

Weight-bearing Exercise for Better Balance (WEBB)

**A challenging, safe, evidence-based
physiotherapy program for older
people.**

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Contents

Overview	4
Background	5
Overview of RCTs on exercise for falls prevention	6
How to use this program	7
Pre-exercise screening and exercise safety	8
General principles of exercise prescription for improving co-ordination, strength and endurance	10
Strategies to enhance adherence	13
Exercises	14
<i>Warm-up</i>	
1. <i>High stepping on the spot</i>	
<i>Co-ordination exercises</i>	
2. <i>Standing with a decreased base</i>	
3. <i>Graded reaching in standing</i>	
4. <i>Stepping in different directions</i>	
5. <i>Walking practice</i>	
<i>Strength/co-ordination exercises</i>	
6. <i>Sit-to-stand</i>	
7. <i>Heel raises</i>	
8. <i>Lateral step-up</i>	
9. <i>Forward step-up</i>	
10. <i>Half- squats sliding down a wall</i>	
<i>Endurance exercise</i>	
11. <i>Bike, treadmill walk, overground walk or sit-to-stand</i>	
<i>Other interventions if appropriate</i>	
<i>Getting off the floor training</i>	
<i>Additional strength/co-ordination exercises and stretches</i>	
Appendix 1. Safety advice to participants	29
Appendix 2. Doctor's approval for commencement of exercise program	30
Appendix 3. Safe exercise prescription guidelines for physiotherapists	32
Appendix 4. Commonly observed gait problems	33
Appendix 5. Borg Rating of Perceived Exertion Scale	34
Appendix 6. List of equipment required for the program	36
Appendix 7. Tips for running the program in a group setting	37
Appendix 8. Managing freezing in people with Parkinson's Disease	38
References	40

Overview

- This program has been developed from
 - a recent systematic review (which established that exercise that challenges balance is the key feature of successful exercise programs for the prevention of falls in older people) [1]
 - our collective clinical experience,
 - previous research by ourselves and others [1-21].

- This program aims to help physiotherapists to individually prescribe progressive exercise which is challenging but safe. It is designed for use in either an individual or small group context at home or at a centre. A combination of different settings can be used such as a weekly group class with additional home exercise. If used in a group setting we recommend the use of a circuit class design to facilitate individual prescription.

- The program is designed to be undertaken on a long-term basis and as such includes suggestions for progression and variety.

- The program also includes a range of practical resources e.g. contraindications to exercise, sample letter to GP, guidelines for safe exercise and tips for group exercise.

- An accompanying client manual has been developed to assist in the use of this program and includes pictures of the exercises from the freely-available www.physiotherapyexercises.com website.

- This program is not intended to replace individualised assessment and intervention for specific movement problems which some people will require from time to time. Section 13 provides some examples of a range of intervention strategies.

Background

- Impaired balance and mobility is a problem for many older people. Up to 50% of people aged 65 years and older have some difficulty with mobility tasks [22] and over one quarter of non-disabled older people will develop mobility disability within three years [23].
- Impaired balance and mobility contributes to falls in the general older population [24] and for people with neurological conditions such as stroke, Parkinson's disease and multiple sclerosis [25]. Impaired performance in tests of lower extremity physical functioning also increases risk of nursing home admission and mortality [26].
- "Balance" can be viewed as the ability to activate muscles with the amplitude and timing necessary to control movements of the body to prevent a fall during a range of tasks e.g. standing, reaching, stepping, walking [27]. Thus, avoiding a fall can be viewed as reflective of lower limb muscle dexterity.
- Well-prescribed exercise programs can enhance mobility [28-31] and prevent falls [32] among older people but programs which are not well designed and implemented may not reduce falls. Key features of successful programs are summarised in the next section.
- Exercise needs to be physically challenging, targeted to an individual's skill level and progressed as they improve, yet be conducted safely so as to avoid injuries, falls and cardiac events.
- Home programs have been successful in preventing falls in older people [33]. There are likely to be additional benefits of group exercise in terms of socialisation and motivation as well as efficient use of limited health resources. A circuit-style program means that participants can complete various exercise stations sequentially at individually prescribed intensity with supervision as required [34-37].

Overview of randomised controlled trials on exercise for falls prevention.

Dr Sherrington and colleagues recently identified 44 randomised controlled trials (RCTs) investigating exercise programs for falls prevention in older people [1]. The programs which were found to prevent falls in these studies included home-based balance and strength training with the Otago Programme [38, 39] group-based Tai Chi (eg [40-42]) and some other forms of group exercise (eg [43-48]).

We used meta-analysis to assess whether various aspects of exercise programs were associated with bigger reductions in falls. We found that greater reductions in falls occurred with the inclusion of exercise which presented a high-level of challenge to balance abilities.

This involved:

- movement of the centre of mass,
- narrowing of the base of support and
- minimising upper limb support.

Programs which included more time exercising also had bigger effects on falls. While walking has health benefits for older people, programs which included walking were associated with smaller effects on falls. Therefore we suggest that walking only be included in exercise programs aiming to prevent falls if it is clear that the individual is safe to walk outdoors and that walking should not be conducted instead of balance training. We found exercise programs reduced falls rates by 40% (rate ratio = 0.58, 95%CI 0.48 to 0.69, 68% of between-study variability explained) if they included a combination of a higher total dose of exercise (more than 50 hours over the trial period) and challenging balance exercises and did not include a walking program.

To develop the WEBB program we have drawn on strategies used in successful programs from individual trials as well as the meta-analysis findings.

How to use this program

This program is designed to facilitate individual prescription of exercises based on the ability of participants to complete exercises within the program. It includes a warm up exercise, four coordination exercises and five strength/co-ordination exercises. Each exercise has several levels of difficulty.

To use the program:

1. Conduct screening for safety to exercise, in conjunction with the participant's medical practitioner, based on the guidelines in this document.
2. Follow the safety protocol outlined in Appendices 1 and 3.
3. Select a series of exercises for an individual to complete. We suggest initially completing:
 - the warm-up exercise,
 - three of the co-ordination exercises and
 - three of the strength/co-ordination exercises
 - Sit-to-stand or squats
 - Lateral step-up (or forward step-up if lateral not being done well)
 - Heel raises
4. Each exercise has several different levels of difficulty. Establish the appropriate level for each exercise for each individual by assessing their ability to carry out the exercises (aim for challenging but safe)
5. Establish a home program using the Participant Instructions and recording sheets provided (most images and text from www.physiotherapyexercises.com).
6. The program can be upgraded by increasing level of difficulty, increasing resistance, increasing the number of repetitions and/or by adding or changing exercises.
7. Use the list of aspects common to successful exercise programs given on above to guide the general nature of the program.

Pre-exercise screening and exercise safety

Exercise can be undertaken by those with chronic disease if screening and prescription are carefully done.

The American College of Sports Medicine [49] states that “sedentariness appears a far more dangerous condition than physical activity in the very old” and that “the mere presence of cardiovascular disease, diabetes, stroke, osteoporosis, depression, dementia, chronic pulmonary disease, chronic renal failure, peripheral vascular disease, or arthritis (which may all be present within a single individual) is not by itself a contraindication to exercise”.

Similarly, a recent statement on physical activity for people with cardiovascular disease by the National Heart Foundation of Australia [50, 51] recommends that: people with established clinically stable cardiovascular disease should aim, over time, to achieve 30 minutes or more of moderate intensity physical activity on most, if not all, days of the week; less intense and even shorter bouts of activity with more rest periods may suffice for those with advanced cardiovascular disease; and regular low-to-moderate level resistance activity, initially under the supervision of an exercise professional, is encouraged.

Some conditions require investigation prior to commencing an exercise program

The American College of Sports Medicine statement [49] suggests that when a person has particular conditions, investigation by a medical practitioner should be undertaken prior to commencement of a new exercise program i.e.

- acute illnesses, particularly febrile illnesses
- unstable chest pain
- uncontrolled diabetes
- hypertension
- asthma
- congestive heart failure
- musculoskeletal pain
- weight loss
- falling episodes

Temporary avoidance of certain kinds of exercise may be required during treatment of hernias, cataracts, retinal bleeding, or joint injuries [49].

Exercise is contra-indicated in some individuals.

The American College of Sports Medicine statement [49] also stated that the following conditions require permanent exclusion from vigorous exercise: inoperable enlarging aortic aneurysm, malignant ventricular arrhythmia related to exertion, severe aortic stenosis, end stage congestive heart failure, other rapidly terminal illness, severe behavioral agitation in response to exercise.

Screening prior to commencing the program:

We suggest that all individuals be required to present a letter from their medical practitioner indicating that they are suitable to participate in a program of moderate intensity aerobic and resistance training. A suggested format for such a letter is given in Appendix 2.

Individuals with the following conditions and/or symptoms should not undertake the program:

- Unstable angina
- Uncontrolled cardiac failure
- Severe aortic stenosis
- Uncontrolled hypertension or grade 3 (severe) hypertension (e.g., blood pressure \geq 180 mmHg [systolic] or \geq 110 mmHg [diastolic])
- Symptomatic hypotension $<$ 90/60 mmHg
- Acute infection or fever, or feeling unwell (including, but not limited to, acute myocarditis or pericarditis)
- Resting tachycardia or arrhythmias
- Diabetes with poor blood glucose control (e.g., blood glucose level $<$ 6 mmol/L or $>$ 15 mmol/L)

Exercise safety

Advice to participants on exercise safety is given in Appendix 1 and is included in the information provided for participants.

Guidelines for physiotherapists to enhance safety in exercise prescription are given in Appendix 3.

General principles of exercise prescription for improving co-ordination, strength and endurance.

Co-ordination exercise

Background

- The ability to maintain “balance” during standing and other tasks requires the individual to be aware of where s/he is in space and be able to pre-empt and adjust body position for any potential challenges (i.e. from breathing, moving one’s own body or reaction to an external push or unstable surface).
- Muscle co-ordination (ie dexterity) is thus required to prevent falls by making the appropriate adjustments at the appropriate times during performance of a range of tasks (e.g. standing, reaching, stepping, walking, stair climbing).
- This program aims to train this muscle co-ordination by practicing activities relevant to a range of functional tasks. Research suggests that to improve functional task performance, a large volume of practice relevant to these tasks is required [52].

General prescription principles

- Aim for a large number of repetitions (initially 30, progressing to 100).
- Simplify exercise conditions initially (if required) by minimising distractions and providing hand support.
- Provide instructions and feedback for exercise to be successfully completed (eg, keep hips forward when reaching forwards).
- Structure environment to enhance performance and provide feedback, (e.g., use of markers on floor to constrain base of support, or to indicate direction and magnitude of steps).
- Progress by increasing the physical challenge (e.g., remove hand support, increase speed, practice on different surfaces, add concurrent manipulative and/or cognitive tasks to promote automaticity).
- Suggestions for systematically progressing movements of centre of mass, base of support and amount of arm support are given below.

Grading components from easiest to hardest

Centre of mass <i>Aim to increase number of body segments involved</i>	Base of support <i>Aim to reduce size of base provided by feet</i>	Arm support <i>Aim to reduce support</i>
Reaching within arm’s length- unilateral	Feet more than shoulder width apart, externally rotated	Grasping support bilaterally
Reaching within arm’s length- bilateral	Feet together shoulder width apart	Grasping support unilaterally
Reaching beyond arm’s length- unilateral	Feet together	Resting hand on support bilaterally
Reaching beyond arm’s length- bilateral	Step stance (1 foot in front)	Resting hand on support unilaterally

Reaching above shoulder height-unilateral	Standing on one leg	Resting two fingers on support bilaterally
Reaching above shoulder height-bilateral	Pivoting on 1 leg	Resting two fingers on support unilaterally
Reach beyond arm's length above shoulder height unilaterally by rising onto toes		Resting one finger on support bilaterally
Reach beyond arm's length above shoulder height bilaterally by rising onto toes		Resting one finger on support unilaterally
Reaching down to floor-unilateral		Hovering hand/fingers above support
Reaching down to floor-bilateral		

Strength exercise

Background

- It is clear that muscle strength can be enhanced by resistance training but carry-over to improved functional abilities is less consistent [53].
- Traditionally, strength training has been conducted in seated positions yet in recent years, several authors have been able to add resistance to more functional weight-bearing tasks by using weighted waist belts [54, 55], weighted vests [56-58], hand weights [59] or elastic tubing [60]. For this program we suggest the use of weighted belts or vests.
- High intensity progressive resistance training appears to be the best way to enhance strength in older people [53] yet may have a high injury rate in a home setting [61]. For this program we suggest the use of high intensity training in a supervised setting in the absence of contra-indications outlined above and moderate intensity training in the home setting.
- Intensity of strength training has traditionally been prescribed by 60-80% of one repetition maximum (i.e. the maximum weight that can only be lifted once through range with good form) or 10-15RM (the weight that can be lifted 10-15 times but no more)[49].
- For this program we suggest the use of the 10-15 RM method ie the person should aim to complete each exercise with sufficient weight that no more than 10-15 repetitions can be completed, in good form. By following the guidelines below, similar intensities should be achieved. In recent years, the Borg Scale for Rating Perceived Exertion (15-category scale where 6 = no exertion at all and 20 = maximal exertion) has been used to assist in prescription of resistance training (see Appendix 5 for scale) [62, 63]. For this program we suggest the use of the Borg Scale to supplement the 10-15 RM method; the participant should aim to perform strengthening exercises at a perceived exertion rating of 15 on the Borg Scale.

General prescription principles

Initial session

- Apply vest or belt with no weight or up to 2% of body weight added before commencing strength exercises.
- Do 2 sets of 10 reps of three exercises in the following order: (i) sit-to-stand or squats, (ii) Lateral step-up (or forward step-up if lateral not being done well) (iii) heel raises (L and R)

Subsequent sessions

- Gradually increase the amount of resistance so that the person is working at a level of 10-15 RM (also aim to achieve a perceived exertion rating of 15 on the Borg RPE scale).
- Every 2-4 weeks, reassess and, if indicated, progress intensity of exercise to maintain intensity at 10-15 RM.
- To focus on power production, participants should perform the concentric component (rising) as quickly as possible, while maintaining good form, followed by a one second pause and lowering of the body over two seconds [57].
- If possible, the same weight should be used for all exercises. If there are marked differences between exercises or sides, weights should only be changed once within a session.
- Intensity can also be adjusted by changing the height of the block or chair or by changing performance from bilateral to unilateral for some exercises (e.g. heel raises).
- Gradually increase the number of exercises as tolerated.

Endurance exercise

Background

- Several of the successful falls prevention exercise programs had an endurance component. We suggest that increased endurance may assist in falls prevention by increasing the time the person can safely undertake mobility tasks.
- Endurance training may also contribute to a better sense of well-being and play a role in the prevention and management of heart disease.

General prescription principles

- The addition of endurance training to the program should only be undertaken if the person is deemed safe to undertake this, and if an appropriate mode is available and acceptable to the person.
- Aim to achieve, over time, 30 mins of moderate intensity exercise on 2-3 days when the participant is not doing a strength/co-ordination exercise session.
- Moderate intensity physical activity elicits a moderate, noticeable increase in depth and rate of breathing, while still allowing comfortable talking.
- Initially, the amount of activity can be achieved in shorter bouts (e.g., three 10 min sessions) and at lower intensity.

Strategies to enhance adherence (from Gill et al)

- Explanation of relationship between impairments (eg poor balance) and on functional ability
- Agreement from participant to address these via exercise
- Explanation of why exercises are expected to enhance function
- Discuss participant preferences of exercise eg individual versus group
- Set goals for frequency of exercise
- Provide instruction and logbook for recording exercise and effects of exercise
- Identify and address barriers to participation
- Consider use of behaviour modification principles such as contracts, rewards
- Monitor adherence to recommended exercise schedule and re-negotiate as required

Exercises

Warm-up

1. High stepping on the spot

Aims: warm-up, enhance co-ordination, endurance

Suggestions for progression and variety:

Making it harder:

- Step higher
- Step for longer

Making it easier:

- place a table beside the person for hand support

To enhance co-ordination and endurance

- Minimise hand support
- Aim to increase time without using hand support



Co-ordination exercises

2. Standing with a decreased base

Aims: enhance co-ordination

Suggestions for progression and variety:

Making it harder:

- Feet together and level
- Semi-tandem stance
- Tandem stance
- Stand on one leg
- Maintain position for longer
- Close eyes
- Stand on different surfaces eg foam rubber mat

Making it easier:

- place a table beside the person for hand support

To enhance co-ordination

- Minimise hand support
- Aim to increase time without hand support



3. Graded reaching in standing

Aims: enhance co-ordination

Suggestions for progression and variety:

Making it harder:

- Foot placement- narrower, step standing
- Reaching further
- Reaching in different directions
- Reaching down to a stool or the floor
- Reaching for heavier objects
- Reaching for a full cup of water
- Standing on a softer surface eg foam rubber mat
- Stepping while reaching

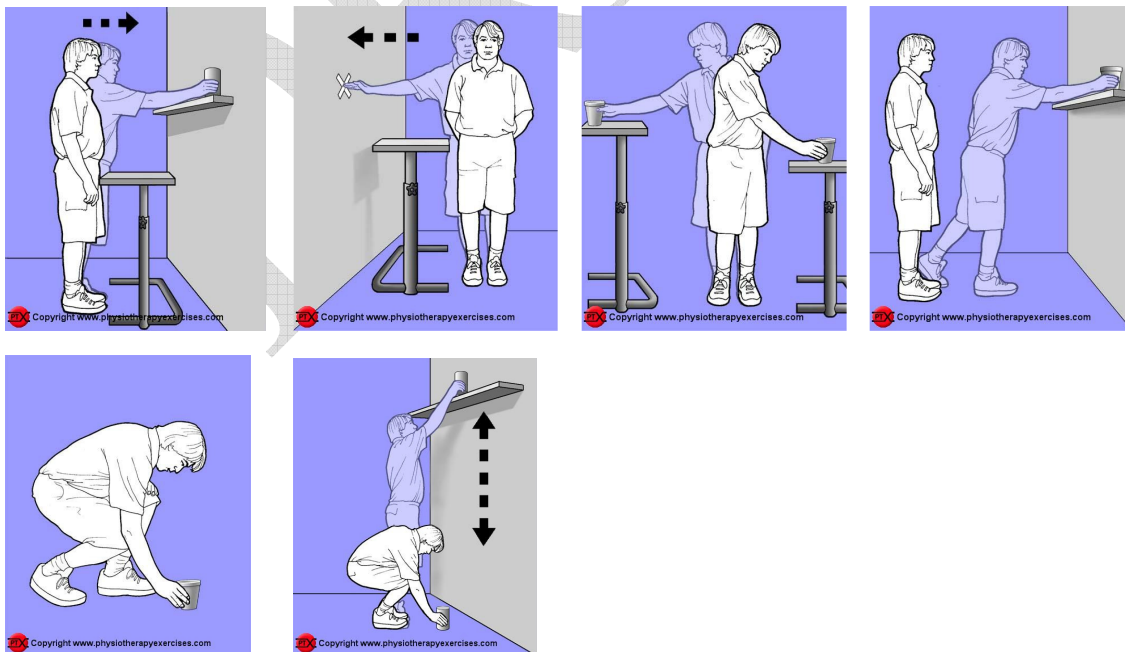
Making it easier:

- place a table beside the person for hand support
- give feedback to enable the task to be successfully completed (eg, keep your hips forward)
- structure the environment to enhance performance eg markers on floor to show foot position, an object to move hips towards

Tip. If you have a sway-meter, people may enjoy tracing different size “race track” paths with this.

To enhance co-ordination

- Minimise hand support
- Aim for as long as possible with out hand support



4. *Stepping in different directions*

Aims: enhance co-ordination

Suggestions for progression and variety:

Making it harder:

- Narrow foot position
- Longer steps
- Faster steps
- Step over objects
- Choice component eg step forward with left foot
- Incorporate pivoting on the non-stepping foot
- Use different colours, numbers of letters or a clock face or coins as targets for variety

Making it easier:

- place a table beside the person for hand support

To enhance co-ordination

- Minimise hand support
- Aim for as long as possible without hand support



5. Walking practice

Aims: enhance co-ordination and endurance

Suggestions for progression and variety:

Making it harder:

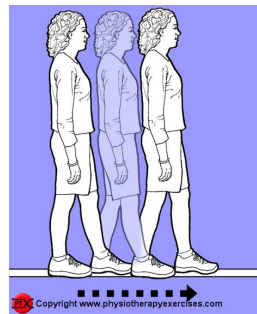
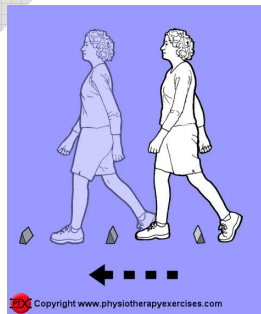
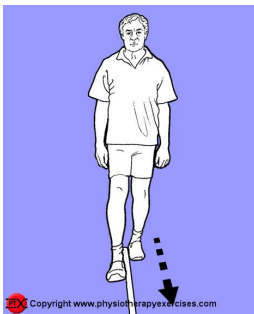
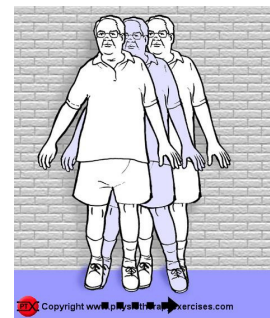
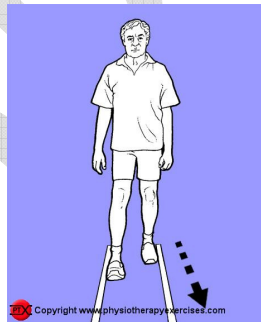
- Decrease base of support i.e. progress to tandem walk
- Increased step size
- Increase speed
- Change direction
- Walk on different surfaces
- Walk sideways, backwards
- Obstacles to step over and walk around

Making it easier:

- Use a bar, wall or walking aid for hand support

To enhance co-ordination and endurance

- Minimise hand support
- Aim for as long as possible with out hand support



Strength and co-ordination exercises

6. Sit-to-stand

Aims: enhance co-ordination, strength and endurance

Suggestions for progression and variety:

Making it harder:

- lowering the height
- don't use hands to push off, cross arms across chest
- changing the nature of the surface (eg softer chair)
- ask the person to stand up with most weight on one leg- the other leg can be placed in front or on a stool to ensure this
- adding weight (either vest or belt)

Making it easier:

- place a table in front of or beside the person for hand support
- give feedback to enable the task to be successfully completed (eg feet back behind your knees, move your shoulders forward)
- structure the environment to assist performance eg markers on floor to show foot position

Tip. Height can be adjusted by using an electric plinth, using different chairs or stools and by placing large stable block/s under the feet.

To enhance co-ordination and endurance

- Aim for as many repetitions as possible, the height should be such that it is easy for the subject to complete multiple repetitions
- Minimise hand support
- Increase speed eg count repetitions done in one minute

To enhance strength

- Aim for a chair height and amount of added weight for which the person can just do 2 sets of 10-15 repetitions (ie 10-15 RM).



7. *Heel raises*

Aims: enhance co-ordination and muscle strength and endurance

Suggestions for progression and variety:

Making it harder:

- decrease hand support
- hold the raise for longer
- one leg at a time
- adding weight (either vest or belt)
- use a wedge to increase the range of motion

Making it easier:

- place a table on one or both sides of the person for hand support or use their walking aid

To enhance co-ordination and endurance

- Minimise hand support
- Do as many repetitions as possible

To enhance muscle strength

- Aim for an amount of added weight for which the person can just do 2 sets of 10-15 repetitions (ie 10-15 RM).



8. *Lateral step-up*

Aims: enhance co-ordination and strength

Suggestions for progression and variety:

Making it harder:

- increasing block height
- adding weight (either vest or belt)

Making it easier:

- place a table on one or both sides of the person for hand support or use their walking aid

Tip. Make sure the person doesn't push off by plantar flexing ankle of foot on floor instead of extending leg on block

To enhance co-ordination

- Aim for as many repetitions as possible, the height should be such that it is easy for the subject to complete multiple repetitions
- Minimise hand support

To enhance strength

- Aim for a block height and amount of added weight for which the person can just do 2 sets of 10-15 repetitions (ie 10-15 RM).



9. *Forward step-up*

Aims: enhance co-ordination and strength

Suggestions for progression and variety:

Making it harder:

- increasing step height
- adding weight (either vest or belt)
- decrease hand support
- step up and over block

Making it easier:

- place a table on one or both sides of the person for hand support or use their walking aid

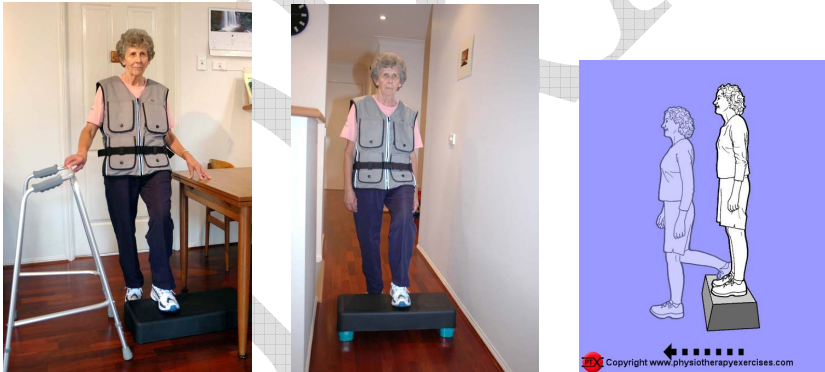
Tip. Make sure the person lowers the leg in a controlled manner when stepping over the block

To enhance co-ordination

- Aim for as many repetitions as possible, the height should be such that it is easy for the subject to complete multiple repetitions
- Minimise hand support

To enhance strength

- Aim for a block height and amount of added weight for which the person can just do 2 sets of 10-15 repetitions (ie 10-15 RM).



10. Half- squats sliding down a wall

Aims: enhance co-ordination and muscle endurance

Suggestions for progression and variety:

Making it harder:

- decrease hand support
- hold the squat for longer
- move a short distance away from the wall
- adding weight (either vest or belt)
- one leg at a time

Making it easier:

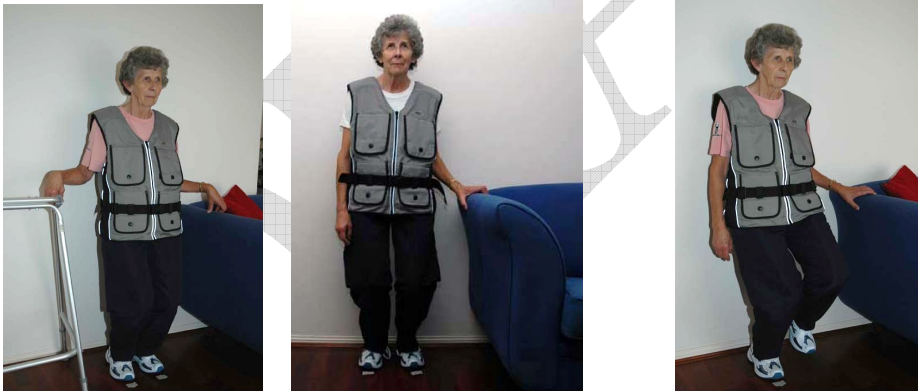
- place a table on one or both sides of the person for hand support or use their walking aid

To enhance co-ordination

- Minimise hand support

To enhance muscle endurance

- Aim to hold the position for as long as possible



Endurance exercise

11. Bike, treadmill walk, overground walk or sit-to-stand

- Chose an activity which the person can perform safely according to the prescription principles outlined earlier.
- Examples of activities include: exercise bike (a recumbent bike may be safer), treadmill walk (ensure available treadmill can go slowly enough), overground walk (up and down an indoor area or outdoors if safe), sit-to-stand (from a height that is easy for the person).

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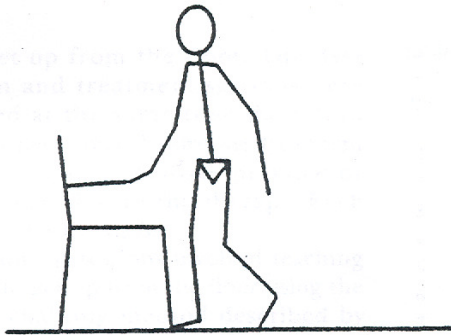
Other exercises

12. Getting off the floor training

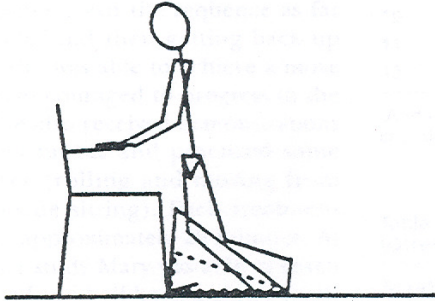
Aim. Enhance ability to get off the floor and enhance confidence

Procedure: Follow backward chaining method described in Adams and Tyson [64].

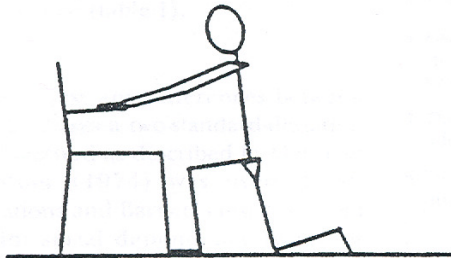
- Begin by practicing Move 1 and 2, then return to starting position
- Systematically increase the number of moves practiced before returning to the starting position, until the person can practice the whole task of standing up from supine lying on the floor.



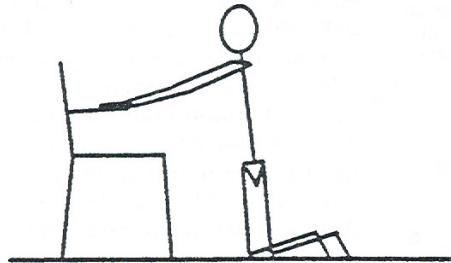
Starting position: Stride standing



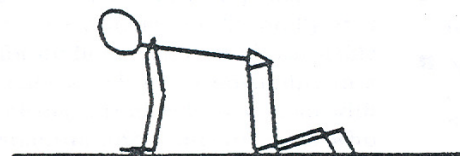
Moves 1 and 2: To half-kneeling on to a large foam wedge and up (using a small wedge = move 2)



Move 3: To half kneeling on a mat and up



Move 4: To high kneeling and up



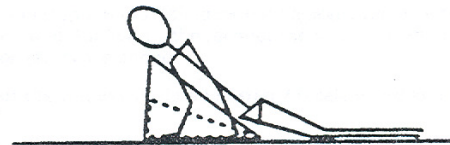
Move 5: To prone kneeling and up



Moves 6 and 7: To half sitting on two pillows and up (using one pillow = move 7)



Move 8: Half sitting on mat and up



Moves 9 and 10: Side lying on a large wedge and up (using a small wedge = move 10)



Move 11: Side lying on a mat and up



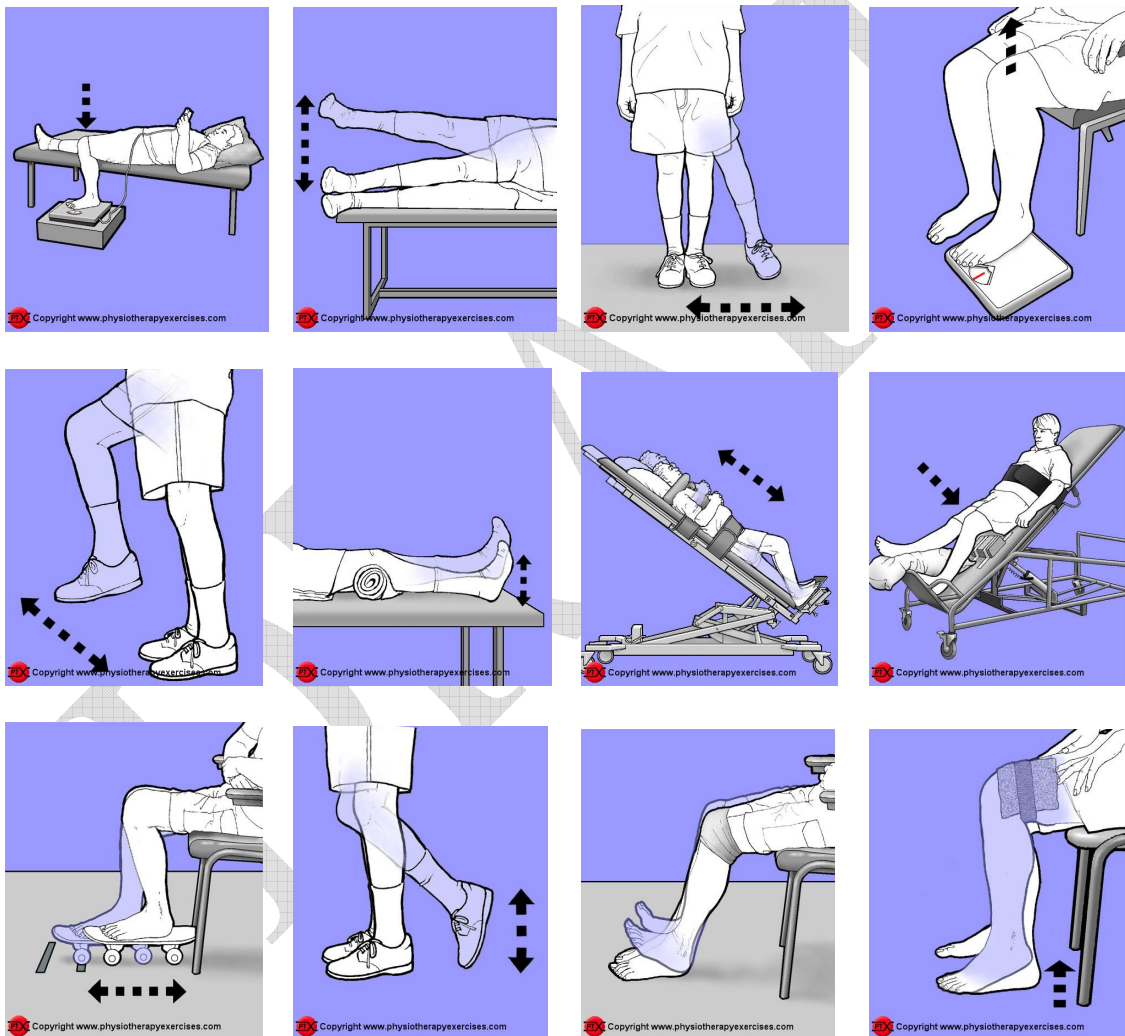
Move 12: Supine lying and up

Figure reproduced from Adams and Tyson [64].

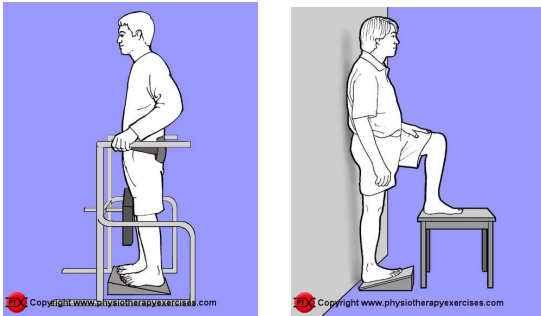
13.. Additional interventions for some individuals

Appendix 4 outlines commonly observed gait problems and possible causes and intervention strategies for these. This may assist in identification of additional areas that require intervention for an individual. Examples of other interventions are shown below. For further information on rehabilitation for people with movement problems please see recent text books [52, 65].

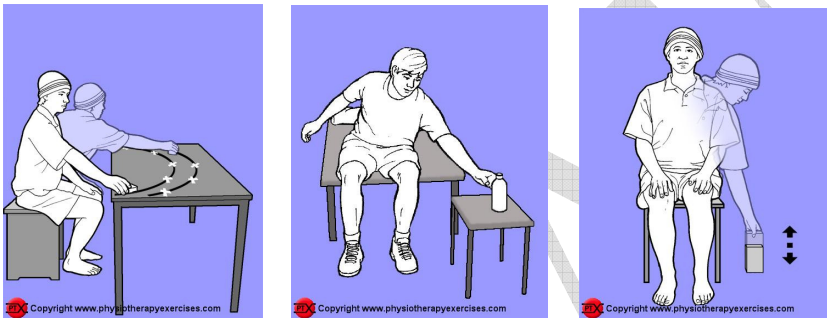
Additional strength training may be needed for individuals with specific strength impairments. *Additional co-ordination training* may be needed for individuals with difficulty coordinating muscles. Some exercises which can be undertaken are illustrated below.



Prolonged calf muscle stretches may be indicated if a person is unable to stand on a 10 degree wedge comfortably. (i.e. aim for 10 mins on the wedge and build up to 30 mins).



Additional task training may also be required if an individual has a problem with a particular task e.g. getting from supine to sitting, sitting balance.



Appendix 1. Safety advice for exercise participants

General advice

- Wear walking shoes or joggers. Do not wear open shoes of any kind, such as thongs and sandals, high-heeled shoes, slippers or ill-fitting shoes
- Clothing should be comfortable and cool. Do not wear flowing clothing, such as ties, scarves, flowing trousers or sleeves
- Please ask the other people in your household not to distract you when you are concentrating on your exercises
- Make sure you replenish your fluids by having a drink of water after your exercise session

Warnings

Do not perform your exercise session if:

- You are feeling unwell, due to a temporary illness such as a cold or flu
- You have not taken your regular medications as scheduled

Indications to terminate an exercise session and seek medical advice:

These indications to terminate exercise and seek medical advice apply to all participants (regardless of whether you have recognised cardiovascular disease or not)

- Squeezing, discomfort or typical pain in the centre of the chest or behind the breastbone ± spreading to the shoulders, neck, jaw and/or arms; or symptoms reminiscent of previous myocardial ischaemia
- Dizziness, light headedness or feeling faint
- Difficulty breathing
- Nausea
- Uncharacteristic excessive sweating
- Palpitations associated with feeling unwell
- Undue fatigue
- Leg ache that curtails function
- Physical inability to continue
- For people with diabetes: shakiness, tingling lips, hunger, weakness, palpitations

Indications to stop a particular exercise and rest for a couple of minutes before proceeding:

- Severe local muscle fatigue (mild fatigue is expected).

Appendix 2. Doctor's approval for commencement of exercise program

MEDICAL CLEARANCE FOR EXERCISE

Date: _____

Dear Doctor

Your patient _____ has expressed an interest in commencing an exercise program to be established and monitored by a physiotherapist in a home or group setting.

This program aims to enhance the balance and strength of older people and to increase their current level of physical activity. Participants are encouraged to work at a moderate intensity depending on their individual capabilities. Rest intervals will be incorporated into the program at appropriate intervals, and as necessary for each individual.

We have adopted the American College of Sports Medicine statement which states that the following conditions require permanent exclusion from vigorous exercise: inoperable enlarging aortic aneurysm, malignant ventricular arrhythmia related to exertion, severe aortic stenosis, end stage congestive heart failure, other rapidly terminal illness, severe behavioral agitation in response to exercise.

Specifically we have been advised that individuals with the following conditions and/or symptoms should not undertake the program:

- Unstable angina
- Uncontrolled cardiac failure
- Severe aortic stenosis
- Uncontrolled hypertension or grade 3 (severe) hypertension (e.g., blood pressure \geq 180 mmHg [systolic] or \geq 110 mmHg [diastolic])
- Symptomatic hypotension $<$ 90/60 mmHg
- Acute infection or fever, or feeling unwell (including, but not limited to, acute myocarditis or pericarditis)
- Resting tachycardia or arrhythmias
- Diabetes with poor blood glucose control (e.g., blood glucose level $<$ 6 mmol/L or $>$ 15 mmol/L)

Please sign the attached sheet if the participant's medical condition is adequate to commence this program. If you have any questions, please do not hesitate to contact _____

Thank you for your assistance.

Yours sincerely,

DRAFT 19, 1 September 2008

MEDICAL CLEARANCE FOR EXERCISE

Dear _____

The medical condition of _____ is adequate to commence an exercise program of the type you describe in your letter of _____.

Dr's name: _____

Signature: _____

Date: _____

DRAFT

Appendix 3. Safe practice guidelines for physiotherapists (Prepared by Dr Connie Vogler, Geriatrician, Royal North Shore Hospital).

- 1) ANYONE who develops chest pain, collapse, faintness, or severe breathlessness during exercise should go directly to hospital (via ambulance). In the case of chest pain, lie the patient down and administer 1 sublingual anginine (if the patient has them), and call an ambulance. In the case of cardiac arrest, commence CPR and call an ambulance.
- 2) Always carry details of patients' medical background, and have information to be able to contact their local doctor if necessary.
- 3) Take extra care when individuals are on warfarin – they are more likely to bruise and bleed.
- 4) Anyone with a known heart murmur who develops a cut or graze will need antibiotics – inform their local doctor if a cut/graze occurs. Apply antiseptic immediately.
- 5) Some exercise participants will have osteoarthritis/rheumatoid arthritis – only exercise in the pain free range of motion.
- 6) Check and adhere to any special precautions for individuals who have had a total hip replacement.
- 7) Individuals with respiratory disease should have their puffers/nebulisers nearby, and may need to take the exercises slowly.
- 8) Individuals who report dizziness or fainting should see their local doctor.
- 9) Individuals with diabetes should be encouraged to test their blood sugar level after exercise.
- 10) Individuals on diuretics, or with bladder irritability should be encouraged to void prior to the commencement of exercise.
- 11) Ensure appropriate breathing with resistance training – inhale before a lift, exhale during the lift and inhale as weight is lowered to the starting position.
- 12) Never force a patient to perform an exercise they are not keen to do.

Appendix 4. Commonly observed gait problems and their possible causes. For more details see [66, 67]

Decreased hip extension in late stance phase



Hip - possible causes

- Weak/paralysed hip extensor muscles early in stance
- Weak/paralysed hip flexor muscles in mid/late stance phase
- Shortening of hip flexor muscles/loss of range of hip extension

Knee – possible causes

- Weak knee extensor muscles throughout stance (excessive flexion)
- Knee flexion contracture
- Weak gastrocnemius

Ankle/Knee – possible causes

- Excessive tension/poor eccentric control of ankle plantarflexor muscles
- Weak/paralysed ankle plantarflexor muscles
- Contracture of ankle plantarflexor muscles and/or soft tissues around the ankle joint
- Excessive tension in knee extensor muscles (hyperextension)
- Weak/paralysed knee extensor muscles

Increased lateral pelvic displacement



Hip – possible causes

- Weak hip abductor muscles in mid to late stance
- Poor eccentric → concentric control of hip abductors

Knee hyperextension (decreased knee flexion)



Knee/ankle – possible causes

- Weak knee extensor muscles
- Weak knee flexor muscles in early stance
- Excessive active tension in knee extensors
- Excessive active tension in the ankle plantarflexor muscles in early or mid-stance
- Contracture of ankle plantarflexor muscles

Increased knee flexion in stance phase



Knee/ankle - possible causes

- Weak knee extensor muscles in shortened range
- Contracture of knee flexor muscles or other tissues on the flexor aspect of the knee
- Weak/paralysed plantarflexor muscles

Decreased ankle plantarflexion at toe off



Ankle - possible causes

- Weak/paralysed ankle plantarflexor muscles

Appendix 5. Borg Rating of Perceived Exertion Scale

Instructions for Borg Rating of Perceived Exertion (RPE) Scale

While doing physical activity, we want you to rate your perception of exertion. This feeling should reflect how heavy and strenuous the exercise feels to you, combining all sensations and feelings of physical stress, effort, and fatigue. Do not concern yourself with any one factor such as leg pain or shortness of breath, but try to focus on your total feeling of exertion.

Look at the rating scale below while you are engaging in an activity; it ranges from 6 to 20, where 6 means "no exertion at all" and 20 means "maximal exertion." Choose the number from below that best describes your level of exertion. This will give you a good idea of the intensity level of your activity, and you can use this information to speed up or slow down your movements to reach your desired range.

Try to appraise your feeling of exertion as honestly as possible, without thinking about what the actual physical load is. Your own feeling of effort and exertion is important, not how it compares to other people's. Look at the scales and the expressions and then give a number.

6 No exertion at all

7

Extremely light (7.5)

8

9 Very light

10

11 Light

12

13 Somewhat hard

14

15 Hard (heavy)

16

17 Very hard

18

19 Extremely hard

20 Maximal exertion

9 corresponds to "very light" exercise. For a healthy person, it is like walking slowly at his or her own pace for some minutes

13 on the scale is "somewhat hard" exercise, but it still feels OK to continue.

17 "very hard" is very strenuous. A healthy person can still go on, but he or she really has to push him- or herself. It feels very heavy, and the person is very tired.

19 on the scale is an extremely strenuous exercise level. For most people this is the most strenuous exercise they have ever experienced.

Borg RPE scale

© Gunnar Borg, 1970, 1985, 1994, 1998

- Note from The US Department of Health and Human Services Center for Disease Control and Prevention home page (Accessed 20 March 2006)
http://www.cdc.gov/nccdphp/dnpa/physical/measuring/perceived_exertion.htm
A high correlation exists between a person's perceived exertion rating times 10 and the actual heart rate during physical activity; so a person's exertion rating may provide a fairly good estimate of the actual heart rate during activity (Borg, 1998) [68]. For example, if a person's rating of perceived exertion (RPE) is 12, then $12 \times 10 = 120$; so the heart rate should be approximately 120 beats per minute. Note that this calculation is only an approximation of heart rate, and the actual heart rate can vary quite a bit depending on age and physical condition. The Borg Rating of Perceived Exertion is also the preferred method to assess intensity among those individuals who take medications that affect heart rate or pulse. (Borg, 1998) [68].
- Additional references of the use of the Borg to prescribe exercise [69-71]

Appendix 6. List of Equipment required for the program

Weight belt or vest and weights
Block, preferable adjustable in height such as an “aerobics” step
Wedge, approx 10 degrees
Tape (to place markers on the floor)
Non-slip mat
Object for stepping over eg high density foam
Borg Scale
Pillows
Tables
Chairs
Objects to reach for

Appendix 7. Tips for running the program in a group setting

- Some group activities can be introduced to help participants get to know each other and to enhance variety and enjoyment. For example, throwing or kicking a large ball or balloon (can use rice in it to make it heavier) to each other in sitting or standing, walking relays.
- A circuit class design can facilitate individual prescription if participants have different levels of ability.
- To enhance variety the exercises and/or stations chosen can be varied each class of after several weeks
- It is useful to have a social aspects to the class too, eg, meeting for morning tea prior to or after the class.
- Home exercises can be individually prescribed by asking several participants to come early or stay later each class.
- Laminated numbered station cards are a useful way to ensure participants move from one exercise station to the next in the correct order.
- When a program first starts 2-2.5 minutes per station may be all that participants can manage but this can be progressed to 4 minutes.
- Games can be incorporated into exercise stations to enhance interest eg finding pairs in playing cards which can be temporarily fixed to a wall for standing tasks, magnetic darts or quoits, mini-golf.

Appendix 8. Managing freezing in people with Parkinson's Disease

“Freezing” is the word used to describe a sudden difficulty in starting or continuing a movement experienced by some people with Parkinson's disease. People report feeling as though they are frozen, or that their feet are stuck to the ground.

Using cues is thought to help prevent freezing and to end a freezing episode. Cues are prompts that help people to move. They usually provide information about the

- timing (eg stepping to metronome beat, counting) or
- size (eg strip of tape on the floor to step over)

of the next movement.

Common times for freezing and some suggested strategies to overcome it are given below.

Taking the first step to start walking

- Shift your weight from side to side so you are rocking between your right and left leg.
- Count to yourself as you rock, and start walking on a particular number you have chosen.
- Use a metronome beat to rock with and then start walking on the beat.
- Step over a stripe or other object on the floor (if you regularly freeze in the same place, you could put a strip of tape on the floor there).
- Try to step into an uncrowded space.
- If shifting from side to side is not successful, try taking a step back or to the side, then step forwards.

Walking in a confined space (eg doorway, between 2 chairs)

- Start counting to yourself a few steps before hand and keep stepping with your counting rhythm.
- If you feel you are beginning to freeze, then STOP. Use the strategies above to get started again.
- Take steps in time to a metronome to help you keep your rhythm.
- Step very deliberately or stamp your feet
- Place strips of tape on the floor, step width apart, in places where you regularly freeze. Step over each strip of tape as you walk.
- Place a single strip of tape in doorways and focus on stepping over the tape.

Turning from a stationary start (eg, from kitchen bench) or in confined spaces

- Stepping and turning on the spot
- Step around with high steps, keep feet apart, do not swivel
- Count to yourself as you begin stepping on the spot, and maintain the stepping rhythm throughout the turn
- Take steps in time with a metronome to help you keep your rhythm

Turning when walking

- Turn in an arc using big steps.
- Start counting to yourself a few steps before the turn and keep stepping with your counting rhythm.
- Take steps in time to a metronome to help you keep your rhythm.
- Step very deliberately or stamp your feet as you turn.
- Place strips of tape on the floor, step width apart, in places where you regularly freeze when turning. Step over each strip of tape as you turn.

For evidence and further information, see:

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