



Family member:  
PCRS, Target  
outcomes

EQ-5D VAS, PHQ-9,  
Caregiver Burden

TBI is a very heterogeneous condition



## *Why choosing this design?*

Documentation of effect is needed

Possible to separate from natural recovery



Randomized controlled trials/Pragmatic trials

# *Consideration of patient, intervention outcome assessments*

How to deal with

Different problems

Different treatment/rehabilitation

Different outcomes



# *Evaluating rehabilitation intervention*

## Solution

Keep the individual problem

Target the intervention to the individual problem

Evaluate the effect on the individual problem

## Challenge

Aggregate the results at the group level

# *Instruments for assessing patient reported outcomes in TBI*

[Traumatic Brain Injury | NINDS Common Data Elements \(nih.gov\)](#)

Participation Assessment with Recombined Tools–Objective PART-O (standardized)

Multidimensional systems

Patient-Reported Outcomes Measurement Information System (PROMIS) (standardized items but not item selection)

No individual problem tool included

# Individual problems-PSFS

## Patient-specific activity scoring scheme (Point to one number):

0	1	2	3	4	5	6	7	8	9	10
Unable to perform activity					Able to perform activity at the same level as before injury or problem					

(Date and Score)

Activity	Initial					
1.						
2.						
3.						
4.						
5.						
Additional						
Additional						

Total score = sum of the activity scores/number of activities  
Minimum detectable change (90%CI) for average score = 2 points  
Minimum detectable change (90%CI) for single activity score = 3 points

PSFS developed by: Stratford, P., Gill, C., Westaway, M., & Binkley, J. (1995). Assessing disability and change on individual patients: a report of a patient specific measure. *Physiotherapy Canada*, 47, 258-263.

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## Evaluated in TBI

Evensen et al.  
Journal of Multidisciplinary Healthcare  
2020:13 1121–1132

**No aggregation approach across individual problem areas**

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} Baseline level



Bovend'Eerd TJ, Botell RE, Wade DT. Writing SMART rehabilitation goals and achieving goal attainment scaling: a practical guide. *Clin Rehabil* 2009 Apr;23(4):352-61.

Malec JF. Goal attainment scaling in rehabilitation. *Neuropsychological rehabilitation* 1999;9(3/4):253-75.

# *Challenges with SMART GOALS*

Time consuming

Cognitive abilities

Therapist/evaluator dependent

Scaling challenges

NOT POSSIBLE to apply in “natural recovery” or “treatment as usual” control group

# Target Outcomes

Traumatic brain injury; needs and treatment options in the chronic phase.

## PROBLEM AREA (TARGET OUTCOMES)

ID: \_\_\_\_\_

Date: \_\_\_\_\_

I will now ask you about what challenges or problems that you consider the most troublesome after the brain injury. These questions are related to how you have perceived the challenges during the last month.

### PROBLEM AREA #1

What is the main activity problem caused by your TBI that you have experienced in the past month?

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Degree of difficulty in handling each problem  
Rated from 0 to 4  
(0 = not difficult at all, 4 = extremely difficult)

Easier to apply in the control group  
Scaling challenges at group level remains

Winter et al., 2018, Borgen et al 2021,  
<https://doi.org/10.1097/HTR.0000000000000744>



# *Scaling challenges a measurement problem*



## *Additional challenges*

Adjust the intervention to the individual problems and the outcome to be measured

Evaluate to which extent the intervention really is delivered and received at the individual level

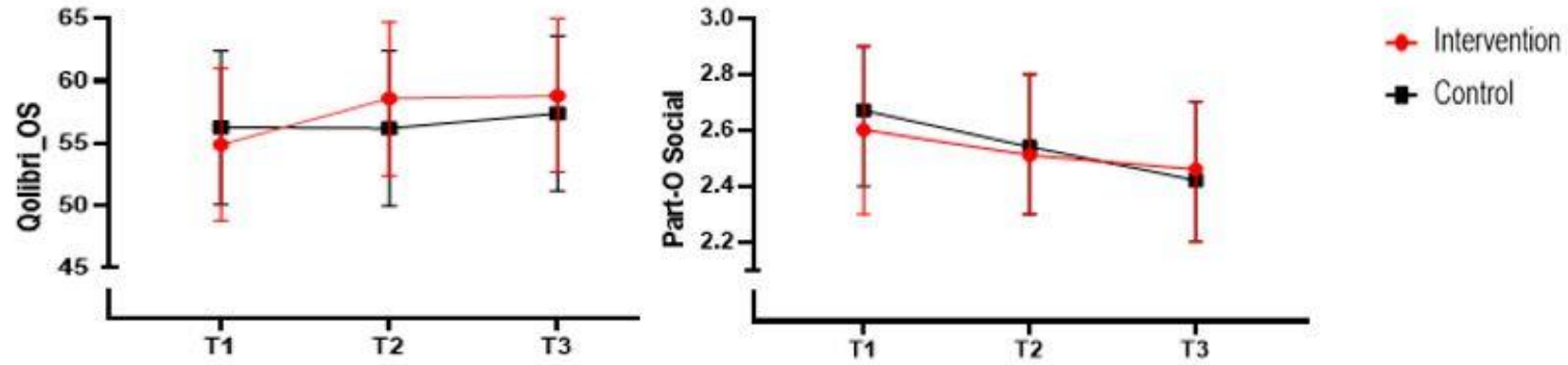
Present statistical requirements in randomized trials (even pragmatic) (correcting for multiple comparisons, expected effect sizes etc)



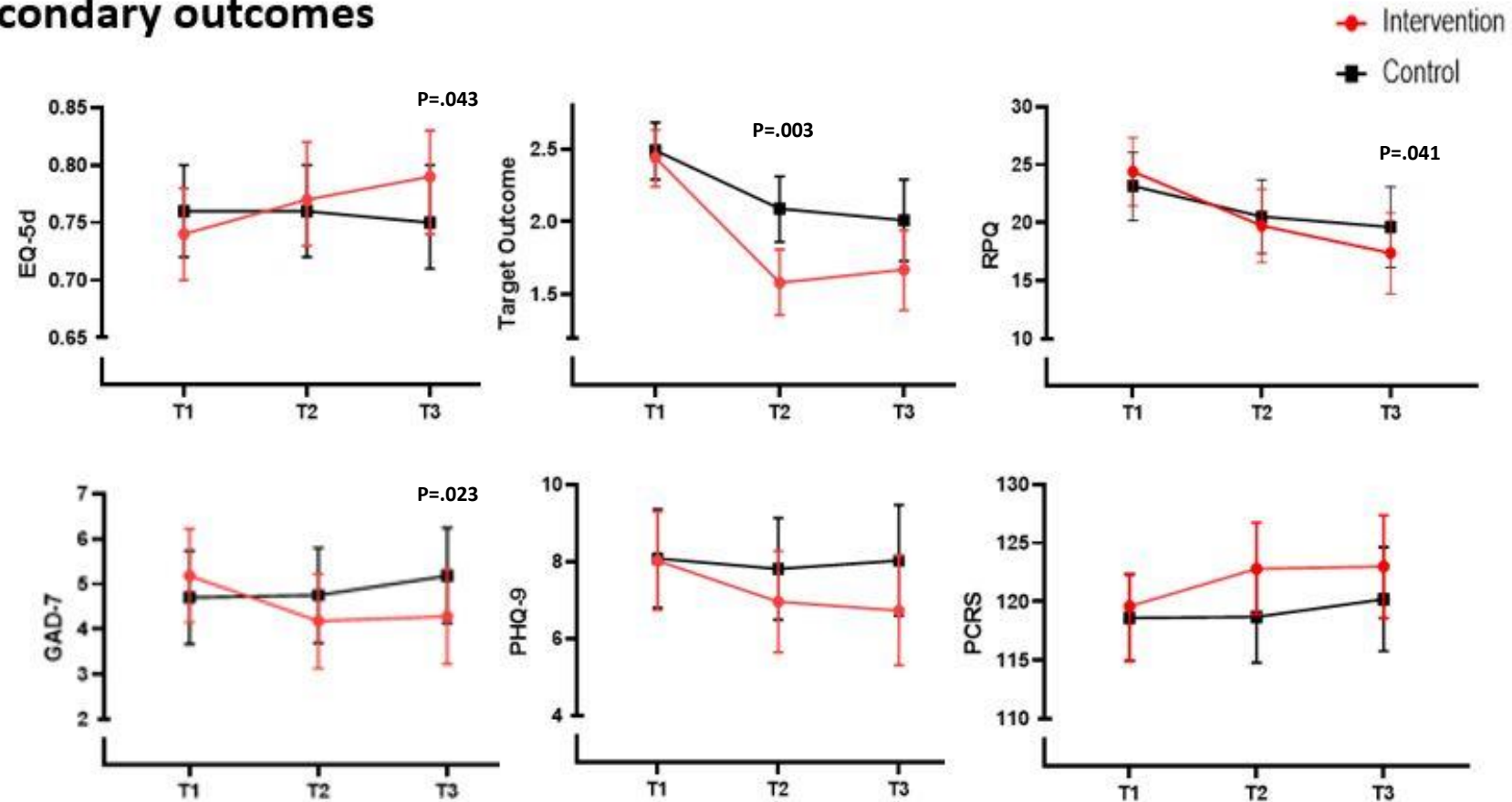
# Results



## Primary outcomes



## Secondary outcomes



# Conclusion



# Future perspectives

Randomization introduced outside clinical trials  
(f. example single subjects design)

Process evaluation better integrated in the  
RCTs

Changes in statistical corrections and power evaluation

