Dizziness and Falls

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NSW Falls Prevention Network Webinar
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www.NeuRA.edu.au
Seminar outline

- Dizziness and falls: summary of the evidence
- Our research
- Clinical implications
Review of the evidence
What is dizziness?

“I feel disconnected – like I am floating on a wharf”

“Electric shock”

“Feeling faint”

“An earthquake inside me”

“Veering to one side”

“Electric blue jagged lines and multi-coloured rectangles”

“Frostbite in the brain”

“Like the room is spinning”
Vertigo
Vestibular

Pre-syncope
Cardiovascular (including cerebrovascular)

Disequilibrium
Sensory, musculoskeletal

Floating / dissociation / vague lightheadedness
Psychological

- Can also be related to medication side effects, neurological pathology...

Adapted from Sloane et al., Ann Intern Med, 2001
Dizziness prevalence

- 10-30% among those aged 50+ years\(^1-6\)
- Increases with older age\(^1,3,5-6\)
- Higher in women vs. men\(^1,3,5-6\)

2. Stevens et al., Age Ageing, 2008;
3. Colledge et al., Age Ageing, 1994
5. Penger et al., Public Health, 2017
6. Maarsingh et al., BMC Family Practice, 2010

Fig. 1 – Map of weighted prevalence of dizziness across Europe aged 50+ years (n = 69,225).

Penger et al., Public Health, 2017
Negative sequelae of untreated dizziness

- Reduced participation in social activities
- Increase in self-reported disability
- Reduced falls efficacy
- Depression
- Poor self-reported health
- Increased risk of falls

References:
2. Stevens et al., Age Ageing, 2008
## Dizziness & prospective falls

<table>
<thead>
<tr>
<th>Study</th>
<th>Population</th>
<th>Dizziness definition</th>
<th>Falls data collection</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deandra et al., Epidemiol, 2010</td>
<td>At least 80% community-dwellers and aged 65+y N&gt;200</td>
<td>Dizziness and vertigo (yes/no)</td>
<td>Prospective</td>
<td>Systematic review and meta-analysis</td>
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<td>Pooled data (yes dizziness / vertigo)</td>
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<td><strong>All fallers: OR (95%CI)= 1.80 (1.39-2.33) (6 studies)</strong></td>
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<td><strong>Multiple fallers: OR (95%CI)=2.28 (1.90-2.75) (8 studies)</strong></td>
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<td>Tinetti, JAGS, 2000</td>
<td>1087 community-dwellers aged 72+ y</td>
<td>Chronic dizziness – present for 1+ month in past 2 months</td>
<td>Monthly diaries for 1 year</td>
<td>261 (24%) with chronic dizziness</td>
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<td>Relative Hazard (95%CI) for falls: 1.35 (1.06-1.72)</td>
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<td>Disappears after adjusting to confounders</td>
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<td>Graafmans et al., Am J Epidemiol, 1996</td>
<td>354 aged-care facilities residents 72-92y (median MMSE : 25, range 4-30)</td>
<td>Dizziness upon standing</td>
<td>weekly diaries for 6 months</td>
<td>36% fallers – 16% multiple fallers</td>
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<td>22% of participants with dizziness</td>
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<td><strong>1+fall: OR(95%CI)=2.3 (1.3-3.8)</strong></td>
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<td><strong>Multiple falls (2+): OR = 2.8 (1.2 -4.3)</strong></td>
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<tr>
<td>Menant et al., J Am Geriatr Soc, 2013</td>
<td>516 community-dwellers aged 73-92 y</td>
<td>History of dizziness, vertigo or light-headedness since age 60</td>
<td>Monthly diaries for 1 year</td>
<td>42% history of dizziness</td>
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<td>18% multiple fallers</td>
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<td>Relative risk (RR) (95%CI)= 1.55 (1.08-2.23)</td>
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→ Variations in settings, sample’s age range, definition of dizziness
417 primary care patients aged 65-95 y
Dizziness present for at least 2 weeks
Multidisciplinary assessment

Major contributing causes
- Cardiovascular disease 57% (n=237)
- Peripheral vestibular disease 14% (n=60)
- Psychiatric illness 10% (n=41)

Minor contributing causes
- Adverse drug effect
- Locomotor disease
Orthostatic hypotension (OH)

- Orthostatic Hypotension (OH): blood pressure recording \(^1,\,^2\)
- **Versus.** Orthostatic Dizziness\(^3\): symptom
- \(~10\%\) prevalence of OH and OD \(^1,\,^3\)
- Inconsistent relationships between OH, OD and falls \(^1,\,^2\)

1. Angelousi et al., J Hypertension, 2014
3. Radtke et al., Clin Auton Res 2011
Vestibular dysfunction

- Prospective studies of falls
  - No relationship with Fukuda’s stepping test and dynamic visual acuity
  - Increased error and variability in perception of postural vertical associated with increased risk of falling

- Retrospective studies – significant associations with falls and fractures
  - Deficit in vestibulo-ocular reflex suppression
  - Benign Paroxysmal Positional Vertigo
  - Positive head shaking test (vestibular asymmetry)

→ Conflicting and limited published evidence of clear association with falls

2. Menant et al., Gerontology, 2012
3. Di Fabio et al., Arch Phys Med Rehabil, 2002
4. Lawson et al., Age Ageing, 2008
Medications

Medications often causing dizziness (Sloane et al., Ann Intern Med, 2001)

- a1-Adrenergic
- Alcohol
- Aminoglycosides Ototoxicity (eg. Gentamicin)
- Anticonvulsants
- Antidepressants
- Anti-Parkinsonian medication
- Antipsychotics
- b-Blockers
- Calcium-channel blockers
- Class Ia antiarrhythmics
- Digitalis glycosides
- Diuretics
- Narcotics
- Oral sulfonylureas
- Vasodilators

Fall-risk inducing drugs (Seppala et al., and de Vries et al., JAMDA, 2018\(^a, b, c\))

- Antipsychotics
- Antidepressants
- tricyclic antidepressants
- selective serotonin reuptake inhibitors
- benzodiazepines
- long-acting benzodiazepines
- short-acting benzodiazepines
- Opioids
- anti-Parkinson drugs
- Antiepileptics
- polypharmacy
- Loop diuretics
- Digitalis
- Digoxin

→ Overlap between drugs leading to dizziness and also associated with falls
Psychological / functional disorders

Psychiatric comorbidity and psychosocial impairment among patients with vertigo and dizziness

Claas Lahmann,1,2 Peter Henningsen,1,2 Thomas Brandt,2,3 Michael Strupp,2,4 Klaus Jahn,2,4 Marianne Dieterich,2,4,5 Annegret Eckhardt-Henn,6 Regina Feuerecker,2,4 Andreas Dinkel,1 Gabriele Schmid1,2

- 547 patients from a specialized interdisciplinary treatment centre for vertigo/dizziness
- ~ 50% psychiatric disorder identified by standardized test
Our research
1. Relationship between dizziness and falls?
2. What are the risk factors for dizziness burden?
3. Effects of a multifactorial intervention on dizziness burden (main trial)?
Inclusion / Exclusion criteria

- **Inclusion criteria**
  - age $\geq 50$ years
  - Dizziness symptoms in past year & not currently treated for them
  - Living independently
  - Understanding English

- **Exclusion criteria**
  - Severe cognitive impairment (GPCOG < 5)
  - Degenerative neurological condition (PD, MS, etc)
  - Severe depressive symptoms (PHQ-9 $\geq 20$), severe anxiety symptoms (GAD-7 $\geq 20$), other conditions that require urgent treatment (Suspected stroke; TIA; Acute cardiovascular condition)

ANZ Clinical Trial Registration: ACTRN12612000379819
Study timeline

Baseline

305 adults aged 50+ years (Mean (SD): 67.8 (8.3) years)
1+ dizzy episode in past year & not currently treated for it

2 weeks

Comprehensive baseline Assessment:
Medical history, CV, vestibular, mental health, sensorimotor, balance

Consensus panel meeting

Randomisation - concealed allocation

Control group

Intervention group

Multifaceted tailored intervention

6 months Monthly falls and dizziness calendars

Blinded tester re-assessment

Study end

Participants’ report + recommendations to controls
Questionnaires

- Demographics
- Medical conditions
- Medications
- Physical activity (IPEQ)
- Depression (PHQ-9)
- Anxiety (GAD-7)
- Neuroticism (NEO-FFI)
- Quality of life (EuroQoL-5)
- Dizziness Handicap Inventory (DHI)- scale 0-100 which assesses functional, emotional and physical burden of dizziness

Cardiovascular assessment

- Tilt-table test of Orthostatic hypotension (3min) / delayed (3min +)
  - Fall $\geq 20$mmHg in SBP
  - And/or fall $\geq 10$mmHg in DBP
  - Dizziness symptoms

- 12-lead ECG

- Lying and seated blood pressure
Sensorimotor and balance assessment

Physiological Profile Assessment (PPA): composite fall risk score

Dynamic stability
Choice-stepping reaction time
Gait
Vestibular assessment

- Benign paroxysmal positional vertigo (BPPV)
- Vestibular hypofunction (head impulse test + head shake with Frenzel goggles)

Spontaneous, gaze-directed and head-shaking nystagmus in light and darkness

Head impulse test + head shake test in Frenzel goggles

Dix-Hallpike and roll tests with Frenzel goggles
1/ Relationship between dizziness and falls

- N=294 with 6-month falls follow-up
- 32% (n=96) past fallers
- Total 215 falls (0.7 fall pp)
- 26% (n=77) fallers including 12% (n=36) multiple fallers

Dizziness handicap inventory score
(0-100) (mean (SEM))

P=0.017
After adjusting for age: p=0.019
Factors associated with dizziness burden

- Dizziness handicap inventory (DHI) score
  - 0-30: Mild dizziness burden – n= 210
  - ≥ 31: Moderate / severe dizziness burden – n=95

- One variable from each domain considered to be causal factors for dizziness and significant discriminator in univariate analyses: vestibular, cardiovascular / medications, psychiatric, pain, sensorimotor/balance

<table>
<thead>
<tr>
<th>After controlling for age</th>
<th>Moderate-severe handicap Odds Ratio (95%CI)</th>
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<tbody>
<tr>
<td>Cardiovascular medication use</td>
<td>1.93 (1.09-3.45), p=0.025</td>
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<tr>
<td>Generalized anxiety disorder score</td>
<td>1.18 (1.09-1.28), p&lt;0.001</td>
</tr>
<tr>
<td>Positive Dix-Hallpike test of BPPV</td>
<td>2.93 (1.52-5.81), p=0.001</td>
</tr>
<tr>
<td>Physiological Profile Assessment score</td>
<td>2.56 (1.73-3.80), p&lt;0.001</td>
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3/ Intervention to reduce dizziness burden

Reducing the burden of dizziness in middle-aged and older people: A multifactorial, tailored, single-blind randomized controlled trial

Jasmine C. Menant1,2, Americo A. Migliaccio1,3, Daina L. Sturmieks1,4, Cameron Hicks1, Joanne Lo1, Mayna Ratanapongleka1, Jessica Turner1, Kim Delbaere1,2, Nickolai Titov5, Daniela Meinrath6, Catherine McVeigh7, Jacqueline C. T. Close1,7, Stephen R. Lord1,2*

In press - online open access 24th July
Access at:
http://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1002620
Study timeline

Baseline
- 305 adults aged 50+ years (Mean (SD): 67.8 (8.3) years)
- 1+ dizzy episode in past year & not currently treated for it

Comprehensive baseline Assessment:
- Medical history, CV, vestibular, mental health, sensorimotor, balance

2 weeks
- Consensus panel meeting

Randomisation - concealed allocation

6 months Monthly falls and dizziness calendars
- Control group
- Intervention group
- Multifaceted tailored intervention

Study end
- Blinded tester re-assessment
- Participants’ report + recommendations to controls
# Interventions

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<th>Problem</th>
<th>Intervention</th>
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<tr>
<td>Poor balance / strength</td>
<td>Otago home exercise program</td>
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<tr>
<td>BPPV / vestibular hypofunction</td>
<td>Epley maneuver or vestibular rehabilitation (VR)</td>
</tr>
<tr>
<td>Severe Anxiety / depression</td>
<td>Internet-based Cognitive-Behavioural Therapy (CBT) (8 weeks)</td>
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<tr>
<td>Abnormal ECG, medication interactions, low blood pressure, orthostatic hypotension</td>
<td>Medical management : Letter to General Practitioner (single / simple issue) or hospital falls clinic visit (multiple complex issues)</td>
</tr>
</tbody>
</table>
Dizziness RCT – Results

From Menant et al., PLoS Med, 2018

% intervention group participants (n=146) assigned to the range of intervention combinations
At trial completion, the dizziness handicap inventory scores in the intervention group were significantly reduced when compared to the control group, when controlling for baseline scores (mean (95% CI) difference between groups (baseline adjusted): -3.7 (-6.2 to -1.2); p=0.003).
Dizziness RCT – primary outcome measures results

Dizziness frequency during 6 months follow-up

- No significant between-group differences in other primary outcomes:
  - Dizziness episodes frequency over 6-month FU
  - choice-stepping reaction time performance
  - step time variability during gait

Relative Risk (95% CI)=0.87 (0.65 – 1.17), p=0.360
Dizziness RCT results

- Trend for reduction in composite fall risk (PPA) in the intervention, p=0.085

- Intervention-specific effects on secondary outcomes:
  - Vestibular rehabilitation: choice-stepping reaction time
  - Otago exercise program: reduced composite falls risk
  - Cognitive-behavioural therapy: reduced anxiety symptoms
Dizziness RCT – conclusions

- A multifactorial tailored approach for treating dizziness was effective in reducing dizziness handicap in community-living people aged 50+ years.

- Future translational research: development and implementation of a dizziness profile assessment, based on our empirical data and to assist clinicians in diagnosing pathologies contributing to dizziness, thereby offering the opportunity for effective intervention.
Clinical implications
The MPA-D: multiple profile assessment of dizziness

Dizziness Handicap Inventory (DHI)

DHI score ≥31
- CVS Medications
  - Medication review
- Physiological Profile Assessment
  - Target the deficit (eg. exercise for leg weakness ...)
- GAD-7 scale
- Cognitive-behavioural therapy
- Dix-Hallpike
  - Repositioning manoeuvre (eg. Epley’s)

DHI score <31
- General advice on dizziness management
Take home messages

- Dizziness independent falls risk factor thus fall risk screen is indicated

- Do not overlook those aged < 65 years

- Multifactorial nature of dizziness therefore requires multidisciplinary approach

- Most evidence-based therapies to address the dizziness contributing factors exist in current health services
Acknowledgements

- Co-Chief Investigators: Stephen Lord, Americo Migliaccio, Nick Titov, Jacqueline Close, Kim Delbaere, Daina Sturnieks, Catherine McVeigh
- Research staff and students: Mayna Ratanapongleka, Joanne Lo, Jessica Turner, Cameron Hicks, Daniela Meinrath, Holly Hawtin, George Poller, William Figtree
- Statistical advice: Barbara Toson, Rob Herbert
- Randomisation: Esther Vance

- NHMRC project grant funding: 1026726
- ANZ Clinical trial registry: 12612000379819
Thank you!

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