Evaluation of an obstacle course, the *Sherbrooke Functional Evaluation of the Risk of Falls in Elderly* (SFERE): reliability and validity study



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Overview

- Introduction
  - Evaluation of risk of falls: obstacle course
  - SFERE
- Objectives of the study
- Method
  - Population
  - Data collection
- Results
- Discussion
- Conclusion

Introduction

Problematic

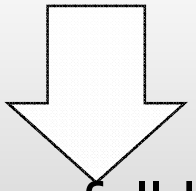
- 1/3 people over 65 years fall at least once each year[1]
- 86% of hospitalizations of people over 65 years old are caused by falls[2]
- Consequences of falls:
  - Hospital and long-term care institutions[3,4];
  - Quality of life diminution[5-8]
  - Economic burden[3]: In Canada, falls over 65 cost 2.5G$ per year[9]
- 1/3 of those falls could potentially be prevented[10]

[1] Word health Organization, 2007; [2] Statistiques Canada; [3] Papaioannou, 2001; [4] Wiktorowicz, 2001; [5] Sawka, 2005; [6] Cranney, 2005; [7] Pasco,2005; [8]Papaioannou, 2009; [9] OMSS, 2005; [10] Campbell, 2002

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Problematic

Reliable and valid tool allowing the identification of fallers



Are not usefull because they:

1) Controlled the environment;
2) Evaluated a single task at a time;
3) Do not mimic the reality of daily living

Introduction

Solution!

A tool representative of daily living including double tasking[1,2]

As an Obstacle Course like is the *Sherbrooke Functional Evaluation of the Risk of Falls in Elderly* (SFERE)

[1] Dubé, 2008; [2] Means , 1998

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Introduction

- Developed by Marcel Rivard, PT[1]
- Total of 10 tasks
  - Activities of daily living including double tasking[1,2]
  - Assessment of the participant's endurance
  - Assessment of the participant's impulsivity
- Score varying from 0 to 3 for each task
- Total score of 30 points
- The times taken to complete the test is 20 minutes

[1] Rivard, 2000

SFERE : COURSE DESCRIPTON

1. Sit to stand transfer from a chair with armrests and 1,83m (6’) walk



2. Move 2 towels using only the foot

3. Open a door, cross the door sill and close the door



4. Walk 1,83m (6’), sit and stand up from a chair without armrests

5. Open a door, cross the door sill and close the door



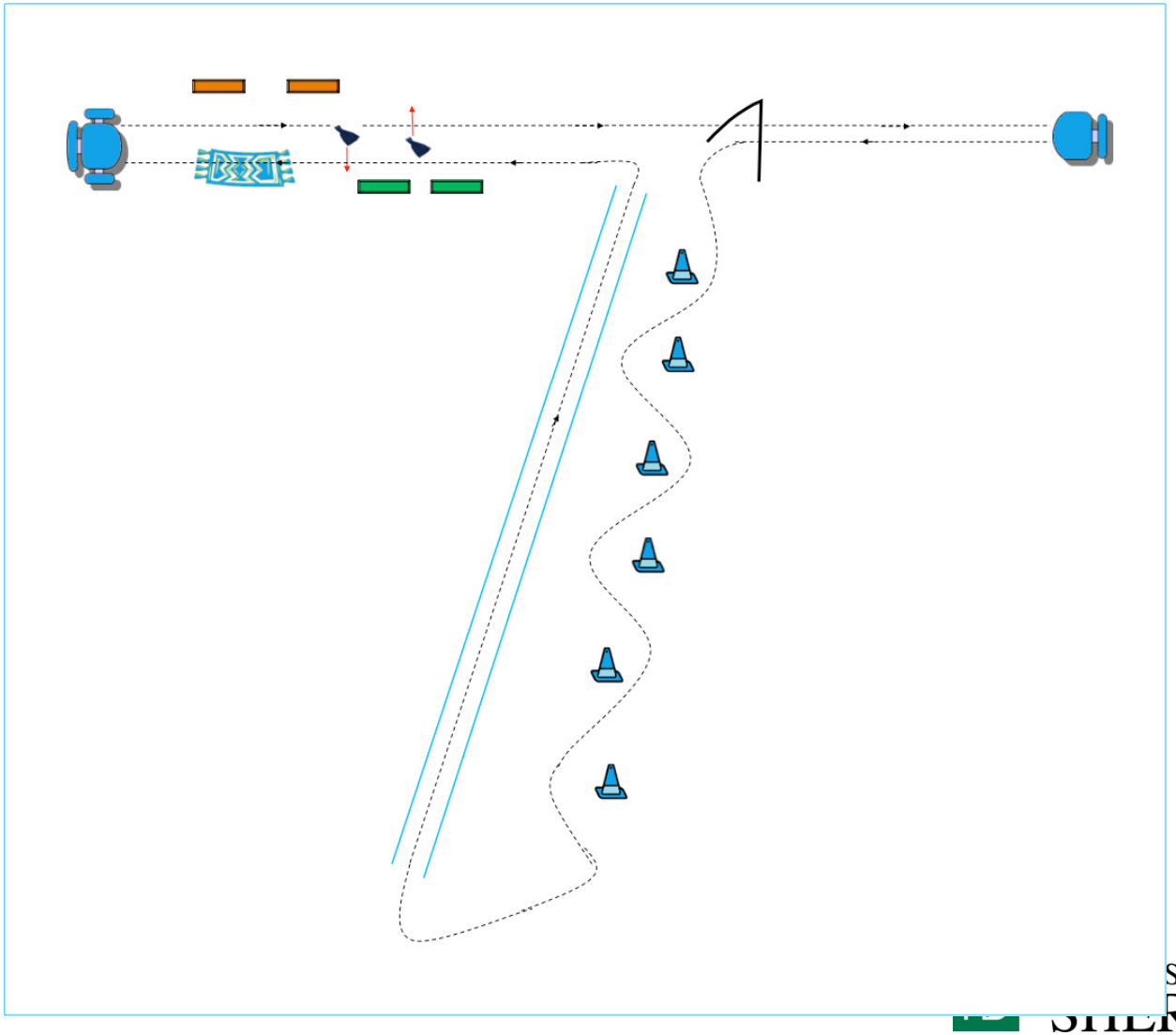
6. Zigzag through 6 obstacles

7. Walk 6,1m (20’) while counting from 20 to 10



8. Walk 4,57m (15’) while identifying 4 visual targets

SFERE: OBSTACLE COURSE



Objectives of the study

1. Estimate the reliability :test-retest and simultaneous inter-rater
   - Intraclass correlation coefficient
   - Cohen Kappa
2. Determine the validity (sensitivity and specificity);

Is the tool adequate to identify fallers?

- Faller: decisional algorithm
- Receiver Operating Characteristic (ROC) curve

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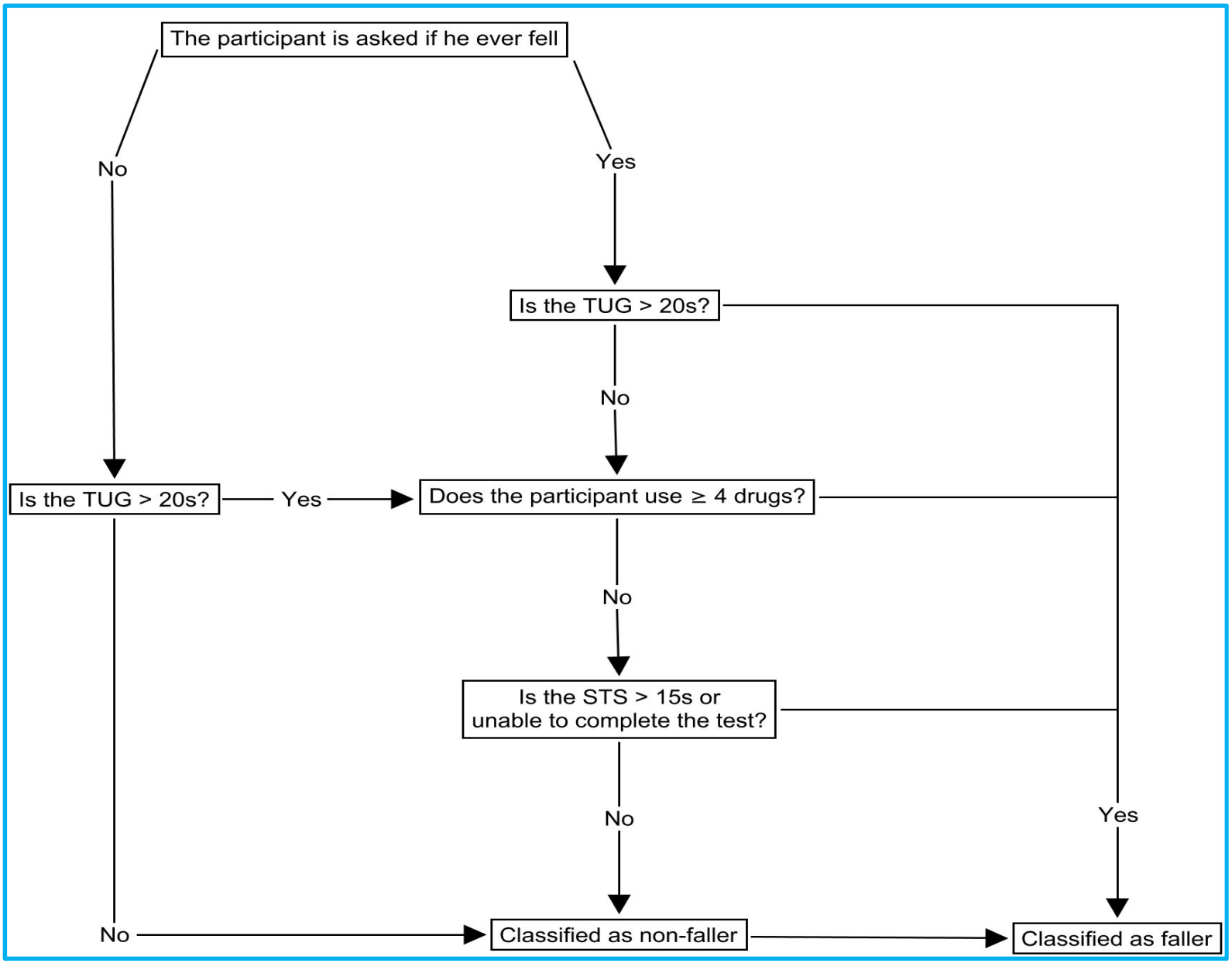
Method

Population

	Reliability study	Validity study
Inclusion criteria:	1) Able to walk with or without walking aids; 2) Able to follow simple instructions; 3) Medically stable; 4) 65 years or older	
Exclusion criteria:	Important comorbidity preventing them from accomplishing the obstacle course	

	Reliability study	Validity study
Data collection	1) Social demographic (questionnaire); 2) Mobility (TUG); 3) Dual tasking (TUG manual); 4) Lower limb strength (Sit to Stand)	
	Interrater and test-retest reliability 1st session: 2 raters/participant; 2nd session (2-5 days later): one rater/participant	Validity: 1 session
Data analysis	Intraclass correlation coefficients (ICC)	▪ Criterion concurrent validity: sensibility and specificity with receiver operating characteristic (ROC) curves for: 1) Total score of the SFERE; 2) Time to complete the SFERE; 3)Time to complete the TUG • Construct convergent validity: Pearson's correlation coefficient Spearman Rho

DECISIONAL ALGORITHM



RESULTS

Population characteristics

	Reliability	Validity
Population	n=41	n=95 (including 45 fallers)
Mean age (years)	72.2	83.7
Sex	35 women	83 women
Mean number of drug taken	5	6

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Results - Reliability

Simultaneous inter-rater

ICC*: 0.90
CI: (0.81- 0.95)**

	Mean ± SD	E1-E2
1st Evaluator (E1)	22.80 ± 4.47	0.76 (p< 0.0001)
2nd Evaluator (E2)	23.56 ± 4.80	

Significant bias
*Wilcoxon test

* Intraclass Correlation Coefficients
** Confidence Interval 95 %

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Results - reliability

Test-retest

ICC*: 0.73
CI: (0.55- 0.85)**

	Result Mean ± SD	E1-E2
Test 1 (E1)	22.80 ± 4.47	-0.98 (p< 0.0001)
Test 2 (E2)	23.78 ± 4.18	

Significant bias:
- Learning phenomenon
- Anxiety diminution

* Intraclass Correlation Coefficients
** Confidence interval 95 %

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Results – Reliability of each item

Tasks	Kappa	CI (95%)
1. Transfer (sit to stand)	0.44	(0.18 - 0.70)
2. Move 2 towels	0.474	(0.24 – 0.71)
3. Cross a door	0.511	(0.27 – 0.75)
4. Transfer in a chair without armrests	0.344	(0.08 – 0.61)
5. Cross a door in reverse	0.565	(0.29 – 0.83)
6. Zigzaging	0.27	(-0.09 – 0.63)
7. Walk while counting	0.119	(-0.21 – 0.45)
8. Walk while looking at something	0.154	(-0.22 – 0.53)
9. Endurance	0.696	(0.48 – 0.91)
10. Comportement	0.396	(0.16 – 0.63)

Results – Convergent Construct Validity

Variables	Instruments	Obstacle course	p value
Balance	BERG	0.536*	<0.0001
	Time up and go (TUG)	-0.331	0.34
	Walking speed	-0.343	0.28
Cognitive	3MS	0.506	0.001
Perceptual	Motor Free Visual Perceptual test (MVPT)	0.256	0.106
Executive functions	Assessment of Motor and processing skills (AMPS)	0.069	0.668
Fear of falling	ABC	0.005	0.976

*Pearson Correlation

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Results - Validity

Sensitivity and specificity

Cut-off	Sensibility	Specificity
SFERE score ≤ 27/30	0.911	0.620
SFERE time ≥ 89,2s	0.911	0.800

Sensitivity and specificity for other screening tools

	Sensibility	Specificity
BERG	0,84	0,78
TUG	0,87	0,87
TUG manual	0,80	0,93
Sit-to-stand	0,67	0,72

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Results - Validity

Criterion concurrent validity

Cut-off	Sensibility	Specificity
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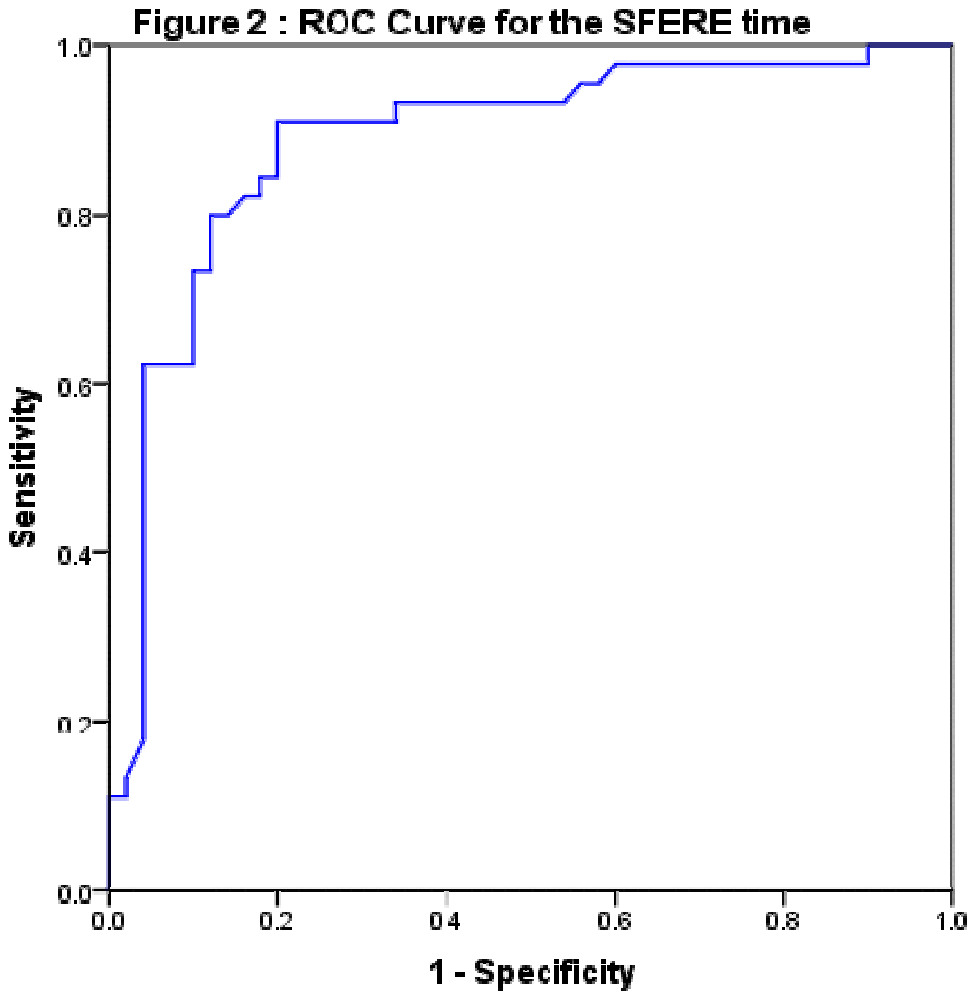
Construct convergent validity

SFERE score and SFERE time	-0,804
SFERE time and TUG time	0,846
SFERE score and TUG time	-0,731

Sensitivity and specificity for screening tools

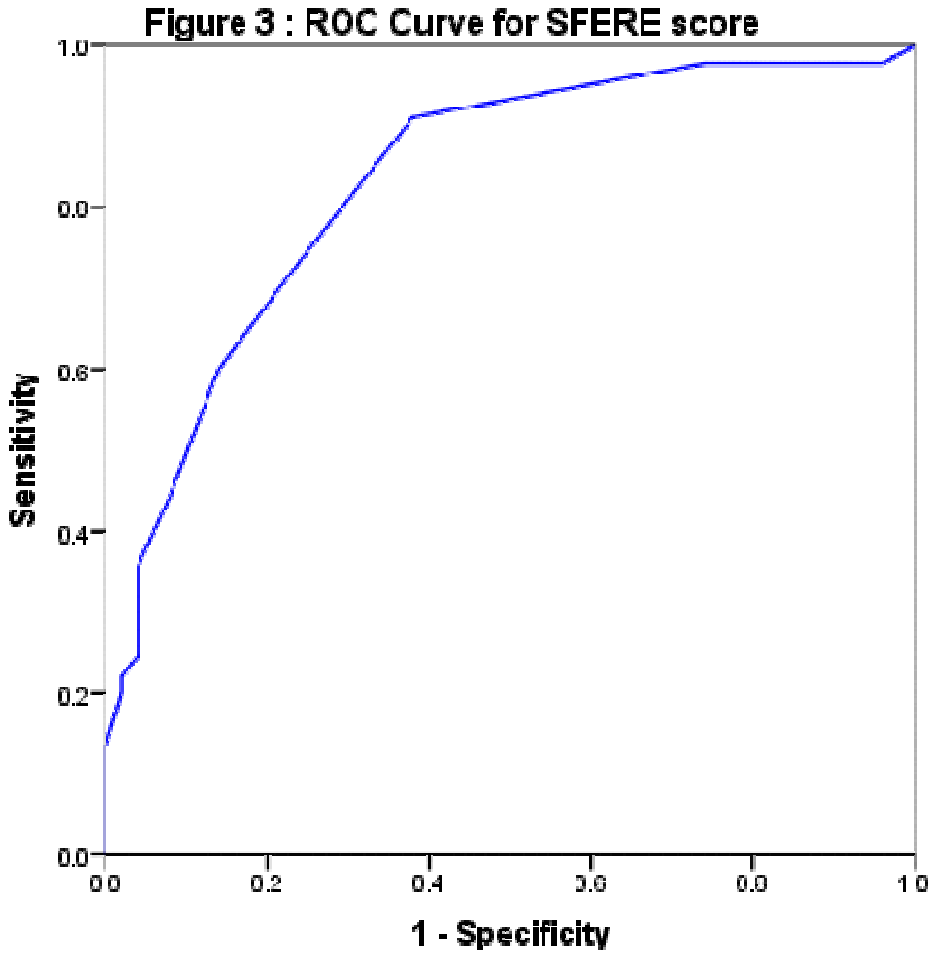
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Results



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Results



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Discussion

- The SFERE have excellent inter-rater reliability (ICC = 0.90) and good test-retest reliability (ICC = 0.73)
  - But the results are influenced by an unequal performance of the participants during a short period.
  - Clinicians must be aware that different factors, such as anxiety and learning, could influence the performance during the obstacle course.
  - The participants must practice at least one before the assessment

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Discussion

- The cut-off of the time variable (89.2s) has values of sensitivity (0.911) and specificity (0.800) that are even better than those of the total score (≤27), sensitivity (0.911) and specificity (0.680).
- An elderly having a score inferior to 89.2 sec is a faller.
- The specificity is good,
  - IT is important that a tool assessing the risk of falls has a good capacity of ruling out a non-faller

Conclusion

- In comparison with traditional instruments, the numerous functional tasks present within the SFERE help health care professionals in developing a plan of treatment and preventive measures, in order to reduce the risk of falls.
  - Guides the interventions related to less successfully tasks
  - Gives recommendations for the safety within the home

Acknowledgement

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Références

- BEAUCHET, O., DUBOST, V., NEVERS, A., STIERLAM, F., A BLANCHON, M., MOUREY, F., PFITZENMEYER, P. and GONTHIER, R., 2002. Development of a clinical test of gait in frail elderly by a cognitive approach of locomotion. *Annales de readaptation et de medecine physique : revue scientifique de la Societe francaise de reeducation fonctionnelle de readaptation et de medecine physique,* **45**(3), pp. 123-130.
- BONGUE, B., DUPRE, C., BEAUCHET, O., ROSSAT, A., FANTINO, B. and COLVEZ, A., 2011. A screening tool with five risk factors was developed for fall-risk prediction in community-dwelling elderly. *Journal of clinical epidemiology,* **64**(10), pp. 1152-1160.
- CHAIWANICHSIRI, D., JANCHAI, S. and TANTISIRIWAT, N., 2009. Foot disorders and falls in older persons. *Gerontology,* **55**(3), pp. 296-302.
- COLLÈGE NATIOANAL DES ENSEIGNANTS DE GÉRIATRIE., 2010-last update, Corpus de Gériatrie. Available: http://www.longuevieetautonomie.fr/index.php?option=com_content&view=article&id=47&Itemid=53 [07/12, 2012].
- DUBE, F., ROUSSEAU, J., KAEGI, C., BOUDREAULT, R. and NADEAU, S., 2008. Development of a Walking-Safety Scale for Older Adults, Part II: Interrater and Test-Retest Agreement of the GEM Scale. *Physiotherapy Canada.Physiotherapie Canada,* **60**(3), pp. 274-282.
- EGGERMONT, L.H., PENNINX, B.W., JONES, R.N. and LEVEILLE, S.G., 2012. Depressive symptoms, chronic pain, and falls in older community-dwelling adults: the MOBILIZE Boston Study. *Journal of the American Geriatrics Society,* **60**(2), pp. 230-237.
- GAXATTE, C., NGUYEN, T., CHOURABI, F., SALLERON, J., PARDESSUS, V., DELABRIERE, I., THEVENON, A. and PUISIEUX, F., 2011. Fear of falling as seen in the Multidisciplinary falls consultation. *Annals of physical and rehabilitation medicine,* **54**(4), pp. 248-258.
- JEANDEL, C., 1998. Les chutes du sujet âgé. *Soins gérontologique,* (12),.
- KAEGI, C., BOUDREAULT, R., ROUSSEAU, J., BOURBONNAIS, D., NADEAU, S. and DUBE, F., 2008. Development of a Walking Safety Scale for Older Adults, Part I: Content Validity of the GEM Scale. *Physiotherapy Canada.Physiotherapie Canada,* **60**(3), pp. 264-273.
- KOJIMA, T., AKISHITA, M., NAKAMURA, T., NOMURA, K., OGAWA, S., IIJIMA, K., ETO, M. and OUCHI, Y., 2012. Polypharmacy as a risk for fall occurrence in geriatric outpatients. *Geriatrics & gerontology international,* **12**(3), pp. 425-430.
- LORD, S.R., MENZ, H.B. and SHERRINGTON, C., 2006. Home environment risk factors for falls in older people and the efficacy of home modifications. *Age and Ageing,* **35 Suppl 2**, pp. ii55-ii59.

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References

- MEANS, K.M., RODELL, D.E. and O'SULLIVAN, P.S., 1998. Obstacle course performance and risk of falling in community-dwelling elderly persons. *Archives of Physical Medicine and Rehabilitation,* **79**(12), pp. 1570-1576.
- MEANS, K.M., RODELL, D.E. and O'SULLIVAN, P.S., 1996. Use of an obstacle course to assess balance and mobility in the elderly. A validation study. *American Journal of Physical Medicine & Rehabilitation / Association of Academic Physiatrists,* **75**(2), pp. 88-95.
- MORRIS, R., HARWOOD, R.H., BAKER, R., SAHOTA, O., ARMSTRONG, S. and MASUD, T., 2007. A comparison of different balance tests in the prediction of falls in older women with vertebral fractures: a cohort study. *Age and Ageing,* **36**(1), pp. 78-83.
- MYERS, H. and NIKOLETTI, S., 2003. Fall risk assessment: a prospective investigation of nurses' clinical judgement and risk assessment tools in predicting patient falls. *International journal of nursing practice,* **9**(3), pp. 158-165.
- NEULS, P.D., CLARK, T.L., VAN HEUKLON, N.C., PROCTOR, J.E., KILKER, B.J., BIEBER, M.E., DONLAN, A.V., CARR-JULES, S.A., NEIDEL, W.H. and NEWTON, R.A., 2011. Usefulness of the Berg Balance Scale to predict falls in the elderly. *Journal of geriatric physical therapy (2001),* **34**(1), pp. 3-10.
- NORDIN, E., LINDELOF, N., ROSENDAHL, E., JENSEN, J. and LUNDIN-OLSSON, L., 2008. Prognostic validity of the Timed Up-and-Go test, a modified Get-Up-and-Go test, staff's global judgement and fall history in evaluating fall risk in residential care facilities. *Age and Ageing,* **37**(4), pp. 442-448.
- RUBENSTEIN, L.Z., JOSEPHSON, K.R., TRUEBLOOD, P.R., YEUNG, K., HARKER, J.O. and ROBBINS, A.S., 1997. The reliability and validity of an obstacle course as a measure of gait and balance in older adults. *Aging (Milan, Italy),* **9**(1-2), pp. 127-135.
- SIBLEY, K.M., STRAUS, S.E., INNESS, E.L., SALBACH, N.M. and JAGLAL, S.B., 2011. Balance assessment practices and use of standardized balance measures among Ontario physical therapists. *Physical therapy,* **91**(11), pp. 1583-1591.
- THRANE, G., JOAKIMSEN, R.M. and THORNQUIST, E., 2007. The association between timed up and go test and history of falls: the Tromso study. *BMC geriatrics,* **7**, pp. 1.
- TINETTI, M.E., WILLIAMS, T.F. and MAYEWSKI, R., 1986. Fall risk index for elderly patients based on number of chronic disabilities. *The American Journal of Medicine,* **80**(3), pp. 429-434.
- TODD C, S.D., 2004-last update, What are the main risk factors for falls among older people and what are the most
effective interventions to prevent these falls?. Available: http://www.euro.who.int/document/E82552.pdf [07/12, 2012].
- WALKER, P.C., ALRAWI, A., MITCHELL, J.F., REGAL, R.E. and KHANDERIA, U., 2005. Medication use as a risk factor for falls among hospitalized elderly patients. *American Journal of Health-System Pharmacy : AJHP : Official Journal of the American Society of Health-System Pharmacists,* **62**(23), pp. 2495-2499.

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Results - Validity

Clinical variables

	Mean ± SD	Standard deviation
SFERE score (/30)	26 ± 0	3
SFERE time (s)	126.8 ± 6.0	58.9
TUG (s)	19.6 ± 1.2	11.5
TUG manual (s)	15.1 ± 1.0	4.7
STS (s)	27.01 ± 1.77	17.2