

Falls Prevention in 'High-Risk' Populations: A Canadian Perspective

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Centre for Hip Health & Mobility
Vancouver Coastal Health Research Institute
University of British Columbia, Canada



Transpacific travel(l)ers

1. Prof Heather McKay
2. Dr Teresa Liu-Ambrose
3. Dr Meghan Donaldson
4. Dr Jennifer Davis
5. Dr Fabio Feldman
6. Dr Anat Feldman
7. Lindsay S Nagamatsu, PhD Candidate
8. Caitlin Gomez, Geriatrician Assistant/Research team member
9. k2
10. Warren McKay, Josie McKay (freeloaders, outlaws)



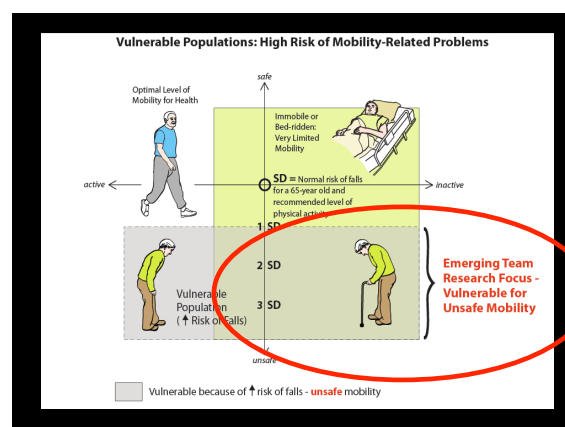
Presentation overview / goals

THE STORY OF SUCCESS



GLADWELL
as bestselling author of *The Tipping Point* and *Blink*

- International collaboration a key to Vancouver studies



Which high-risk populations?

- Osteoporosis
- Previous fallers
 - Emergency-department presenters
 - Falls clinic patients
- Mild cognitive impairment
- Macular degeneration
- Polypharmacy
- Residential care facilities

Osteoporosis/falls risk research

- Rationale?
- Research question
- Outcome
- Collaborators

Take home from a series of studies

1. Osteoporosis associated with quads weakness and increased sway (Liu-Ambrose, 2003)
2. Back pain associated with ↓ balance and ↓ functional mobility (Liu-Ambrose, '02)

3. Strength and balance training ('Osteofit') safe and effective in 65-75 yr old women with osteoporosis by DXA (RCT, Carter, CMAJ 2002)

Community-based exercise program = 'Osteofit' reduces risk factors for falls in 65- to 75-year-old women with osteoporosis: randomized controlled trial

Nick D. Carter,[†] Karim M. Khan,^{†‡} Heather A. McKay,^{†§} Moira A. Petit,^{†§} Constance Waterman,[†] Ari Heinonen,^{†‡} Patti A. Janssen,^{†‡} Meghan G. Donaldson,[†] Arthur Mallinson,[†] Lenore Riddell,[†] Karen Kruse,[†] Jerilyn C. Prior,^{†‡} Leon Flicker^{§§}

Research
Recherche

From the UBC Bone Health Research Group, University of British Columbia, Vancouver, BC; †Department of Family Practice, Faculty of Medicine, University of British Columbia, Vancouver, BC; ‡the BC Women's

4. Highlight study from this period (2000- '04) - *Better Bones & Balance*

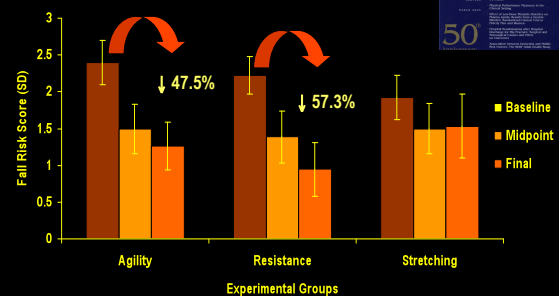
Research question:

Effect of resistance vs. agility training on fall risk profile (PPA) in 75-85 yr-old women with low bone mass.



Liu-Ambrose, Khan, Lord, et al., JAGS, May 2004

Both interventions



Fall risk profile (PPA) ameliorated with both interventions

Richmond resident Betty Sullivan, 76, is no dabbler when it comes to her health. "I haven't fallen once since starting the weight training program" at the Stevenson Community Centre. "It helps with my balance. I'm more steady on my feet and I'm more confident," Sullivan says.

Senior women pump iron for old bones

Weight training reduces risk of elderly females falling by as much as 57 per cent, study indicates

BY PAMELA FAYERMAN
VANCOUVER

Published in the *Journal of the American Geriatrics Society*, it is the first study of its kind to compare the benefits of different types of exercise — resistance (weight training), agility and stretching (yoga).

Research Institute investigators found that older women with osteoporosis are considered to have a greater risk of falling, and of being injured in such falls, because of compromised balance and muscular strength, compared to their counterparts who do not have osteoporosis.

aged 75 to 85 in the six-month study enjoyed a lower fall-risk score by the end of their training program. They all started the program with bone-mass scores which predisposed them to injuries from falling. Older women with osteoporosis are considered to have a greater risk of falling, and of being injured in such falls, because of compromised balance and muscular strength, compared to their counterparts who do not have osteoporosis.

in Robin Khan, study co-author and a leading bone health expert, said the results are "dramatic and fantastic," especially because about 30 per cent of people over age 65 fall at least once a year and 95 per cent of hip fractures in the elderly are caused by falls. The resulting fractures often have devastating results because 50 per cent of patients end up losing their independence and another 20 per cent die within a year.

the study was conducted at the Stevenson Community Centre, which has a dedicated room for senior citizens to exercise.

"It just makes the quality of your life that much better."

Geraldine W, 84



2008: Arguing for a paradigm shift - BMJ

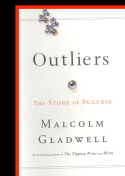
ANALYSIS

Shifting the focus in fracture prevention from osteoporosis to falls

Preventing fractures in older people is important. But **Teppo Järvinen and colleagues** believe that we should be putting our efforts into stopping falls not treating low bone mineral density

Collaborators (Home and Away)

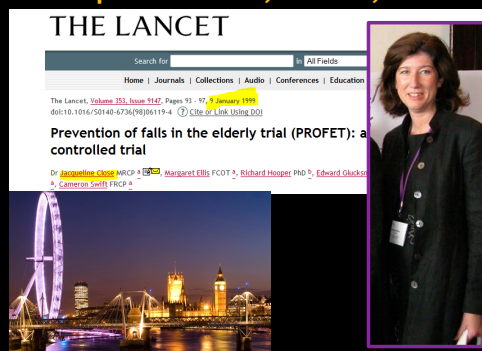
- Leon Flicker (falls, geriatrics, gerontology)
- Stephen Lord, 2001, '03, '04, etc...
- Pekka Kannus (Finland), 2003
- Teppo Jarvinen, 2004, '06
- Clare Robertson, 2003, '07, '08, '09, '10
- John Campbell, 2004, 07, 08



Which 6 high-risk populations?

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- Residential care facilities
- (Highlights from 30+ papers)

Jacqueline Close, Lancet, 1999



THE LANCET

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The Lancet, Volume 353, Issue 9147, Pages 93 - 97, 8 January 1999
doi:10.1016/S0140-6736(98)06119-4 (Cite or Link Using DOI)

Prevention of falls in the elderly trial (PROFET): a controlled trial

Dr [Jacqueline Close](#) FRCP, Dr [Margaret Ellis](#) FCOT, Dr [Richard Hooper](#) PhD, Dr [Edward Gluckstein](#), Dr [Cameron Smith](#) FRCP



CMAJ Medical knowledge for all

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CMAJ • September 4, 2001, 165 (5)
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Research

Recherche

A randomized controlled trial of a community-based consultation service to prevent falls

David B. Hogan^{1,2}, Frank A. MacDonald³, Jennifer Betts⁴, Sheila Bricker, Erika M. Eby⁵, Barb Delarue⁶, Tak S. Fung⁷, Cathy Harbidge, Maggie Hunter⁸, Colleen J. Maxwell⁹ and Barb Metcalfe¹⁰

Emergency Dept High prevalence of falls as per Close 1999

Osteoporosis Int (2006) 17: 672-683
DOI 10.1007/s00198-005-0032-7

ORIGINAL ARTICLE

Community-dwelling seniors who present to the emergency department with a fall do not receive Guideline care and their fall risk profile worsens significantly: a 6-month prospective study

A. E. Salter · K. M. Khan · M. G. Donaldson · J. C. Davis · J. Buchanan · R. B. Abo-Laban · W. L. Cook · S. R. Lord · H. A. McKay

MSc - Salter (now family physician)

Emergency Dept Research (2004 - ongoing)

- 2 care gap papers (including Meghan Donaldson)
- New studies of **cost of emergency department care** (\$10,000 per admission, Woolcott, in progress)
- Studies using 'operations research' - health systems research

Melbourne RCT (Melissa Russell...., Keith Hill), JAGS, 2011



- 712 fallers presenting to Emerg. Dept.
- Comprehensive falls risk assessment and interventions (by referral)
- No difference in falls or falls injury
- Challenges - intervention:
 - Limited uptake and adherence

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Falls Prevention Clinic, 2004 +



www.fallsclinic.com

Falls Clinic - Clinical Service



- By GP referral
- PPA – physiological risk assessment
- 1-hr Geriatrician assessment
- 12-month followup to assess implementation of Rx

Practical issues relating to Falls Clinic



- Over 1000 patients seen in the clinic over 6 years
- Challenges with having patients referred even if they had a very strong falls risk profile
- Personal and physician barriers
- Fall is a 4 letter word...

Research questions...

Our research relates to the Otago Exercise Programme...



Clare Robertson
John Campbell,
(New Zealand)

"Otago Exercise Programme" (OEP)



Research questions...

In falls clinic patients, does the Otago Exercise Programme (OEP)...

1. Reduce falls? (12 months)
2. Ameliorate fall risk profile? (PPA)
3. Improve executive function (Stroop Test)

(NB: economics studies underway in Falls Clinic as well...discuss later)

Did the OEP reduce falls among falls clinic folks?

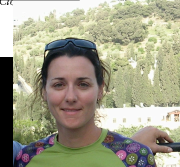
CLINICAL INVESTIGATIONS

Otago Home-Based Strength and Balance Retraining Improves Executive Functioning in Older Fallers: A Randomized Controlled Trial

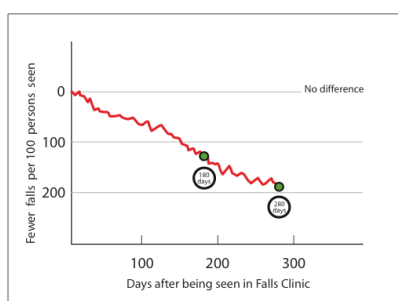
Teresa Liu-Ambrose, PhD, PT,*^{1,2} Meghan G. Donaldson, PhD,*³ Yasmin Ahamed, MSc,*³
Peter Graf, PhD,*³ Wendy L. Cook, MD,*³ Jacqueline Côté, PhD,*³ and Karim M. Khan, MD, PhD*^{1,2}



Donaldson, now PDF,
UCSF, California



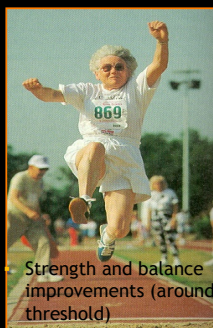
50% Fewer Falls Among Clinic Patients who did Strength and Balance Training



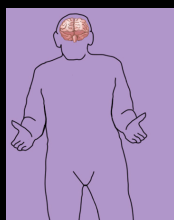
!! Stroop test showed significant changes; minimal changes in strength and balance measures!

red blue orange purple
orange blue green red
blue purple green red
orange blue red green
purple orange red blue
green red blue purple
orange blue red green
green purple orange red

Mechanism of fall reduction?



- Central mechanisms - executive function; better decisions to avoid falls



Falls clinic studies in progress

- OEP extended out to falls
- Mechanism explaining falls reduction (greater number of participants needed to have sufficient power)
- Economic studies including health care utilization and patient rated outcome measure studies
- Exploring computer animation of the OEP program for distance / cost reduction



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Teresa Liu-Ambrose

Laboratory for studies of exercise and cognitive function - neuroscience



Exercise and cognition and falls research (1:45pm today ☺)

Research question

- Does Resistance training improve cognitive function - executive function?



Study design

- RCT powered for the Stroop test as the primary outcome
- Also innovative evaluation of brain anatomy and function using fMRI

ORIGINAL INVESTIGATION

Resistance Training and Executive Functions

A 12-Month Randomized Controlled Trial

Teresa Liu-Ambrose, PhD, PT; Lindsay S. Nagamatsu, MA; Peter Graf, PhD; B. Lynn Beattie, MD; Maureen C. Ashe, PhD, PT; Todd C. Handy, PhD



Conclusion: Twelve months of once-weekly or twice-weekly resistance training benefited the executive cognitive function of selective attention and conflict resolution among senior women.

Trial Registration: clinicaltrials.gov Identifier: NCT00426881

Arch Intern Med. 2010;170(2):170-178

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12-month cohort study: Emphasis - Injurious falls

Osteoporos Int (2010) 21:855–862
DOI 10.1007/s00198-009-1025-8

ORIGINAL ARTICLE

Neovascular AMD: an overlooked risk factor for injurious falls

S. M. Szabo • P. A. Janssen • K. Khan • S. R. Lord • M. J. Potter

Meta-analysis, 2009 update

REVIEW ARTICLE

Meta-analysis of the Impact of 9 Medication Classes on Falls in Elderly Persons

John C. Winkler, MA, Kathryn J. Richardson, MSc, Matthew O. Wines, BSc, Pharm, PharmD, Bharati Patel, MPharm, Judith Martin, BPharm, PharmD, Karim M. Khan, MD, PhD, Carlo A. Marra, BSc, Pharm, PharmD, PhD

Conclusion: The use of sedatives and hypnotics, anti-depressants, and benzodiazepines demonstrated a significant association with falls in elderly individuals.

Arch Intern Med. 2009;169(21):1952-1960

Residential care: Steve Robinovitch, Teresa Liu-Ambrose, Fabio Feldman, Heather McKay

Team Lead: ROBINOVITCH, S.N.
Program title: CHRS TEAM IN THE PREVENTION OF FALL-RELATED INJURIES IN OLDER ADULTS THROUGH BIOENGINEERING

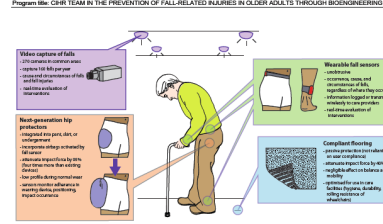


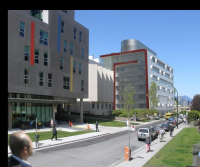
Figure 1. "Real life" laboratory for studying the cause and prevention of falls in the long-term care (LTC) environment. Video capture and wearable sensors will be used to determine the characteristics of injurious and non-injurious falls, and examine how these associate with physiological function and environmental features. Next-generation hip protectors will be developed, and compliant flooring will be installed and evaluated for its potential to reduce fall injuries.

Vancouver, Canada



Centre for Hip Health and Mobility

PREVENTION • EARLY DETECTION • NEW TREATMENTS

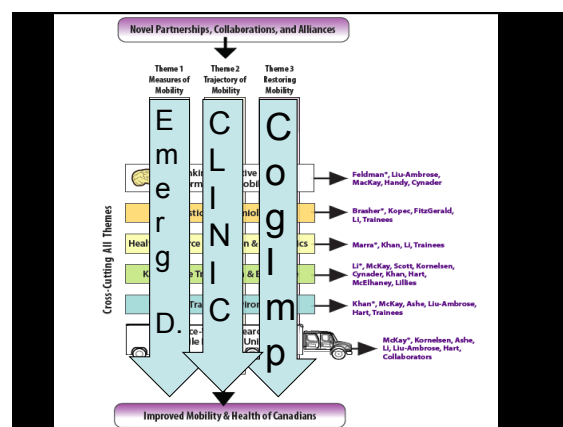


▪ **MISSION:** to prevent, detect, and treat bone and joint diseases across the life span through effective behavioral and clinical interventions that foster enhanced mobility.

- 150 researchers, staff and trainees from 13 disciplines
- Over \$50M in research grants
- 1000 peer-reviewed articles



Health Economics



6 papers 2010 in PubMed...

1. Economic evaluation of bone response resistance training in older women: a cost-effectiveness and cost-utility analysis. *Osteoporos Int* 2010 Aug 4. Epub ahead of print. PMID: 20827177 (Published - as supplied by publisher) [Related citations](#)
2. Changes in executive functions and self-efficacy are independently associated with improved usual gait speed in older women. *BMC Geriatr* 2010 May 18;10:25. PMID: 20482830 (Published - in process) [Free PMC Article](#) [Epub link](#) [Related citations](#)
3. The independent contribution of executive functions to health-related quality of life in older women. *BMC Geriatr* 2010 Apr 1;10:16. PMID: 20369253 (Published - in process) [Free PMC Article](#) [Epub link](#) [Related citations](#)
4. International comparison of cost of falls in older adults living in the community: a systematic review. *Osteoporos Int* 2010 Aug 21;18(12):1295-301. Epub 2010 Feb 27. PMID: 20150444 (Published - in process) [Related citations](#)
5. Promotion of the mind through exercise (PROMoTE): a proof-of-concept randomised controlled trial of aerobic exercise training in retirement. *Liu-Ambrose T, Eng JJ, Boyd LA, Jacova C, Davis JC, Bryan S, Lee P, Brasher P, Hsiung GY. BMC Neurol* 2010 Feb 17;10:14. PMID: 20150444 (Published - indexed for MEDLINE) [Free PMC Article](#) [Epub link](#) [Related citations](#)
6. Does a home-based strength and balance programme in people aged > or =60 years provide the best value for money to prevent falls? *Davis JC, Robertson MC, Ashe MC, Liu-Ambrose T, Khan KM, Marra CA. Br J Sports Med* 2010 Feb 12;44(3):180-8.

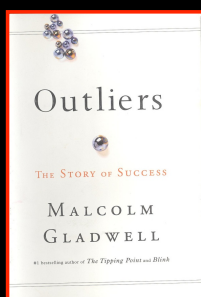
5 of Dr Davis' contributions...

1. Cost of falls in the world (Burden of Illness study, Osteoporosis Int, 2010)
2. Systematic review of interventions for falls prevention - value for money ('10)
3. Exercise in 65-75 yr olds is cost saving with respect to health care utilization (Cost-effectiveness analysis, OI, 2010)
4. Prolonged economic benefit of exercise intervention - slow offset (CEA, Archives, 2010)

Dr Davis' major contributions...(2)

5. Effect of exercise on quality of life as measured by the EuroQoL-5D (EQ-5D); Cost-utility analysis (JAGS, in press, poster at this meeting)
6. Guidelines for economic studies (with Paul Scuffham, Clare Robertson)

Acknowledging collaborations



- Clare Robertson (falls health economist; epidemiologist)
- Teresa Liu-Ambrose (funding of clinical studies, mentorship)
- John Campbell - mentorship
- Carlo Marra (health economist, UBC)
- Stirling Bryan (health economist UK, now UBC)
- Melbourne ANZFPS conference

Strongly committed to Training Opportunities - >\$1 million in trainee \$ in past 5 years

- Small focused journal clubs across subgroups
- Local mentors
- International visitors
- International exchanges
- Govt/health authority internships
- Skills beyond science - leadership, negotiation, etc



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Future Directions and Opportunities at CHHM



WALK-THE-TALK: LINKING RESEARCH AND COMMUNITY ON THE BUILT ENVIRONMENT FOR HEALTHY AGING



Symposium Date ▶ April 20, 2010 9:00am - 4:00pm
Location ▶ Room 9229, Gordon & Leslie Diamond Centre
2775 Laurel Street, Vancouver General Hospital

Built environment influences all...

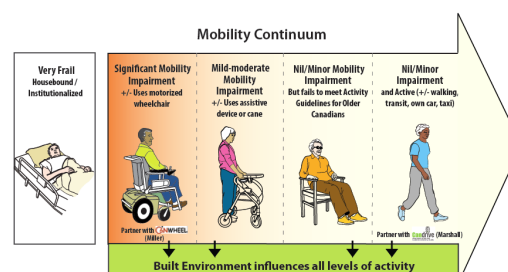
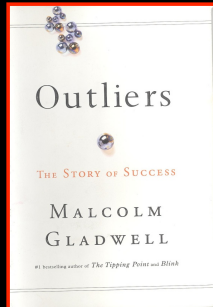


Figure 1. Mobility Continuum - Built Environment relevant for various levels of impairment

Summary



- 'High-risk' populations: Tree of knowledge is growing globally - **population specific Rx**
- Canadian investigators - Drs Liu-Ambrose, Donaldson, Jen Davis
- Aim to partner with the best!

Working together very closely ☺



**Clare Robertson
John Campbell**

Thank you for mentoring a generation of falls researchers across the globe!

