

Appendix B: Rehabilitation program – additional guidance for clinical reasoning and physiotherapy approach.

1. Clinical assessment

The physiotherapist will assess each individual at the beginning of the intervention to ensure the chosen therapy options are appropriate for (i) the participant's capacity and impairments; (ii) the environment of the home exercise program (HEP); (iii) the specific needs of each participant; and (iv) the feasibility of successfully delivering the rehabilitation at that site.

To assist with this the physiotherapist should:

- Review the Baseline Assessment completed by the blinded assessor.
- Complete the Assessment Form, including developing three goals using the Goal Attainment Scale(1).
- Assess 6-15 repetition max (RM) weakened muscles that will be a focus of the strengthening component of the rehabilitation.

The three functional goals determined by the participant and the assessment findings should be used to individualise the rehabilitation program to the participant's specific needs.

2. Clinical reasoning

Considerations to assist with clinical reasoning and the physiotherapy program include:

- Consider order of exercises and focus on controlled movement with correct posture/form where possible.
- If hands on facilitation required for correct posture or facilitation of movement, aim to decrease this over outpatient program.
- Review goals and impairments weekly.
- Determine action plan to achieve goals and address impairments (record weekly).
- Each week review program and consider the following:
 - fatigue levels
 - progression of performance
 - progression to goals
 - variability of training
 - progressive resistance training protocol
 - participant motivation.
- Follow clinical reasoning considerations for each domain as below.
- Document rationale for progression/change.

3. Outpatient rehabilitation intervention

Considerations to assist with the outpatient program, scheduling and monitoring include:

- Choose exercises from Appendix A - Exercise List or add in exercises into the appropriate domain if they are not already included.
- Scheduling:
 - The outpatient program consists of two hours, three days per week for six weeks.
 - Please consider the following if there is a need to reschedule any sessions within the six weeks:
 - You cannot split the two-hour session into two one-hour sessions. If the participant is only able to attend half a session, please document as did not attend (DNA) for that half session.
 - You can reschedule a two-hour session to an alternate day in the same week if feasible.
 - Aim, where possible, to have one break day between each session, but at least one break day per week must be incorporated as a minimum (so cannot run three days of rehab in a row).
- Review program weekly and re-visit clinical reasoning.
- Spend the correct time on each domain (Table 1).

Table 1. Time spent in each domain for outpatient rehabilitation program

	Domain	Time per session
(i)	Strengthening	35 minutes
(ii)	Postural control	20 minutes
(iii)	Functional mobility	20 minutes
(iv)	Balance Training	20 minutes
(v)	Coordination and control	15 minutes
(vi)	Sensory stimulation, mobilisation and stretching	10 minutes

- For the *Strengthening* domain review separate instructions and progress as recommended.
- Monitor fatigue, pain and falls at each visit (monitoring fortnightly).

- Progress the program according to the individual's performance of each exercise, their fatigue and motivation levels, and their goals.

3. Home exercise program

Considerations to assist with the HEP component and monitoring include:

- Devise HEP for first week during outpatient rehabilitation program.
- Assess and modify program at each visit/conference call.
- Program should be one hour, five times per week.
- Choose from Appendix A - Exercise List.
- Participant can use family/carer/therapist/fitness instructor can carry out the program if already available to the participant or initiated by the participant.
- Spend the correct time on each domain (Table 2).

Table 2. Time spent in each domain for outpatient rehabilitation program

	Domain	Time per session
(i)	Strengthening	15 minutes
(ii)	Postural control	10 minutes
(iii)	Functional mobility	10 minutes
(iv)	Balance Training	15 minutes
(v)	Coordination and control	5 minutes
(vi)	Sensory stimulation, mobilisation and stretching	5 minutes

- Each visit re-assessment key problem areas, progress on goals and identified impairments and review clinical reasoning.
- For the *Strengthening* domain review separate instructions and progress as recommended.
- Monitor fatigue, pain and falls at each visit.

5. Documentation

- Document exercises/therapy in program record.
- Document DNAs and adverse events.

- Document fatigue, pain and falls in program record/monitor.
- Document reasons for progression.
- Collect participant's record of HEP once completed.

6. Clinical reasoning considerations for each domain

a) *Strengthening domain*

- Identify muscle weakness and address through progressive resistance training procedure (details under Point 8 below).
- Target key areas of impairment and limitations to function/goals primarily.
- Consider during each program when to complete the strengthening component. For example: completed at the beginning may increase load used; completed at the end may allow the other domains to be performed when the muscles are not fatigued; or completed throughout may enhance muscle recovery.
- Consider position of assessment and treatment to maximise strength gains and/or functional strength.

b) *Postural control*

- Identify areas to work on through observation during functional activities or planned exercises in other domains.
- Can use lying, sitting, standing, prone standing, wall standing, etc. to work on postural control with aim of working on selective control in a functional position (i.e. posterior/lateral pelvic tilt for single leg stance).
- Progress from working at level of control to increasing demands from gravity (consider position when completing the exercise)(2).
- May need to work on increasing available range of movement (ROM) prior to working on active movement control against gravity.
- Monitor and avoid trunk or upper limb fixation when performing stabilising trunk exercises.

c) *Functional mobility*

- Choose tasks that are related to participant goals or steps to achieving goals.
- Practice functional mobility after working on postural control or coordination and control domain exercises that are relevant to the task (e.g. to improve the postural control during that task).
- Practice functional mobility in the hydrotherapy pool to increase balance, strength and coordination demands or increase available ROM during functional activity safely (increasing speed of movement is helpful for this).

d) *Balance*

- Consider different surfaces to challenge balance.
- Increase speed of exercise as able.
- Use “hand’s on” (the physiotherapist providing the stabilisation) and consider location of the body where support/stabilisation is provided, rather than asking the participant to use their upper limbs for stabilization/safety.
- Progress balance to outside of parallel bars where-ever possible and safe.
- If using pool environment, consider functional speed.

e) Coordination and control

- Start movements small and slow and progress to full ROM and fast as able to control.
- Consider required speed of functional movements when prescribing exercises.
- Incorporate eccentric control into exercises worked on in this domain.
- Consider error size for motor learning(3) - push into position of challenge, but with some ability to correct.
- Lots of repetition is important(2).
- Consider exercises that switch between agonist/antagonist concentric muscle activity.
- Consider multi-joint movement have a higher coordination-demand versus single-joint movements.
- Work in functional positions when possible, to improve functional carryover.

f) Sensory stimulation, mobilisation and stretching, and vestibular rehabilitation

- Focus on the foot and intrinsic muscles of the foot and ankle.
- Active activity of the foot is thought to provide greater proprioceptive input(4) so aim for this as able, as a component of this domain.
- If ROM limitations are identified, provide stretching/soft tissue work/mobilisation as required then incorporate changes into part-practice and full practice of functional activity or into strengthening of muscle through new ROM.
- Consider completing activities in barefoot to increase sensory input (where possible).
- It may be appropriate to target vestibular function (i.e. gaze stability(5)) in this domain if vestibular symptoms (such as visual fixation abnormalities(6)) have an impact on achieving participant goals or impact on ability to participate in the rehabilitation program.

7. Additional notes

- Patella-femoral joint pain can be an issue, potentially due to muscle imbalance/weakness. If this is present, hip external rotation activity during sit-to-stand practice and during any other knee work, may assist with this.

- Consider demand on muscles when working eccentrically. Monitor to avoid fatiguing during functional or multi-joint exercises.
- If participants ask for additional homework in between rehabilitation sessions or the structured HEP, this is okay. However, participants need to be prompted to include this extra work when completing the PhoneFITT questionnaire(7) at the relevant assessment as this will be considered physical activity outside of the trial.

8. Progressive resistance training procedure

- *Before commencing the intervention, determine the 6RM - 15RM as the heaviest weight that could be lifted through the participant's full range with good form(8) for 6-15 reps.*
- Identify muscle weakness and address through progressive resistance training procedure (Table 3).
- Focus on maintaining correct movement patterns and eccentric control (this take precedence over following the progressive resistance training procedure).
- Physiotherapist-facilitated movement can be utilised if participants have insufficient muscle strength to perform anti-gravity activity (and progressive resistance principles do not have to be followed).
- Facilitate postural control and/or alignment to isolate control for strengthening.
- Exercise multi-joint or larger muscle groups first.
- Eccentric control and multi-joint muscle exercises require a greater demand than concentric strengthening exercises(9, 10). Consider this when planning timing of strengthening exercises within program.
- If you include ballistic exercises, work to fatigue as appropriate.
- Aim to select key muscles to strengthen throughout the whole of the 30-week program as it may take 10 weeks to see benefits(11).
- If key areas change, you can modify strengthening program midway through the rehabilitation intervention to ensure 10-week strength training per muscle group chosen.
- For the HEP, avoid strengthening same muscle groups on consecutive days (aim three times per week for each muscle group selected).

Table 3. Strengthening protocol (adapted from Kjølhede et al. 2015(12))

	Week	Sets	Reps	Intensity	Rest*
Outpatient Program	1–2	3	10	15 RM	2 minutes
	3–4	3	12	15 RM	2 minutes

	5–6	3	10	12 RM	2 minutes
Home Exercise Program	7–8	4	10	10 RM	2-3 minutes
	9–10	4	8	8 RM	2-3 minutes
	11–12	4	6	6 RM	3 minutes
	13–14	3	10	12 RM	2 minutes
	15–16	4	10	10 RM	2-3 minutes
	17–18	4	10	10 RM	2-3 minutes
	19–20	4	8	8 RM	2-3 min
	21–22	4	6	6 RM	3 min
	23–24	5	6	6 RM	3 min
	25-26	3	10	12 RM	2 min
	27-28	4	10	10 RM	2-3 min
	29-30	4	8	8 RM	2-3 min ⁶

*Rest between sets; ⁶Kjølhede et al (2015) program only documented up to 24 weeks, therefore the week 25-30 protocol is based on the American College of Sports Medicine position stand(10, 12). RM = Repetition Maximum; Reps = Repetitions.

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