



Transforming Everyday Life into Extraordinary Ideas




Advancing best practice in balance and mobility testing for fall risk assessment in older Canadians

Marla Beauchamp, PT, PhD
Ayse Kuspinar, PT, PhD
School of Rehabilitation Science, McMaster

Lauren Griffith, PhD
Dept. Health, Evidence, and Impact
CLSA Associate Scientific Director

McMaster University

Fall Prevention Community of Practice Webinar
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Talk Outline

- Importance of balance for falls
- Fall prevention guidelines
- Balance assessment tools and evidence to date for predicting falls
- Introduction to the CLSA dataset
- Preliminary results using CLSA data
- Clinical implications

Poll

- Who is in the audience today?

A) Physiotherapist

B) Nurse

C) Occupational Therapist

D) Physician

E) Researcher

F) Kinesiologist

G) Government or policy official

E) Other

Care of the Aging Patient: From Evidence to Action

January 20, 2010

The Patient Who Falls
"It's Always a Trade-off"

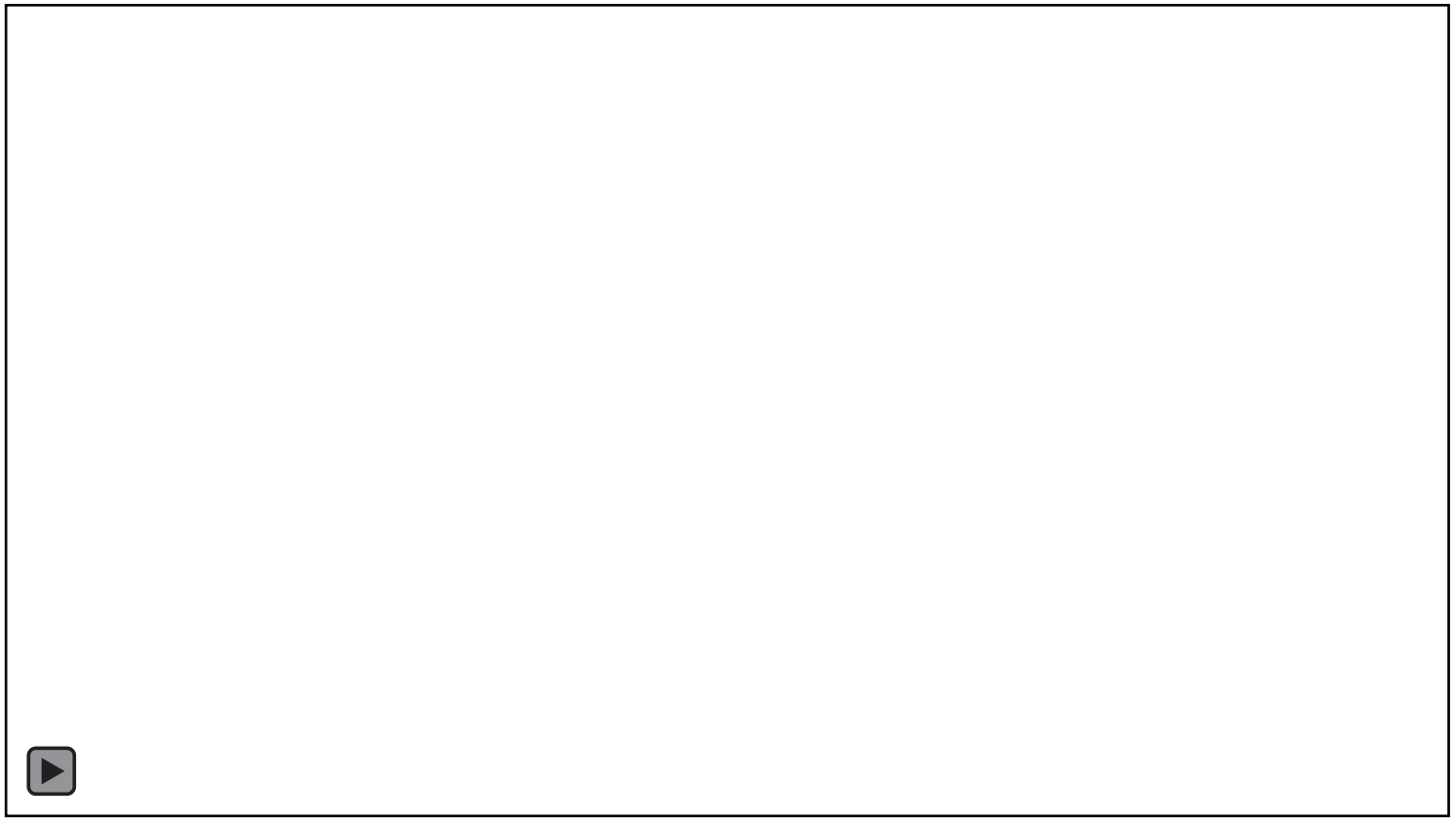
Mary E. Tinetti, MD; Chandrika Kumar, MD

JAMA. 2010;303(3):258-266. doi:10.1001/jama.2009.2024

Risk Factor	Studies in Which Factor Was Significant[c]		Ranges of Adjusted Values[d]	
	No.	References (Listed in eAppendix)	RR	OR
Previous falls	16	1, 2, 5, 6, 7, 9, 10, 11, 15, 17, 18, 19, 21, 25, 26, 29	1.9-6.6	1.5-6.7
Balance impairment[e]	15	1, 4, 5, 7, 9, 12, 13, 17, 18, 19, 22, 24, 28, 30, 31	1.2-2.4	1.8-3.5
Decreased muscle strength (upper or lower extremity)[e]	9	4, 6, 9, 18, 19, 21, 24, 25, 26	2.2-2.6	1.2-1.9
Visual impairment	8	8, 11, 15, 16, 13, 22, 29, 30	1.5-2.3	1.7-2.3

Tinetti JAMA 2010

Even Presidents Need Balance



March 30, 2015. Video available at
https://www.youtube.com/watch?v=y-Btql4G2yE
Slide courtesy of Kathryn Sibley

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Balance is a modifiable risk factor

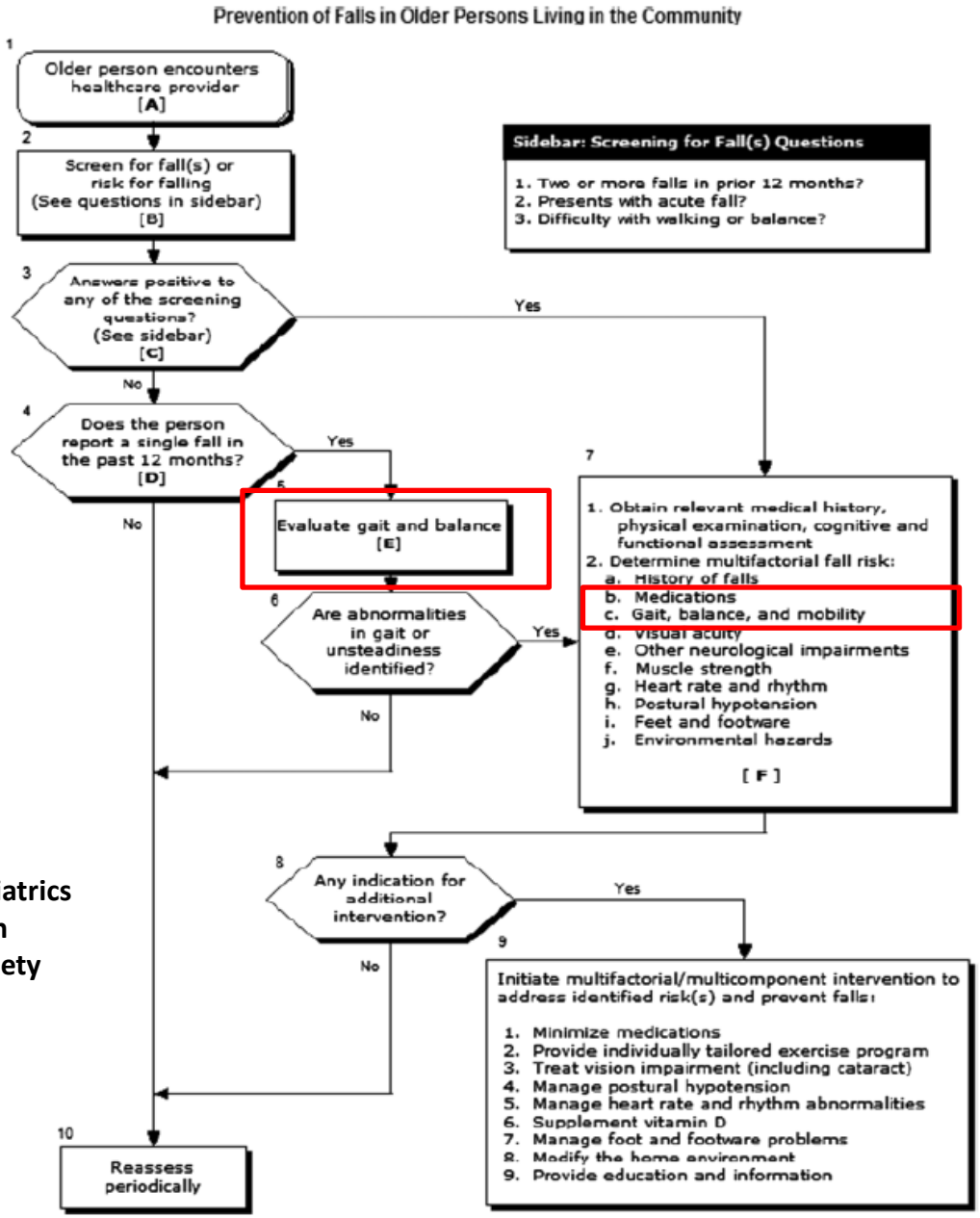
- In a large Cochrane systematic review, compared with control, balance and functional exercises:
  - Reduced the rate of falls by 24% (39 studies)
  - Reduced the number of people experiencing one or more falls by 13% (37 studies)
- Multiple types of exercise (most commonly balance/functional exercises plus resistance exercise):
  - Reduced the rate of falls by 34% (11 studies)
  - Reduced the number of people experiencing one or more falls by 22% (17 studies)

Sherrington et al. Cochrane Database Syst Rev 2019

Fall prevention guidelines

- Produced by a number of different organizations
- American and British Geriatrics Societies (AGS/BGS), National Institute for Health and Care Excellence (NICE), and the CDC Stopping Elderly Accidents, Deaths and Injuries (STEADI) most common
- Tests of balance and mobility recommended by each

AGS/BGS



American Geriatrics Society/British Geriatrics Society JAGS; 2011

Suggested tests:

- **Timed Up and Go (TUG)**
- **Berg Balance**
- **Performance-Oriented Mobility Assessment (POMA or Tinetti)**

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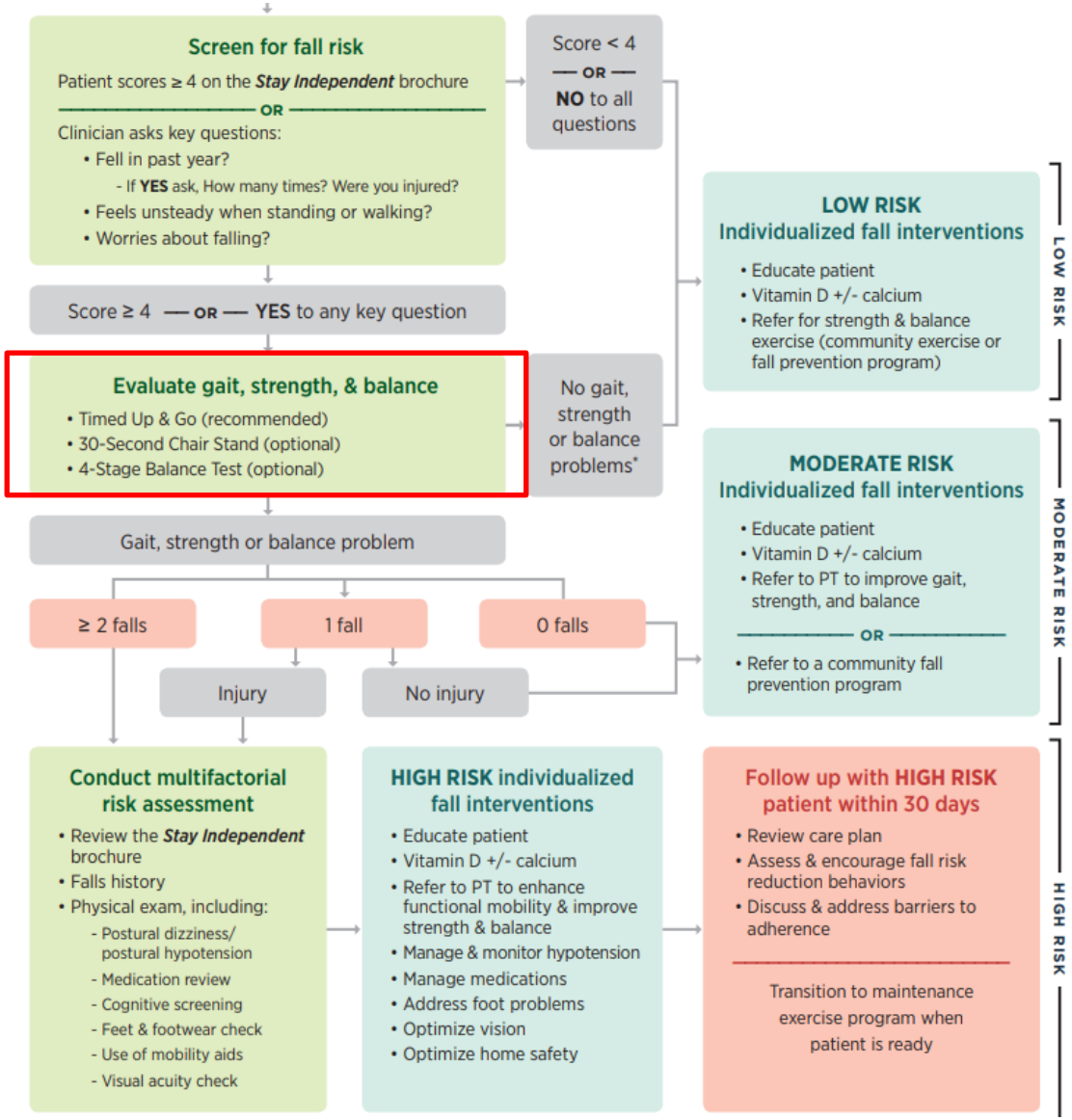
NICE

1.1.1.2 Older people reporting a fall or considered at risk of falling should be observed for balance and gait deficits and considered for their ability to benefit from interventions to improve strength and balance. (Tests of balance and gait commonly used in the UK are detailed in section 3.3.) **[2004]**

Timed up and go test
Turn 180º
Performance-oriented assessment of mobility problems (Tinetti scale)
Functional reach
Dynamic gait index
Berg balance scale

National Institute for Clinical Excellence 2013

CDC STEADI



Centers for Disease Control and Prevention Stopping Elderly Accidents, Deaths and Injuries 2019 https://www.cdc.gov/steadi/

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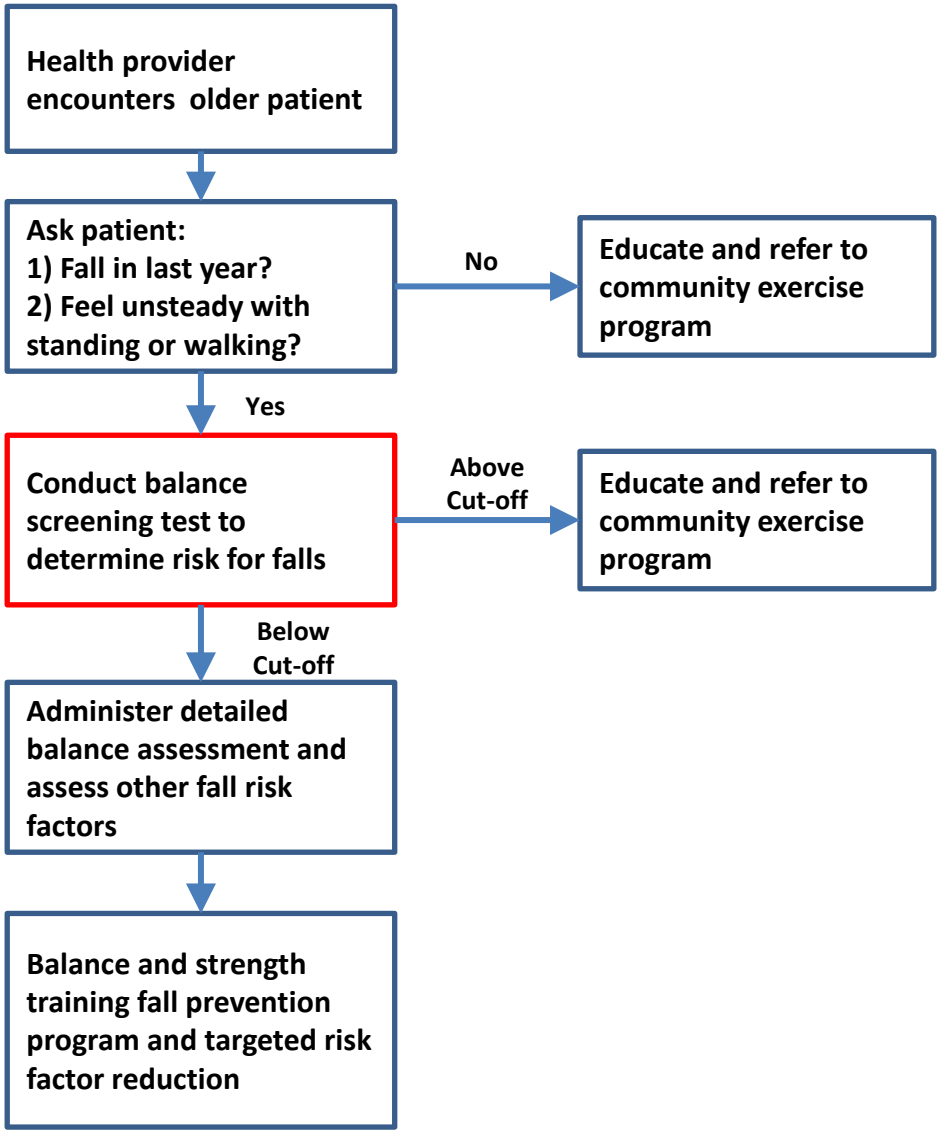
Simplified algorithm



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Poll

- Do you currently use any of the following balance tests for fall risk screening?
- Functional reach test
- Standing balance test (e.g., single leg stance or tandem stance)
- Repeated chair stand test
- Timed Up and Go (TUG)
- Turn 180 test
- Dynamic gait index
- POMA/Tinetti
- Berg Balance
- Other
- I do not use a balance test for fall risk screening

Summary of CPG recommended balance tests

- Functional reach
- 4 stage balance test
- 30 second chair stand
- **Timed Up and Go**
- Turn 180 test

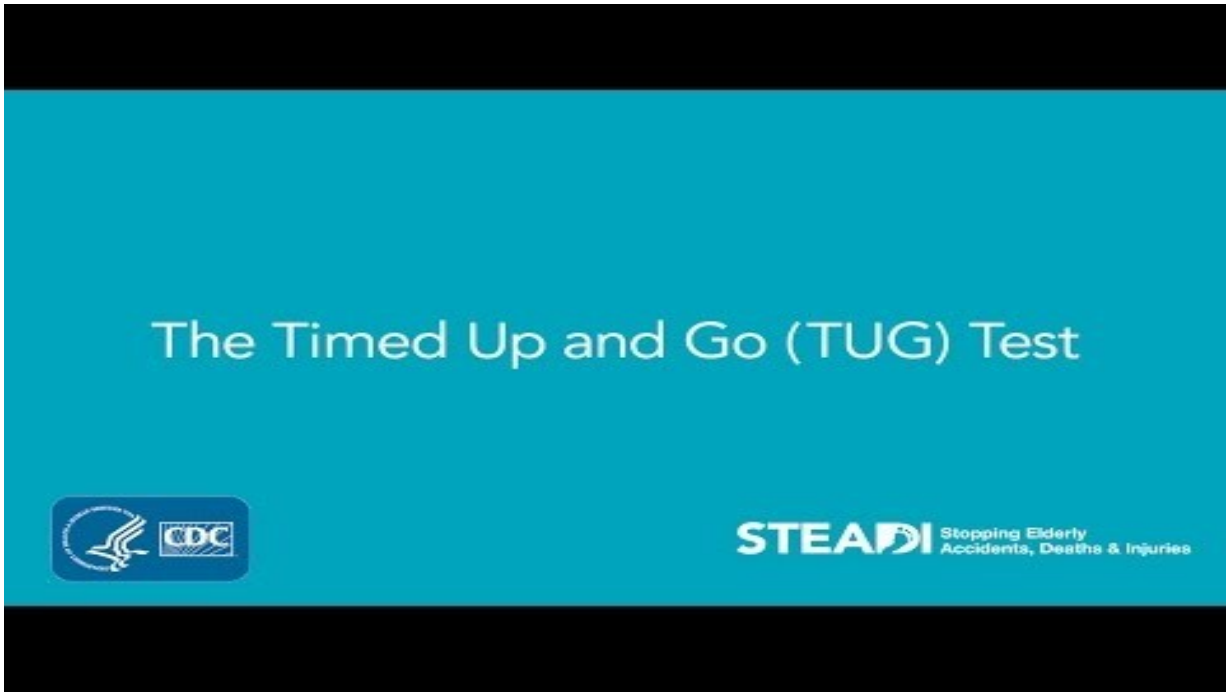
- Dynamic gait index
- **Performance-Oriented Mobility Assessment (aka Tinetti scale)**
- **Berg Balance**

Which test to use and at what cut-off?

- Need short, easy to administer tests for screening
- Only 1 CPG includes cut-off values to identify those who are impaired
  - CDC recommends ≥ 12 seconds on the TUG for risk of falling
  - Cut-offs also suggested for the optional 4-stage balance test and chair-stand test

Centers for Disease Control and Prevention Stopping Elderly Accidents, Deaths and Injuries 2019 https://www.cdc.gov/steadi/

The TUG test



Video available at **https://youtu.be/BA7Y_oLElGY or on https://www.cdc.gov/steadi/**

Evidence for TUG

- Most widely suggested test by CPGs
- Data to support recommended cut-point is limited
  - Based on a single study in which falls were not measured as an outcome[1]
  - A recent systematic review evaluating the predictive validity for falls of the TUG showed inconsistent results[2]

[1]Bischoff et al. Age and Ageing 2003; [2]Park Aging Clin Exp Res 2017

4-Stage Balance Test

- Four standing positions that get progressively harder[1]
  - Feet side-by-side
  - Semi-tandem
  - Tandem
  - Stand on one foot (i.e., single leg stance)
- <10 secs in last 2 positions suggested as a cut-off for risk of falling
- No studies supporting this cut-point

[1] **Winograd JAGS 1994**

Chair Stand Test

SCORING

Chair Stand
Below Average Scores

AGE	MEN	WOMEN
60-64	< 14	< 12
65-69	< 12	< 11
70-74	< 12	< 10
75-79	< 11	< 10
80-84	< 10	< 9
85-89	< 8	< 8
90-94	< 7	< 4

A below average score indicates a risk for falls.

- Participants complete as many chair stands as possible in 30 seconds
- Cut-off based on normative data[1]
- Has not been validated against falls

[1] **Rikli & Jones, Journal of Aging and Physical Activity 1999**

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There is a need for research to determine the best balance test and cut-off value for predicting falls

The Canadian Longitudinal Study on Aging (CLSA) is a potential dataset to look at these issues in a large and random sample of older Canadians

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What is the Canadian Longitudinal Study on Aging (CLSA)?

A research platform – infrastructure to enable state-of-the-art, interdisciplinary population-based *research* and *evidenced-based* decision-making that will lead to better health and quality of life for Canadians.

Canadian Longitudinal Study on Aging (CLSA)

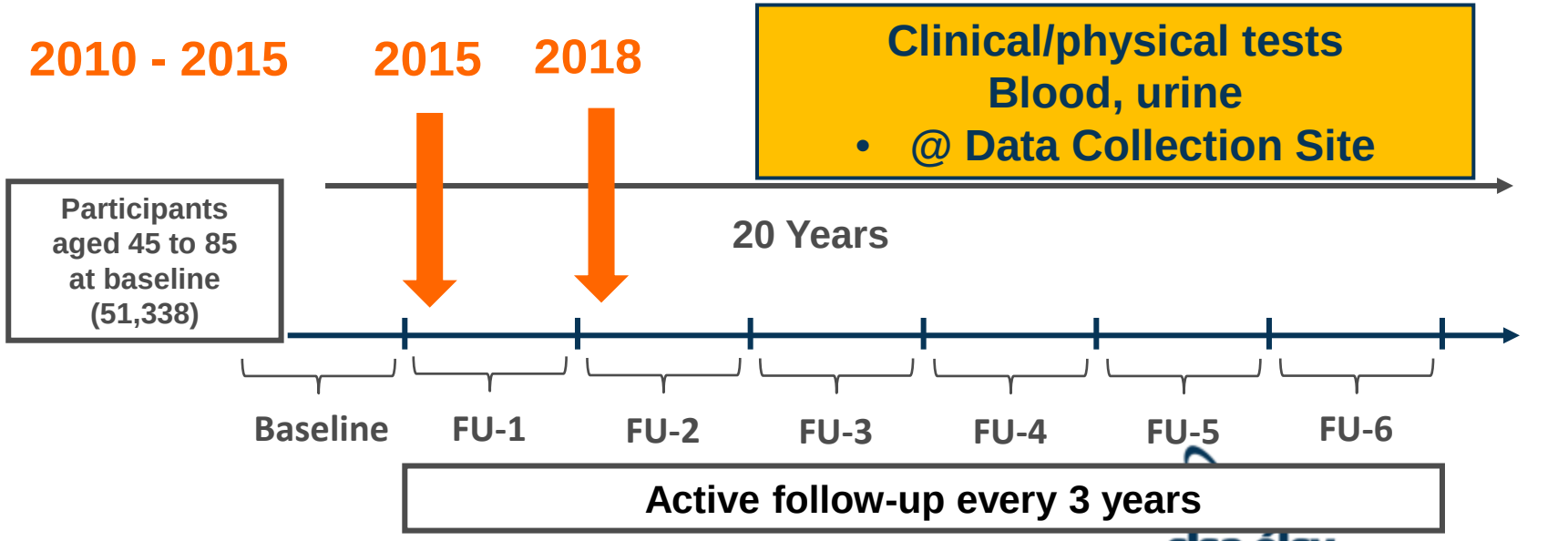
- Strategic initiative of CIHR; on Canadian research agenda since 2001
- More than 160 researchers and collaborators – 26 institutions
- Multidisciplinary – biology, genetics, medicine, psychology, sociology, demography, economics, epidemiology, nutrition, health services, and kinesiology
- Largest research platform of its kind in Canada for breadth and depth
- Following 50,000+ Canadians aged 45-85 at baseline for 20 years

CLSA Research Platform

50,000 women and men aged 45 - 85 at baseline

Target: 20,000 Actual: 21,241 Randomly selected within provinces	Target: 30,000 Actual: 30,097 Randomly selected within 25-50 km of 11 sites

Questionnaire • By telephone (CATI)	Questionnaire • In person, in home (CAPI)



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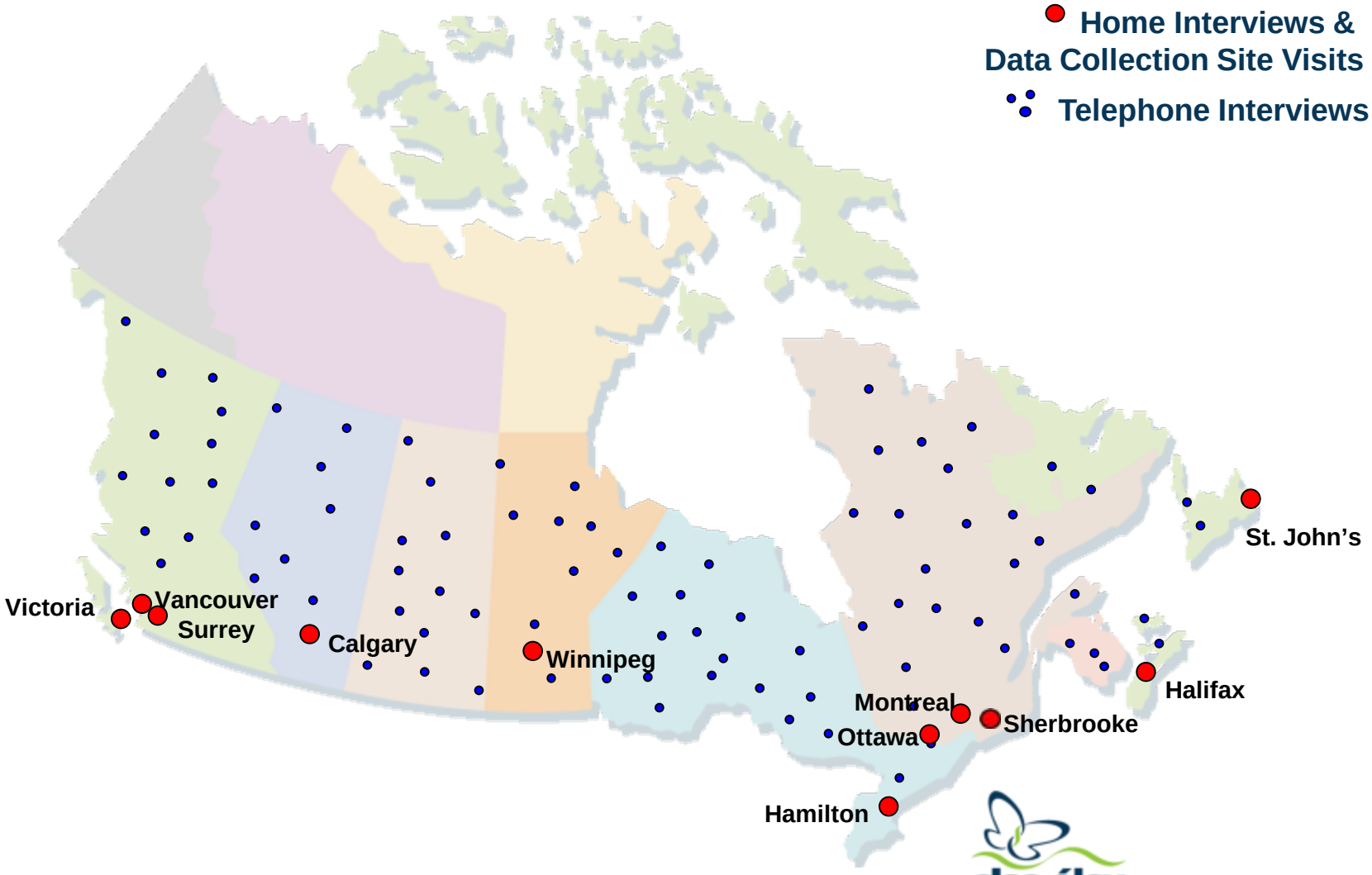
National Scope



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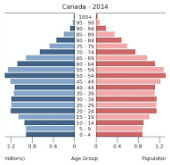
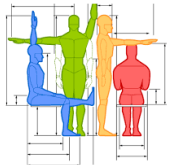
Baseline questionnaires & Physical assessments



Demographic – Education, Ethnicity, Language, Sexual orientation, Marital status, Nutrition, Smoking, Alcohol, HCU, Medication use, …

Health - Disease symptoms, Sleep, Oral health, Injuries, Falls, Mobility, Mental Health, Depression, PTSD, …

Social – Social networks, support, participation, inequality, Online communication, Caregiving & receiving, Labour force participation, Retirement, Transportation, Mobility, Migration, Built environments, …



Basic Measures – Height, Weight, Hip Circumference, Hearing, Vision

Functional Measures - Timed-up-and-go, Standing balance, 4m walk, Chair rise, Grip strength, Neuropsych testing

Physical Measures - Blood pressure, Spirometry, Carotid ultrasound, ECG, DXA, Tonometry, Fundus photography

Biological samples – Blood sample, Urine sample

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Terminology

- **Tracking Cohort**
  - **Target - 20,000 participants from all 10 provinces, followed through Computer-Assisted Telephone Interviews (60 minutes at baseline)**
  - **21,241 recruited***
- **Comprehensive Cohort**
  - **Target - 30,000 participants living within 25 km (or 50 km) of a CLSA Data Collection Site (DCS)**
  - **Followed through in-home interviews (60 minutes) and physical assessments (2-3 hours) at a DCS**
  - **30,097 recruited***

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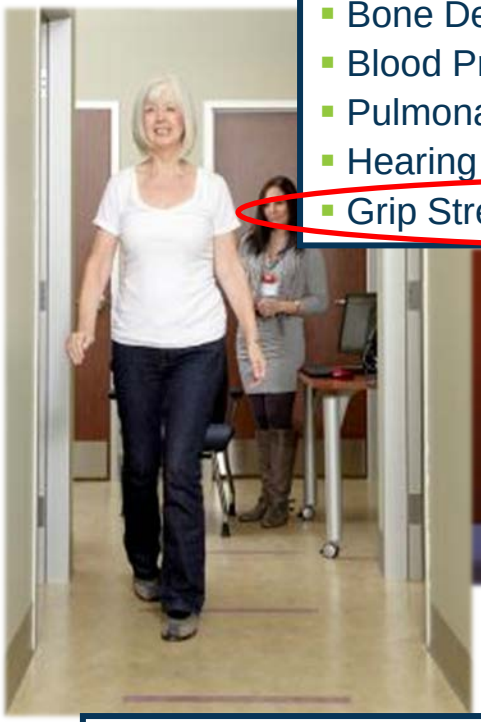
CLSA Data Collection

Data Collection Site

Physical Assessments:

- Height, Weight, Waist-Hip Ratio, BMI
- Bone Density, Body Composition, Aortic Calcification (DXA)
- Blood Pressure, ECG, Carotid Intimal-Medial Thickness
- Pulmonary Function
- Hearing & Vision (Retinal Image, Tonometry, Visual Acuity)
- Grip Strength, TUG, Chair Rise, 4-m Walk, Balance



Biospecimen Collection:

- Blood
- Urine

Cognitive Assessments:

- Neuropsychological Battery
  - Memory
  - Executive Function
  - Reaction Time
  - Prospective Memory

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Baseline Falls Data

- In the last 12 months, have you had any injuries that were serious enough to limit some of your normal activities? For example, a broken bone, a bad cut or burn, a sprain or a poisoning.

- If yes → was the injury caused by a fall?

Baseline Falls Data

- How many falls?
- What was the most serious injury due to a fall?
- Receive medical attention from health professional?
  - If yes → hospitalized? Follow-up care?
- Where did it happen?
- What were you doing when you were injured?

18 Month Falls Data

- In the last 12 months, have you had any falls that were serious enough to limit some of your normal activities? For example, a broken bone, a bad cut or burn, a sprain or a poisoning.

Data Access

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CLSA Data Access

- **Designed as a research study, funded as a research platform**
- **Data available to researchers and trainees based in academic settings and research institutes in Canada and elsewhere**
- **2019 application deadlines:**
  - **June 5**
  - **September 25**

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Data Access Fees

- **Partial Cost Recovery Model**
  - **Alphanumeric data**
    - **$3,000 for a straightforward alphanumeric dataset**
    - **Graduate students using data solely for thesis research & Postdoctoral fellows using data solely for the postdoctoral project are eligible for a fee-waiver. Trainees must be enrolled at a Canadian institution or be supported by Canadian funds if working outside Canada.**
  - **Images & raw data**
    - **Additional fees of $1,000 per application are associated with the request for images & raw data.**

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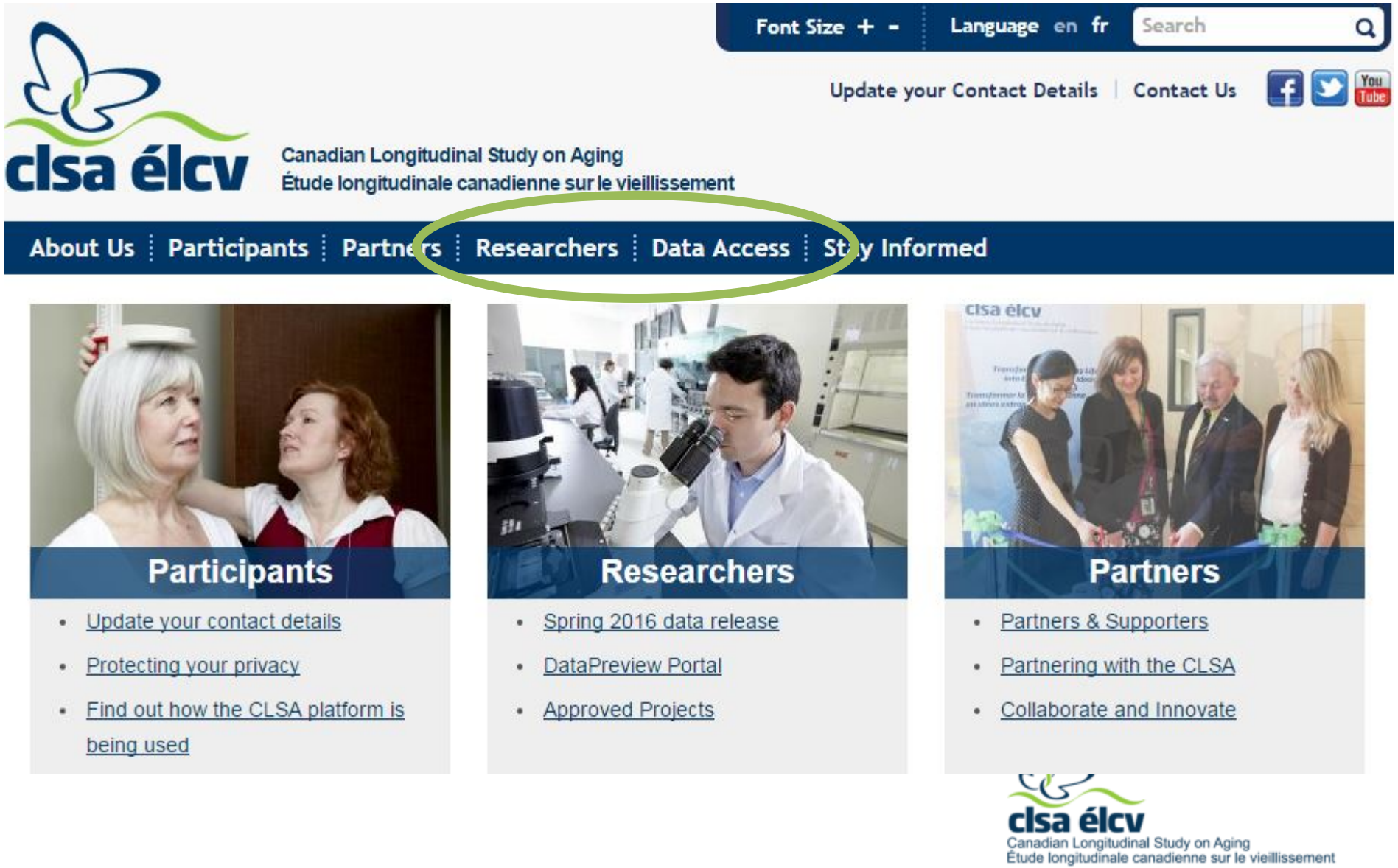
Approved Projects Keywords

Resources: www.clsa-elcv.ca



Addressing evidence gaps in fall risk assessment for older Canadians: preliminary results

Marla Beauchamp, Ayse Kuspinar, Lauren Griffith,
Sohel Nazmul, Jinhui Ma, Parminder Raina

Rationale for our project

- The CLSA includes three of the most commonly used tests for fall risk screening
  - Timed Up and Go
  - Single Leg Stance Test
  - Chair-Rise Test
- All three tests are suggested as possible fall risk screening tests by various CPGs
- Limited data on cut-off values and predictive validity for falls

Objective

- To determine the optimal balance screening test for fall risk assessment in older Canadians

  - 1) determine the accuracy of three commonly used screening tests of balance and mobility for predicting falls in the CLSA;
  - 2) establish cut-off scores on the screening test(s) for identifying fallers in different age and sex strata

Methods

- Analysis of individuals over age of 65 enrolled in the comprehensive cohort of the CLSA
- Primary measures: Timed Up and Go, Single Leg Stance, and Chair Rise Test at baseline.
- Outcome: Falls at 18-months follow-up using data from the Maintaining Contact Questionnaire
- Analysis: Accuracy and cut-off values for fall prediction will be measured by the area under the curve (AUC) of the receiver operating characteristic (ROC) curve for each test in different age and sex strata

Sample characteristics (n=11172)

	Women (n=5575)	Men (n=5597)	Total (n=11172)
Mean no. of chronic conditions			
• 65-74 [mean (SD)]	4.8 (3)	4.1 (2)	4.5 (3)
• 75-85 [mean (SD)]	5.6 (3)	5.0 (2)	5.3 (3)
Education Level (secondary school or less)			
• 65-74 [n (%)]	605 (19)	452 (14)	1057 (17)
• 75-85 [n (%)]	663 (28)	456 (19)	1119 (24)

Sample characteristics (n=11172)

	Women (n=5575)	Men (n=5597)	Total (n=11172)
Depressive symptoms (CES-D≥10)			
• 65-74 [n (%)]	552 (18)	311 (10)	863 (28)
• 75-85 [n (%)]	466 (20)	270 (12)	736 (32)
Vision (fair or poor)			
• 65-74 [n (%)]	241 (8)	246 (8)	487 (16)
• 75-85 [n (%)]	279 (12)	230 (10)	509 (22)

Performance on the TUG at baseline

	Women (n=5575)	Men (n=5597)	Total (n=11172)
TUG			
• 65-74 [mean (SD)]	9.8 (2.3)	9.7 (2.3)	9.7 (2.3)
• 75-85 [mean (SD)]	11.3 (3.6)	11.0 (3.1)	11.1 (3.3)

Falls at baseline

	Women (n=5575)	Men (n=5597)	Total (n=11172)
History of any injurious fall			
• 65-74 [n (%)]	184 (6)	137 (4)	321 (5)
• 75-85 [n (%)]	156 (7)	108 (5)	264 (6)

Falls at 18 months

- Any falls between baseline and 18 month follow-up (maintaining contact questionnaire)

	Women N (%)	Men N (%)	Total N (%)
65-74	419 (13)	289 (9)	708 (11)
75+	339 (14)	276 (12)	615 (13)

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Cut-off values for falls on the TUG

Age	Women		Men	
	Cut-off	**AUC***	**Cut-off**	**AUC***
65-74	11.2 secs	0.61	10.4 secs	0.61
75-85	11.4 secs	0.62	11.9 secs	0.62

*adjusted for education, # chronic condition, depression, cognition, vision, pain and medication

Summary

- These results are preliminary
- CLSA is a high functioning sample, different from a clinical sample
- Nevertheless the data highlight the need for age and sex specific cut-off values
- Consider the need to examine alternate measures for predictive accuracy

Conclusion

- Balance testing is recommended as part of first-level screening for fall risk in community-dwelling older adults
- No consensus on which test to use and at what cut-off value
- TUG is most commonly recommended
  - One cut-off value (e.g., 12 seconds) may not be appropriate across different age and sex groups
- Need for further research to guide balance testing for fall risk screening in older adults

Implications for practice

- For high functioning community-living older adults:
  - TUG ≥ 11 seconds predicts falls in older women
  - TUG ≥ 10 seconds for men 65-74 yrs
  - TUG ≥ 12 seconds for men 75+
- Interpretation of balance scores should be based on a combination of:
  1) Existing research on cut-off values
  2) Clinical observation and judgement

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CANADA FOUNDATION FOR INNOVATION

Contact:

Marla Beauchamp
beaucm1@mcmaster.ca

Ayse Kuspinar
kuspinaa@mcmaster.ca

Lauren Griffith
griffith@mcmaster.ca

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QUESTIONS?