Balance and falls in people with dementia: Impairment and intervention

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Balance and falls in people with dementia: Impairment and intervention

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The sub-studies:

1) Falls risk and balance and mobility dysfunction in

   Alzheimer's disease (AD)

2) Change in falls risk and balance and mobility in AD

3) Feasibility and effectiveness of exercise program

4) Factors influencing exercise program adherence

The issues:

Falls & Dementia

- Falls consequences: injuries, hospitalisations

- 30% older people (≥ 65 years)

- 40-80% older people with dementia

- Falls– predictors of care-transition

Background:

Falls Risk & Balance Dysfunction

- Falls are multifactorial (intrinsic & extrinsic factors)

- Balance performance

  - a major risk of falling

  - modifiable risk factor

  - falls risk assessment/intervention

  - contributing to falls in people with dementia

<u>Study 1</u>: Balance and mobility dysfunction and falls risk in people with Alzheimer's disease.

Aim: to identify the magnitude and type of

balance/mobility impairments in people with

Alzheimer's disease (AD)

Methods: 25 participants with <u>mild to moderate</u> AD/

25 healthy controls

1 assessment occasion (2 groups)

Methods:

measurements

- Balance/mobility performance

  - clinical measures

  - computerised posturography measures

[• static/dynamic; • sensory challenge; • single/dual task]

- Falls

- Falls risk: Falls Risk for Older People-Community version (FROP-com), Physiological Profile Assessment (PPA)

- Physical activity level: Human Activity Profile questionnaire

Methods:

Clinical measures: Functional Reach (FR),

Step Test (ST),

Timed Chair Stand (TCS),

Timed Up and Go test (TUG (single/dual task)

15 seconds

3 m
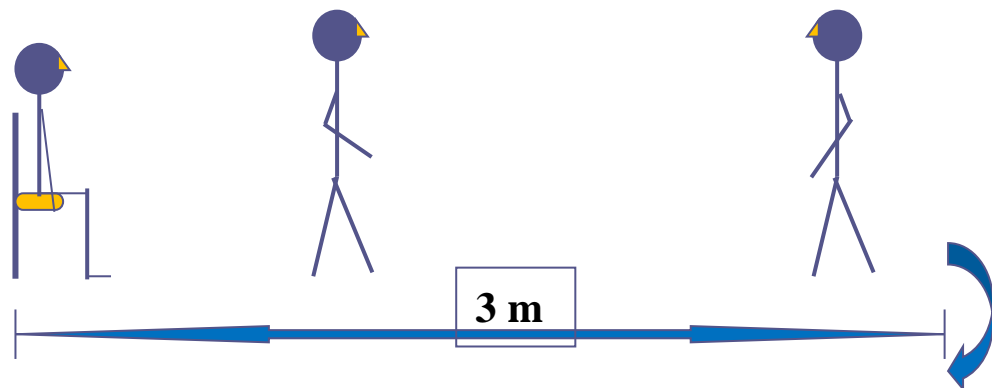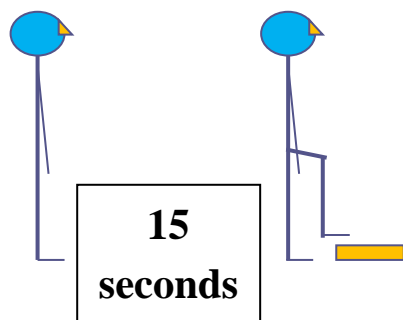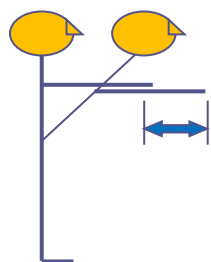
Functional Reach

Step Test

Timed Up and Go test

Methods:

Force platform measures: static/dynamic balance, functional mobility

mCTSIB

Limits of Stability

Mobility functions
- Walking
- Turning
- Sitting to standing

Step Quick Turn

Walk Across

Sit to Stand

The Falls Risk for Older People (Community) (FROP-com)

Left form

MELBOURNE EXTENDED CARE & REHABILITATION

Falls Risk Assessment Form

(To be completed on patient admission and after an acute episode)

Date of Assessment: / /

Place UR sticker here or add patient details:

Name: _____
UR number: _____
Ward: _____
Age: _____ Gender: _____
Admission Date: _____

General issues (do not score, but ensure appropriate actions) — Nursing:
- Has the patient been oriented to the ward & routines, and a patient information brochure/booklet provided? ❏ Yes ❏ No
- Patient's environment assessed and safe? (seating type and height, bed height and assistive equipment eg monkeybar/bedstick) ❏ Yes ❏ No
- Is English the patient's preferred language? ❏ Yes ❏ No

Medical Staff

Recent falls (0-3) — SCORE
- Has the patient fallen recently?
  - ❏ Nil in 12 months (0)
  - ❏ 1 in the last 12 months (1)
  - ❏ 2 or more in 12 months (2)
  - ❏ 1 or more during their current hospitalisation (3) [ ]
- Did they sustain an injury?
  - ❏ No (0)
  - ❏ Minor injury, did not require medical attention (1)
  - ❏ Minor injury, did require medical attention (2)
  - ❏ Severe injury (fracture, etc) (3) [ ]

Medications (0-3)
- Is the patient on **any** medication?
  - ❏ No medication (0) ❏ 1–2 medications (1)
  - ❏ 3 medications (2) ❏ 4 or more medications (3) [ ]
- Does the patient take any of the following type of medication? ❏ Sedative ❏ analgesic ❏ psychotropic ❏ antihypertensive ❏ vasodilator ❏ diuretics ❏ antiparkinsonian ❏ antidepressants ❏ vestibular supressant.
  - ❏ None apply (0)
  - ❏ 1–2 apply (1)
  - ❏ 3 apply (2)
  - ❏ 4 or more apply (3) [ ]

Medical conditions (0-3)
- Does the patient have a chronic medical condition/s affecting their balance & mobility? ❏ Arthritis ❏ Respiratory condition ❏ Parkinson's Disease ❏ Diabetes ❏ Dementia ❏ Peripheral neuropathy ❏ Cardiac condition ❏ Stroke ❏ Other neurological conditions ❏ Lower Limb Amputation. ❏ Vestibular Disorder (dizziness, postural dizziness, Meniere's Disease
  - ❏ None apply (0)
  - ❏ 1-2 apply (1)
  - ❏ 3-4 apply (2)
  - ❏ 5 or more apply (3) [ ]

Sensory loss & communications
- Does the patient have a sensory deficit/s that limits their functional ability?

	Vision	Hearing	Somato Sensory
	❏ no (0)	❏ no (0)	❏ no (0)
	❏ yes (1)	❏ yes (1)	❏ yes (1)	[ ]

- Is there a problem with communication (eg NESB or Dysphasia)?
  - ❏ No (0)
  - ❏ Yes (1) [ ]

Sub total for this page [ ]

Patient Name: _____ UR Number: _____

Right form

Sub total from previous page [ ]

Cognitive status: (score 0-3 points) — Medical Staff cont....
- AMTS score
  - ❏ 9-10 (0 point) ❏ 7-8 (1 point)
  - ❏ 5-6 (2 points) ❏ 4 or less (3 points) [ ]

Nursing Staff

Continence
- Is the patient incontinent? ❏ No (0) ❏ Yes (1) [ ]
- Do they require frequent toiletting or prompting to toilet? ❏ No (0) ❏ Yes (1) [ ]
- Do they require nocturnal toiletting? ❏ No (0) ❏ Yes (1) [ ]

Nutritional conditions (score 0-3 points)
- Has the patient's food intake declined in the past three months due to a loss of appetite, digestive problems, chewing or swallowing difficulties?
  - ❏ No (0)
  - ❏ Small change, but intake remains good (1)
  - ❏ Moderate loss of appetite (2)
  - ❏ Severe loss of appetite / poor oral intake (3) [ ]
- Weight loss during the last 6-12 months
  - ❏ Nil (0)
  - ❏ Minimal (<1 kg) (1)
  - ❏ Moderate (1-3kg) (2)
  - ❏ Marked (>3kg) (3) [ ]

Occupational Therapist

Functional behaviour: (score 0-3)
- Observed behaviours in Activities of Daily Living & Mobility indicate:
  - ❏ Consistently aware of current abilities/seeks appropriate assistance as required (0)
  - ❏ Generally aware of current abilities/occasional risk-taking behaviour (1)
  - ❏ Under-estimates abilities/ inappropriately fearful of activity (2)
  - ❏ Over-estimates abilities/frequent risk-taking behaviour (3) [ ]

Feet & footwear and clothing
- Does the patient have foot problems, e.g. corns, bunions etc.
  - ❏ No (0)
  - ❏ Yes (1) (specify): [ ]
- Is the patient's main footwear: - ❏ poor fitting ❏ poor grip on soles ❏ in-flexible soles ❏ heels greater than 2cm high/less than 3 cm wide ❏ slippers or other inappropriate footwear?
  - ❏ none apply (0)
  - ❏ one applies (1)
  - ❏ 2 apply (2)
  - ❏ 3 or more apply (3) [ ]
- Does the patient's clothing fit well (not too long or loose fitting)?
  - ❏ Yes (0) ❏ No (1) [ ]

Physiotherapist

Balance: (score 0-3 points)
- Were the patient's scores on the Timed Up and Go test and the Functional Reach test within normal limits?
  - ❏ Both within normal limits (0)
  - ❏ One within normal limits (1)
  - ❏ Both outside normal limits (2)
  - ❏ Requires assistance to perform (3)

  Normal limits:- Timed up and Go – less than 18 seconds Functional Reach – 23 cm or more [ ]

Transfers & gait (score 0-3 points)
- Is the patient independent in transferring and in their gait? (Includes wheelchair mobility)
  - ❏ Independent, no gait aid needed (0)
  - ❏ Independent with a gait aid (1)
  - ❏ Supervision needed (2)
  - ❏ Physical assistance needed (3) [ ]

Total Risk Score: [ ]

Score Legend: XX to XX = Low risk; XX to XX = medium risk; XX to XX = high risk

The Physiological Profile Assessment (PPA)
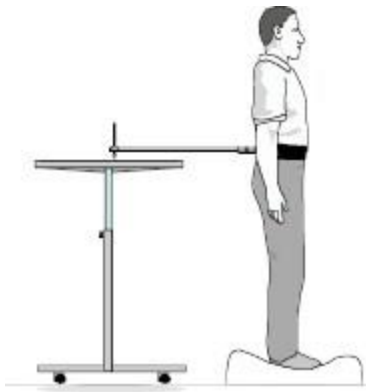
Postural Sway (Balance)
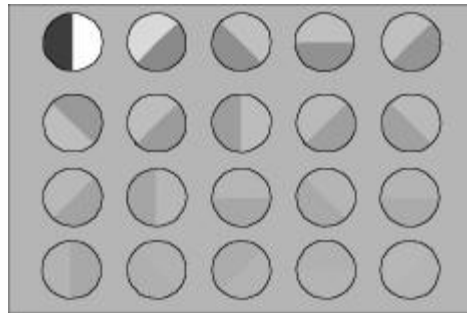
Visual contrast sensitivity
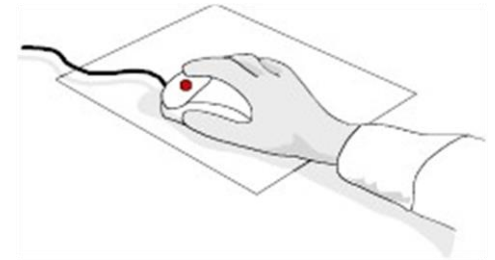
Reaction Time

Leg muscle strength

Lower limb proprioception

Measurements: sub-domains

Outcome measures
Falls risk
Static balance
Dynamic balance - *Dynamic one leg stance* - *Dynamic bilateral stance*
Mobility and function - *Single task_not involving turning* - *Single task_involving turning* - *Dual task* - *Sit to Stand*

Our Findings:

Falls/Falls risk level
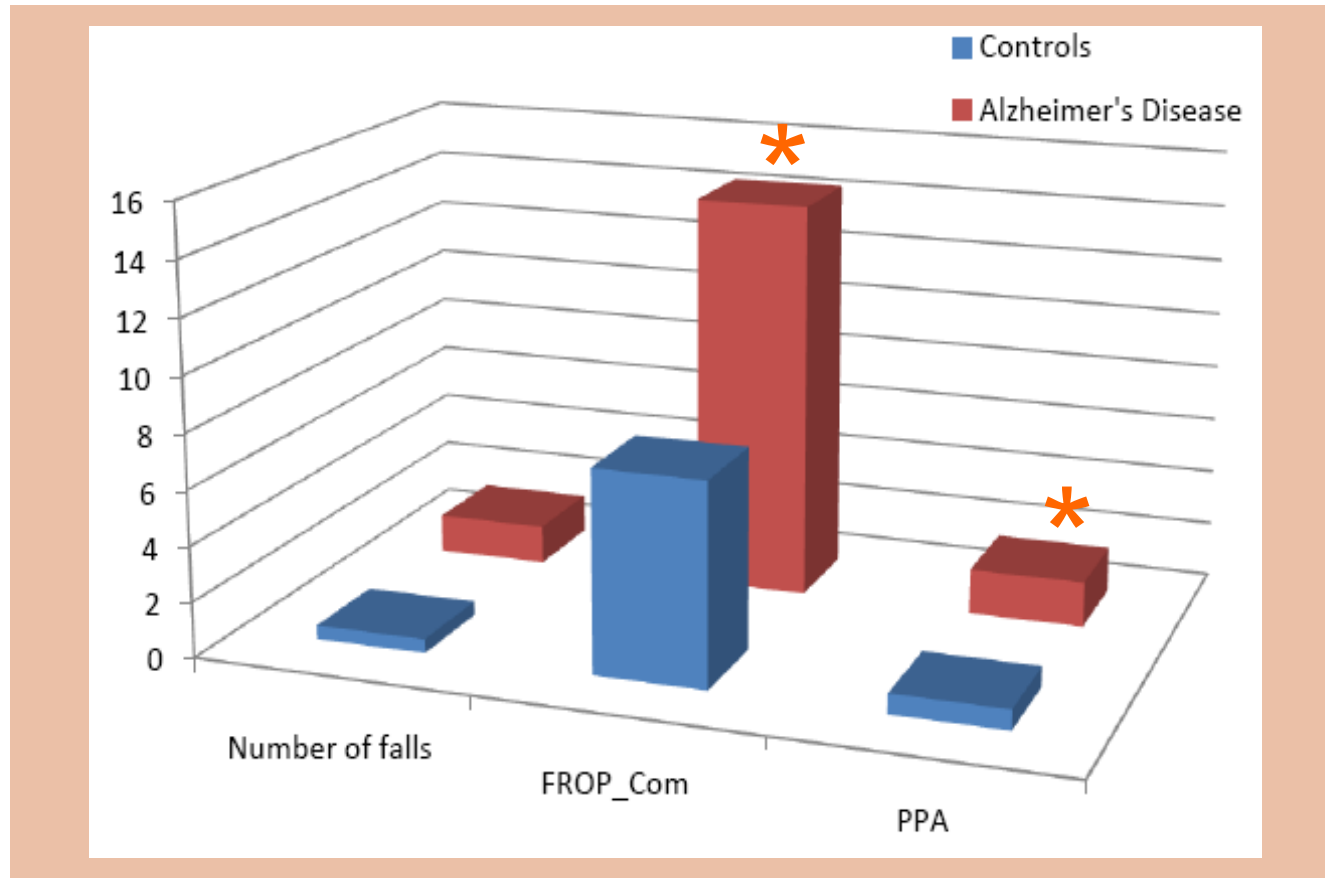
FROP_Com = The Falls Risk for Older People (Community),
PPA = The Physiological Profile Assessment

* significant difference between two groups (after the Bonferroni adjustment)

Our Findings:

Balance: Static (mCTSIB tested on force platform)
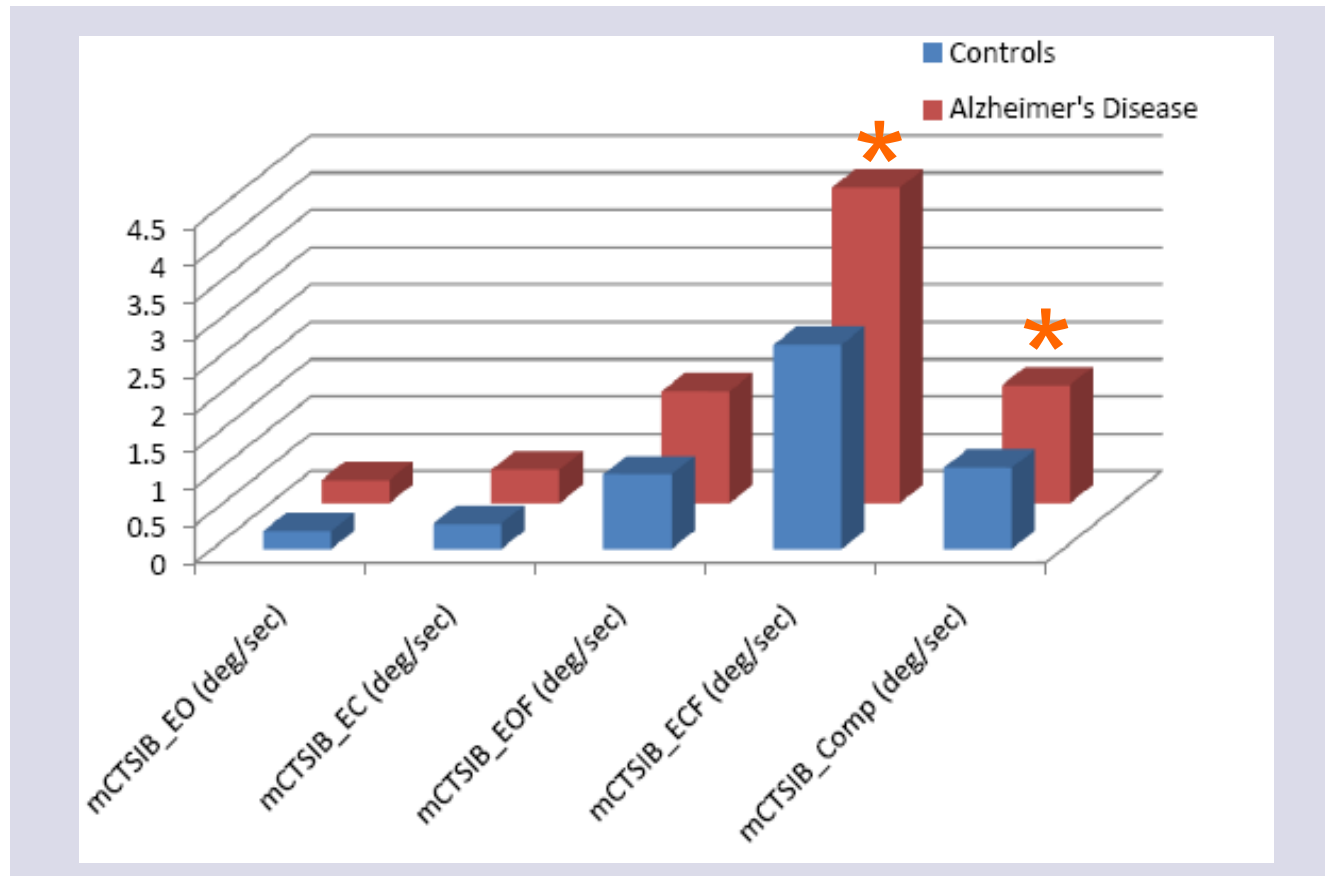
mCTSIB = modified Clinical Test of Sensory Interaction on Balance; EO = Eyes Open, EC = Eyes Closed, EOF = Eyes Open on Foam, ECF = Eyes Closed on Foam, Comp = Composite score

* significant difference between two groups (after the Bonferroni adjustment)

Balance: Static

- Greater sway in altered sensory conditions[1]

- Sensory organisation

- Motor outputs responses

[1] Chong R. K, Horak F. B., Frank J., Kaye J. (1999). Sensory organization for balance: Specific deficits in Alzheimer's but not in Parkinson's disease. *The Journal of Gerontology. Series A, Biological Sciences and Medical Sciences, 54*(3): M122-8.

Our Findings:

Balance: Dynamic
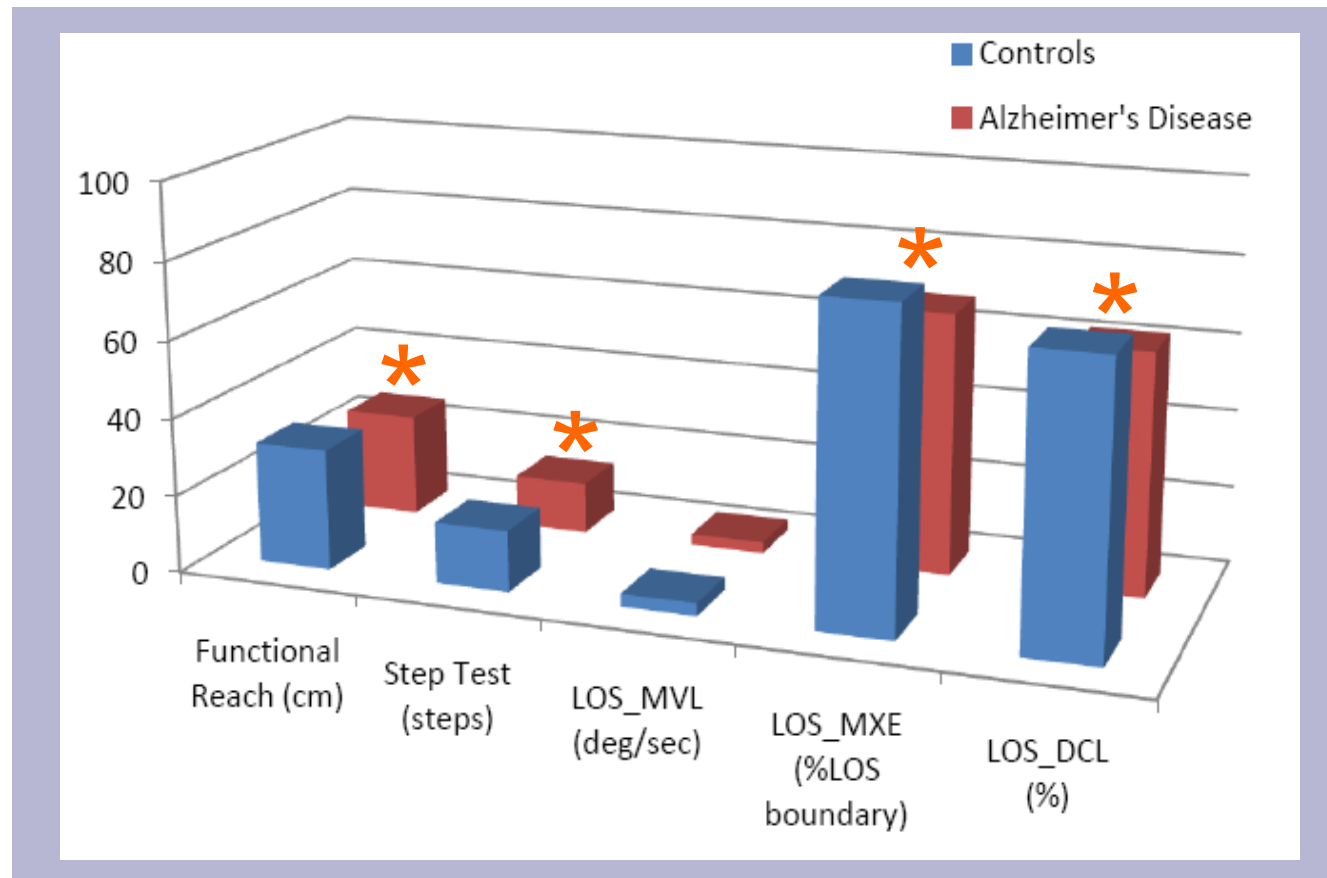
LOS = Limits of Stability test; MVL = Movement Velocity,
MXE = Maximum Excursion, DCL = Directional Control
  ∗ significant difference between two groups (after the Bonferroni adjustment)

Balance: Dynamic

- Voluntary tasks

- Anticipatory movement planning

Our Findings:

Mobility
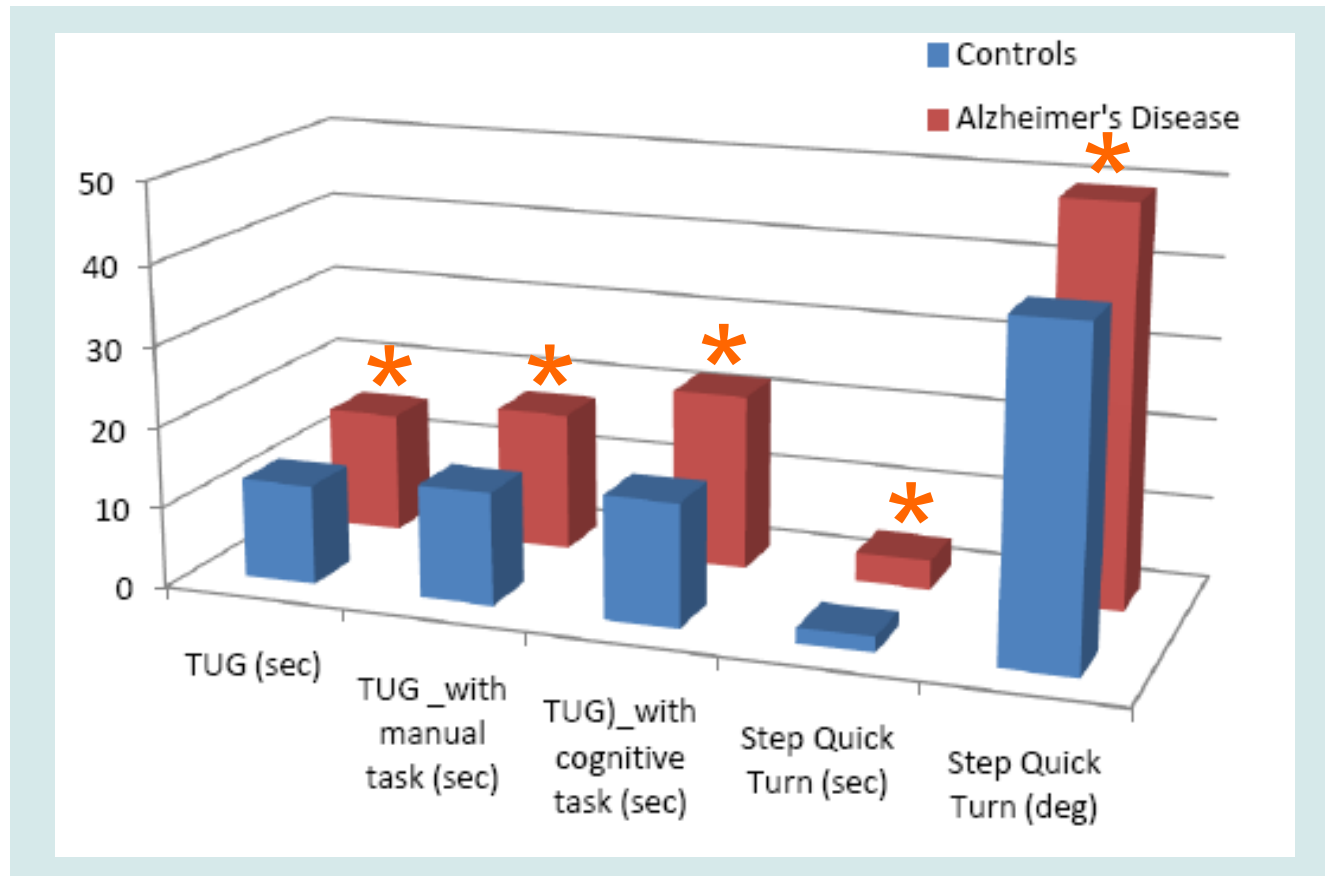
TUG = Timed Up and Go test

∗ **significant difference between two groups** (after the Bonferroni adjustment)

Mobility

- Turning tasks

- Dual tasks

  - deficits in divided attention and selective attention[1,2]

  - differs in different types of additional task

[1] Pettersson A. F., Olsson E., Wahlund, L.O. (2007). Effect of divided attention on gait in subjects with and without cognitive impairment. *Journal of Geriatric Psychiatry and Neurology, 20*(1): 58-62.

[2] Perry R. J, Hodges J. R. (1999). Attention and executive deficits in Alzheimer's disease: A critical review. *Brain, 122*(3): 383-404.

Conclusion: People with mild to moderate Alzheimer's disease…

- **A higher falls risk**

- **Impaired balance and mobility**

  - reaching, leaning tasks

  - stepping, turning tasks

  - altered sensory information (less stable surface/eyes closed)

  - single and dual tasks

Clinical Implications:

- **Balance screening in people with mild to**

  moderate Alzheimer's disease

  - the Functional Reach test

  - the Step Test

  - the Timed Up and Go test

- **Potential balance exercise program**

Study 2: Change in falls risk and balance and mobility in people with Alzheimer's disease

Aim: to determine change (over 1-year period) of

balance/mobility impairments and falls risk in people

with mild to moderate Alzheimer's disease (AD)

Methods: - 15 participants with mild to moderate AD

- 15 healthy controls

- rate of change (from baseline assessment to

reassessment at 1 year period)

Methods:

Measurements: *at baseline and 1-yr follow-up assessment*

- Balance/ mobility performance

- Falls

- Falls risk: Falls Risk for Older People-Community version (FROP-com), Physiological Profile Assessment (PPA)

Our Findings:

Falls/Falls risk level

- Total falls: at the 1 year follow-up assessment

  - Alzheimer's disease (AD) group: 14 falls

  - Control group: 3 falls

- Percentages of fallers:

  - AD group: increased from 20% to 47%

  - Control group: decreased from 33% to 13%

- Falls risk level (Fall Risk for Older People-community version questionnaire): at the 1 year follow-up assessment

  - AD group: increased from 12.80 to 14.67

  - Control group: increased from 6.13 to 6.47

Our Findings:

Balance and mobility performance

Outcome Measures	Control Group		AD Group		B Coefficient (95% CI)	P
	Baseline Performance	12-Mo Performance	Baseline Performance	12-Mo Performance		
Balance/mobility performance						
Functional reach, cm	31.98 (4.40)	28.27 (4.52)	29.04 (4.93)	24.64 (6.70)	−5.00 (−7.91 to −2.08)	0.001[c]
Step Test, steps/15 sec	16.36 (2.10)	15.64 (2.68)	13.53 (3.36)	11.47 (3.16)	−2.11 (−3.82 to −0.40)	0.016[b]
Timed Up and Go test, sec	12.59 (3.15)	12.59 (3.33)	16.16 (7.76)	17.81 (9.13)	1.80 (0.03 to 3.56)	0.046[b]
Timed Up and Go (with manual task), sec	14.52 (5.08)	13.99 (4.93)	17.99 (7.95)	19.66 (8.54)	2.42 (0.5 to 4.34)	0.014[b]
Modified CTSIB, degree/sec	1.32 (0.72)	1.39 (0.73)	1.33 (0.56)	1.59 (0.55)	0.24 (−0.05 to 0.53)	0.103
LOS_MXE, %LOS	79.20 (9.68)	82.87 (8.44)	72.71 (11.45)	72.57 (11.64)	−4.74 (−9.25 to −0.24)	0.039[b]
LOS_DCL, %	71.20 (7.79)	70.80 (9.21)	66.43 (9.80)	64.07 (12.45)	−2.42 (−7.84 to 2.99)	0.381
Walk Across_ step width, cm	14.91 (3.13)	15.55 (2.10)	15.57 (4.87)	15.46 (4.58)	−0.92 (−2.26 to 0.42)	0.179
Walk Across_step length, cm	43.11 (13.61)	45.08 (10.84)	36.29 (11.55)	37.72 (16.05)	−1.22 (−8.50 to 6.06)	0.742
Walk Across_ speed, cm/sec	54.68 (19.91)	57.07 (12.89)	42.57 (14.71)	41.92 (14.74)	−8.10 (−14.13 to −2.07)	0.008[c]
Step/Quick Turn_sway velocity, deg/sec	41.73 (14.34)	40.99 (5.45)	48.05 (7.00)	48.79 (10.02)	8.70 (2.95 to 14.46)	0.003[c]

Conclusion: After 1 year follow up, people with mild to moderate Alzheimer's disease…

- **greater rate of increase in the number of falls**

- **accelerated risk of falling**

- **greater rate of balance and mobility deterioration**

  - reaching, leaning tasks

  - stepping, turning tasks

  - Single, dual tasks

Clinical Implications:

- **Falls risk and balance/mobility screening**

- **Reviewing falls risk and balance/ mobility performance**

  - Dynamic balance

  - Mobility during turning tasks

  - Mobility under dual task conditions

- **Potential balance exercise program at an early stage**

<u>Study 3</u>: Feasibility and effectiveness of exercise program in people with mild to moderate Alzheimer's disease.

Aims: - to evaluate the feasibility/safety of a home-

          based balance exercise program

          - to provide evidence of program effectiveness

Methods: 40 participants with mild to moderate
          Alzheimer's disease

          6 month home-based programs:

          i) balance exercise;
          ii) education program

Methods: Home-based programs

(6 home visits & 5 phone calls)

1. Home-based balance exercise program

- *based on "Otago programme"*

- *included balance and strengthening exercises*

- *by a physiotherapist*

- *an exercise booklet*

- *exercise 5 days/week*

Methods: Home-based programs

(6 home visits & 5 phone calls)

2. Home-based education (control) program

- *based on study by Graff et al., 2007*

- *included education/information sessions*

- *by an occupational therapist*

Methods:

measurements

- Balance/mobility performance

- Falls

- Falls risk: Falls Risk for Older People-Community version (FROP-com), Physiological Profile Assessment (PPA)

- Physical activity level: Human Activity Profile questionnaire

Our findings/conclusion:

- **Program completion:** Exercise program (11 of 19)

   Control program (18 of 21)

Higher drop-out rate in exercise program

- *different nature of the two program*

- *caregivers' limitations*

Our findings/conclusion:

- **Exercise program:**

  - no falls/ adverse events

  - 83% adherence

  - reduced risk of falling (FROP-com score)

  - improve standing balance and mobility performance

Home-based balance exercise delivered by PT

- *can be implemented safely*

- *may reduce falls risk, improve balance/mobility in Alzheimer's disease*

- *further study is required*

<u>Study 4:</u> Factors influencing exercise adherence

Aims: to explore factors that influence

commencement and adherence to the

exercise program

Methods: phenomenological theoretical framework,

semi-structure interview

10 participants with Alzheimer's disease (AD)

and 9 caregivers

Our findings:

Decision to commence the program	
Participants with AD (n = 10)	**Caregivers (n = 9)**
1. Possible benefits	1. Possible benefits
2. Positive attitude/prior exercise experience	2. Positive attitude/prior exercise experience
3. Assist with research	3. Assist with research
4. Advice from health professionals	4. Advice from health professionals
5. Minimise caregiver's burden	

Decision to commence the program	
Participants with AD (n = 10)	**Caregivers (n = 9)**
Possible benefits	1. Possible benefits

C. 6, Female:

" *If we can get the confidence back and the walking back, the quality of life would be maintained. So that was the reason why we got stuck into it.*"

Decision to commence the program	
Participants with AD (n = 10)	**Caregivers (n = 9)**
Positive attitude/prior exercise experience	2. Positive attitude/prior exercise experience

P. 4, Female:

" I was always a great walker… I was a runner…I took first prize all the time…I used to go the gym…swimming."

P. 7, Male:

[too old to exercise?] " Nonsense! You are giving up, if you have got that attitude."

Decision to commence the program	
Participants with AD (n = 10)	**Caregivers (n = 9)**
Assist with research	3. Assist with research

P. 9, Female:

" *A lot of it was because I like to do things to help other people…we both do a lot volunteering.*"

C. 6, Female:

" *If we can help, if mum can help with all this, it is going to help me when I get to that stage…future baby boomers.*"

Decision to commence the program	
Participants with AD (n = 10)	**Caregivers (n = 9)**
Minimise caregiver's burden	

P. 5, Female:

" Well, to get out and not be a burden on xxx (daughter)."

Our findings:

Adherence to the program (Facilitators)

1. Program characteristics (n = 6 P, 9 C)
   - 6-month duration
   - 15-20 minute exercise session
   - Exercise program complexity/preference

2. Physiotherapists (n = 10 P, 9 C)
   - Professionalism
   - Supportive characteristics

3. Exercise recording sheet (n = 3 P, 3 C)
4. Caregivers' support (n = 2 P, 6 C)
5. Participants' sense of commitment (n = 2 P, 5C)
6. Perceived benefits (n = 3 P, 2 C)

Adherence to the program (Facilitators)

1. Program characteristics (n = 6 P, 9 C)
   - **<u>6-month duration</u>**
   - **<u>15-20 minute exercise session</u>**
   - **<u>Provision of an exercise booklet</u>**
   - Exercise program complexity/preference

C. 5, Female:

" I think they (PT visits) were pretty well spread-out."

C. 6, Female:

" The exercises were very clear and xxs (PT) wrote instructions if she varied them and mum would have that on the table and she would flip over and 'how do I do this?' It was easy for her to follow."

Adherence to the program (Facilitators)

1. Program characteristics (n = 6 P, 9 C)
   - 6-month duration
   - 15-20 minute exercise session
   - Provision of an exercise booklet
   - **Exercise program complexity**/preference

C. 7, Female:

" I would sit here and tell him (participant) what to do next…I should have had a director's chair that I could sit in…I just used to sit there and say 'well now we'll do this one' and so forth'."

Adherence to the program (Facilitators)

1. Program characteristics (n = 6 P, 9 C)
   - 6-month duration
   - 15-20 minute exercise session
   - Provision of an exercise booklet
   - Exercise program complexity/**preference**

C. 5, Female:

" Home-visit does spur you on, you know, you think 'well, she (PT) is coming next week, we better get busy' (laughing)…you need that little just sometimes to keep you wound up."

Adherence to the program (Facilitators)

2. Physiotherapists (n = 10 P, 9 C)
- Professionalism
- Supportive characteristics

C. 6, Female:

" She (PT) was not intrusive…she was not going to be here…for two hours and then you would be saying to yourself 'God, I wish she would go away!' , but she did the right thing, she just came, did it and went. Very professional she was."

C. 6, Female:

" She (PT) was good with the exercises; she explained why, what, how, and everything."

Adherence to the program (Facilitators)

3. Exercise recording sheet (n = 3 P, 3 C)

P. 9, Female:

" Cause you have got to fill that form in and if it was blank all the time, it would be a bit of a problem, wouldn't it? (laughing)."

C. 6, Female:

" That (exs sheet) is necessary because after that month is over, she can look back and go ' oh gee I did a good job' and xxx (PT) would go 'you have not missed a week, you have not missed a day'…it is like giving the kids a gold star."

- Exercise recording sheet

Home Exercise recording sheet for: ……………………………….

LA TROBE UNIVERSITY

Please tick each day that each exercise is completed

MONTH: ……………………… (……… week)   Commencing date …………….

EXERCISE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1. Trunk stretching / Calf stretching																															
2. Quadriceps strength / Toe raises / Heel raises																															
3. Tandem stance / Standing with EC / Reaching / Stand, walk, turn																															
4. Walking																															

If you have any concerns regarding any of the exercise, please cease the exercise and contact the Physiotherapist (…………………………., phone …………………….)

If you have been unable to do the exercises 5 times each week, please list reasons:

……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………

Adherence to the program (Facilitators)

4. Caregivers' support (n = 2 P, 6 C)

5. Participants' sense of commitment (n = 2 P, 5C)

P. 4, Female:

"He (caregiver) will often sit and watch and say 'oh you could do a little bit better than that, try it'. Yeah, well it makes you do it"

P. 5, Female:

"Well what I start, I want to finish"

Adherence to the program (Facilitators)

6. Perceived benefits (n = 3 P, 2 C)

P. 4, Female:

"I realised that it was good for me…and I just kept doing it."

C. 2, Male:

"Well, it is doing her (participant) good. She thought she was, with the exercises she was improving, so we kept on with it."

Adherence to the program (Barriers)

1. Pre-existing/acute health conditions (n = 2 P, 4 C)

2. Dislike of structured exercise (n = 1 P, 1 C)

3. Being away from home (n = 1 P)

4. Caregivers' factors (n = 1 P, 1 C)
   - health condition
   - other commitments

5. Inclement weather (n = 2 P)

Conclusion:

- **Pre-intervention strategies:**

  - provision of knowledge of potential benefits of exercises

  - evaluation of both participants and caregivers capability/preferences

- **Individualising the program:**

  - intensity/complexity for participants

  - availability/constraints for caregiver

- **Strategies to support participants through the program**

  - ongoing support (from caregiver/PT)

  - provision of self-monitoring/evaluation

  - planning for any modifications/flexibility

Conclusion: from all the studies

- **Falls risk and balance assessment:**

  - screening

  - further investigation

  - follow up assessment

- **Individualized balance exercise program with supports**

Improving balance and mobility may consequently reduce risk of falling helping in extending length of time people with AD can live in their community

Publications:

- **Suttanon, P., Hill, K. D., Said, C. M., LoGiudice, D., Lautenschlager, N. L., & Dodd, K. J. (2011). Balance and mobility dysfunction and falls risk in older people with mild to moderate Alzheimer's disease.** *American Journal of Physical Medicine & Rehabilitation, 19(1): 12-23.*

- **Suttanon, P., Hill, K.D., Said, C.M., Williams S.B., Byrne, K.N., LoGiudice, D., Lautenschlager, N.L., & Dodd, K.J. (2013) Feasibility, safety and preliminary evidence of the effectiveness of a home-based exercise programme for older people with Alzheimer's disease: a pilot randomized controlled trial.** *Clinical Rehabilitation, 27(5), 427-438.*

- **Suttanon, P., Hill, K. D., Said, C. M., Byrne K. N, & Dodd, K. J. (2012). Factors influencing commencement and adherence to a home-based balance exercise program for reducing risk of falls: Perceptions of people with Alzheimer's disease and their caregivers.** *International Psychogeriatrics,24(7): 1172-1182.*

- **Suttanon, P., Hill, K.D., Said, C.M., & Dodd, K.J. (2013) A longitudinal study of change in falls risk and balance and mobility in healthy older people and people with Alzheimer's disease.** *American Journal of Physical Medicine and Rehabilitation. 92(8), 676-685.*

Thank you

Questions?