

# The Combination of Cognitive Function Test Score and Japanese Fall Risk Index Effectively Identifies the Fall-prone Older Inpatients

Saori Harada, MD, MPH.

Koji Shibasaki, Akiko Sampei, Yuya Yoshioka, Mitsutaka Yakabe, Akihiko Yonenaga, Koichi Toyoshima, Taro Kojima, Masaki Ishii, Yumi Kameyama, Yasuhiro Yamaguchi, Tomohiko Urano, Sumito Ogawa and Masahiro Akishita.  
The University of Tokyo, Japan



# CONFLICT OF INTEREST DISCLOSURE

I have no potential conflict of interest to report.

# Background – Falls in older age

- **Falls are the second leading cause of accidental or unintentional injury deaths worldwide.**
- **Adults older than 65 years of age** suffer the greatest number of **fatal** falls.  
e.g. **Hip fracture**, traumatic **brain** injury, **spinal cord** injury
- Falls may also result in a **post-fall syndrome** that includes **dependence**, **loss of autonomy**, **confusion**, **immobilization** and **depression**, leading to a further restriction in daily activities.



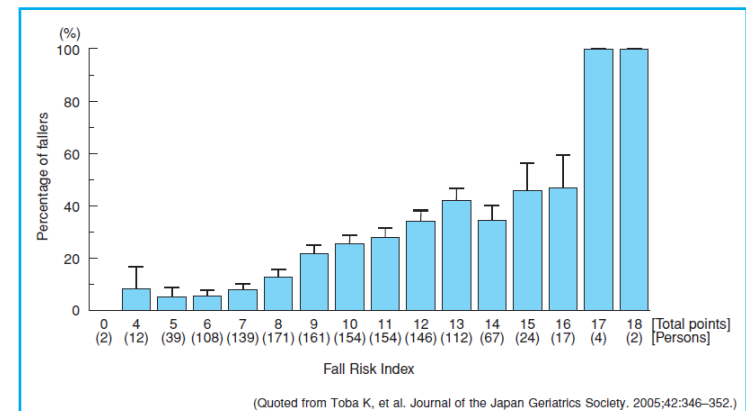
WHO Global Report on  
Falls Prevention in Older Age

# Japanese Fall Risk Index

- 1) *History of falls in the past 12 months*
- 2) Stumble sometimes
- 3) Cannot go up or down the stairs without handrails
- 4) Decreased walking speed
- 5) Cannot cross a road while the traffic light is green
- 6) Cannot walk 1km without a break
- 7) Cannot stand on one foot for 5 sec (eyes open)
- 8) Cane user
- 9) Cannot squeeze a towel tightly
- 10) Dizziness or Staggering
- 11) Bent back
- 12) Pain in knees
- 13) Visual disturbance
- 14) Hearing problem
- 15) Forgetfulness
- 16) Fear of falling
- 17) 5 or more medicines every day
- 18) Feel the house is dim while walking at home
- 19) Obstacles inside the house when walking
- 20) Level differences on the house floor
- 21) Have to use stairs daily
- 22) Have to walk on steep slope around home



Japanese Fall Prevention Guideline,  
Kenji Toba et al. 2012



Simple screening test for risk of falls in the elderly. Okochi J, Toba K, Takahashi T et al. Geriatr Gerontol Int 2006;6:223-227.

“Fall Risk Index” helps clinicians identify high-risk individuals JMAJ 52(4): 237-242, 2009.

# Cognitive function test

- Poor cognitive function is known to be related with higher fall risk.
- Carey E. Gleason et al found the prospective rate of any falls over 12 months increased by 20% for each point decrease in **Mini Mental State Exam (MMSE)** among 172 community-dwelling older adults.

## Study Aim

To identify the more high-risk fall-prone population among the geriatric inpatients, by the combination of Cognitive function test and Japanese Fall Risk Index.

# Patients and Methods

- We utilized the geriatric ward database of 253 inpatients in the University of Tokyo Hospital, discharged from April 2016 to March 2017.
- Patients were mainly admitted for cognitive impairment or treatment against illnesses such as pneumonia, diabetes mellitus and heart failure.
- Database records patients' characteristics, a history of falls in the past 1 year, Fall Risk Index and MMSE.
- Logistic regressions and Receiver Operating Characteristic (ROC) curves were evaluated using SPSS software. Outcome was the fall history in the past 12 months.

# Baseline characteristics

Characteristics	Geriatric Ward Database (N=253)
Age, years	82.7±6.7 (min 52, max97)
Sex, N (%)	
Men	111 (43.9%)
Women	142 (56.1%)
Skeletal Muscle Mass Index (SMI), kg/m <sup>2</sup>	6.7±1.8
Body Mass Index, kg/m <sup>2</sup>	22.1±4.5
Walking speed, m/s	0.94±0.35
Specific Activity Scale, METs	4.0±1.9 (min0, max8)
Geriatric Depression Scale (/15)	6.3±3.9 (min0, max15)
Vital Index (/10)	8.6±2.0 (min0, max10)
Living alone, N(%)	135 (53.4%)
Comorbidities, N (%)	
Hypertension	137 (54.6%)
Diabetes mellitus	67 (26.5%)
Dyslipidemia	114 (45.1%)
Cerebrovascular diseases	202 (81.1%)
Cardiovascular diseases	227 (91.2%)
Sarcopenia	72 (61.5%)
Fall Risk Index (/21)	11±4 (min0, max20)
MMSE (/30)	
23 and more, N (%)	103 (53.9%)
less than 23, N (%)	88 (46.1%)
Fall in the past year, N (%)	77 (46.7%)
Hospitalization, days	20.2±16.0 (min1, max 115)



# Results

Logistic regression:

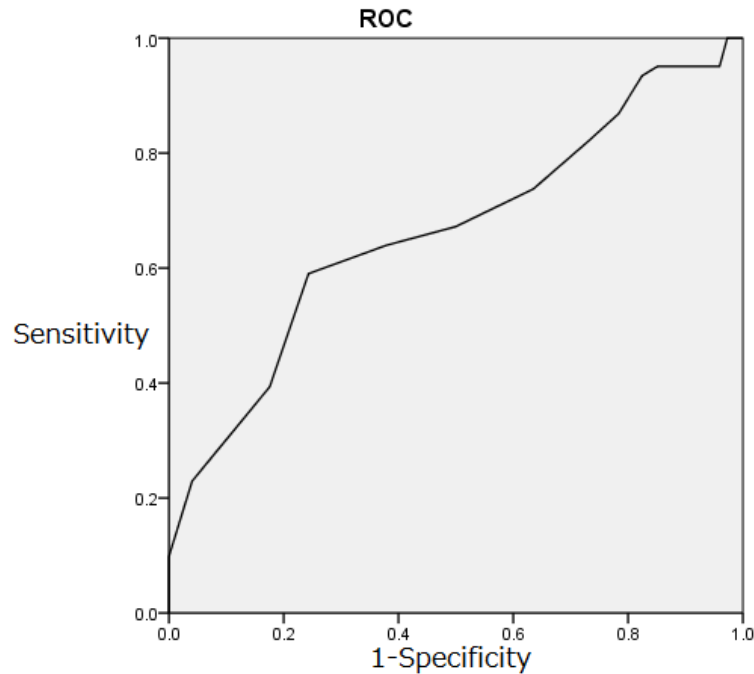
Variables	OR [95% CI]	p
Age	1.054 [0.972-1.143]	0.205
Sex	2.398 [0.910-6.323]	0.077
SMI	1.055 [0.956-1.164]	1.055
Fall Risk Index (/21)	1.156 [1.018-1.312]	0.025
MMSE (/30)	2.788 [1.067-7.194]	0.036

Sex: The reference group is women.

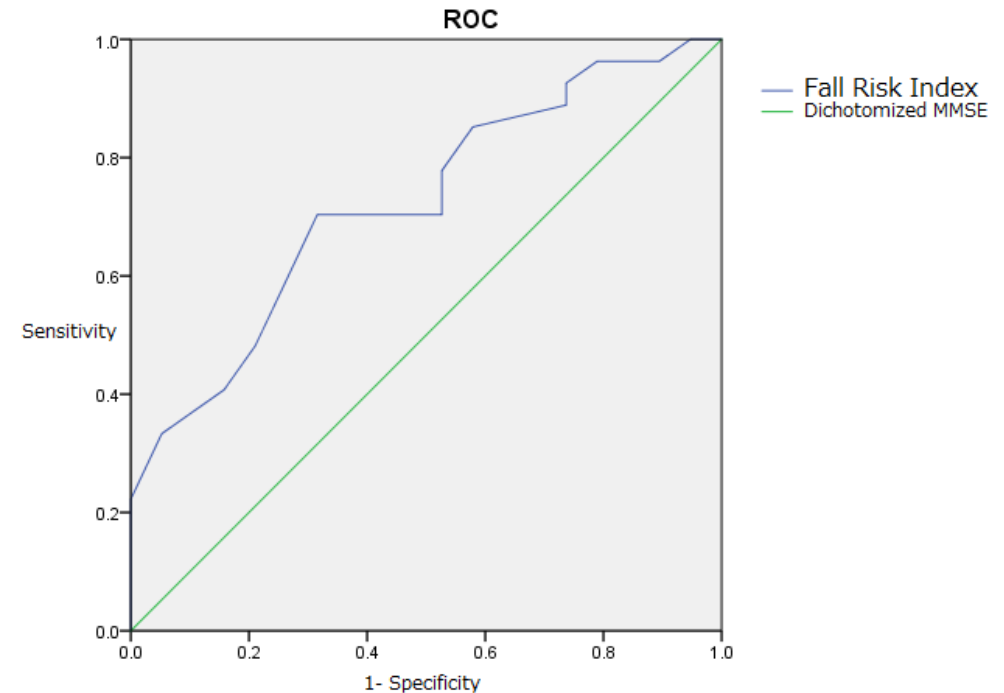
MMSE: Dichotomized at the cutoff points of 23/30.

The reference group is patients with 24 or more MMSE scores.

# Results



Fall Risk Index (continuous)  
for the whole population  
AUC: 0.664 [0.571, 0.758]  $p=0.001$



Fall Risk Index (continuous)  
for the population with 23 or less MMSE  
AUC: 0.723 [0.577, 0.869]  $p=0.011$

# Conclusions

In our patient group,

- Both the **higher Fall Risk Index** and the cognitive impairment with **lower MMSE score** showed significantly higher fall odds ratios.
  - When we applied the **Fall Risk Index** evaluation to the cognitively impaired population with **lower MMSE score**, the area under the ROC curve got larger, meaning the test got higher accuracy.
- >>We suggest for the inpatients, using both the **Fall Risk Index (FRI)** and **MMSE** can identify more high-risk fall-prone patients.

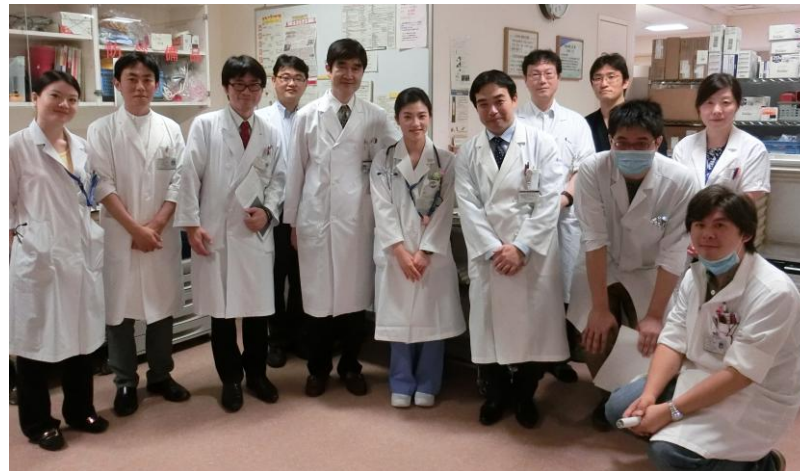
# Strength and Limitations

- Detailed records of comprehensive geriatric assessment.
- Missing numbers in each variable.
- The weight of each risk factor may vary among different populations.
- Our study's target is sicker patients with many comorbidities.

# Acknowledgement



Department of Geriatric Medicine,  
The University of Tokyo Hospital  
Professor Masahiro Akishita  
Dr. Koji Shibasaki



Travel grant from  
**The Japan Foundation for Aging and Health**