EDITORIAL

Journal of Cachexia, Sarcopenia and Muscle 2019; **10**: 953–955
Published online 13 August 2019 in Wiley Online Library (wileyonlinelibrary.com) **DOI:** 10.1002/jcsm.12476

Prevalence, incidence, and clinical impact of cognitive–motoric risk syndrome in Europe, USA, and Japan: facts and numbers update 2019

Marcello Maggio[1,2]* and Fulvio Lauretani[1,2]

[1]*Geriatric Clinic Unit, Medicine and Geriatric-Rehabilitation Department, and Department of Medicine and Surgery, University of Parma, University Hospital of Parma, Parma, Italy,* [2]*Cognitive and Motor Center, Medicine and Geriatric-Rehabilitation Department of Parma, University Hospital of Parma, Parma, Italy*

Abstract

A new syndrome called the 'motoric–cognitive risk' (MCR) syndrome has recently been proposed in older persons. According to this definition, the parallel impairment in muscle and brain function is more predictive for identifying subjects at risk of dementia than impairment a in single system alone. Epidemiological studies suggest that among older persons, enrolled in worldwide population-based studies, 10% are affected by this syndrome, which confers a higher risk of future disability. In detail, the prevalence of MCR in Europe is around 8.0%, 7.0% in the United States, and 6.3% in Japan. The incidence of the MCR syndrome is estimated to be 65.2 per 1000 person years in adults aged 60 years or older. Many studies reported negative outcomes of the syndrome in older persons, emphasizing its clinical impact. In particular, in almost all longitudinal studies, MCR produces a three-time increased risk of future dementia. In Europe, data from the InCHIANTI study report an increased risk of 2.74 [1.54–4.86], which is 2.49 [1.52–4.10] in the United States and 3.27 [1.55–6.90] in Japan. The studies in different continents are also consistent in showing an increased risk of all-cause mortality, which is 1.50–1.87 in the Europeans and 1.69 [1.08–2.02] for incident disability in Japan. For the identification of the MCR syndrome, different tests and procedures have been proposed, with a final 'core-battery' that includes gait speed, dual-task gait speed, the Montreal Cognitive Assessment and Trail Making Test A and B. The criteria used to select this core-battery were based on the best accuracy for identifying older persons at risk of negative outcomes such as dementia, falls, aging-related disabilities, and sensitivity to interventions. The selection of these tests will allow to start studies aimed to better capture older persons at higher risk of mobility and cognitive disability. By these tests, it will be possible to better evaluate the effect of treatment composing of tailored physical exercise, nutritional suggestions, and medical therapy to overturn negative effect of both cognitive and motoric frailty. This article provides an overview of the current knowledge of the MCR syndrome.

Keywords Cognitive–motoric risk syndrome; Older persons; Facts and numbers

**Correspondence to: Marcello Maggio, MD, PhD, Geriatric Clinic, Department of Medicine and Surgery, University of Parma, University Hospital of Parma, Via Antonio Gramsci 14, Parma 43126, Italy. Email: marcellogiuseppemaggio@unipr.it*

Older people will be a huge proportion of all population worldwide, with expected increased risk of cognitive and motoric frailty.[1] Historically, cognition and mobility deficits are usually separately evaluated in younger persons. However, in older persons, because of their frequent simultaneous and parallel presence, the administration of comprehensive geriatric assessment composed of both cognitive and motoric tests can often sensitively detect physical and cognitive frailty.[2]

In the 2013, Verghese *et al*. proposed a new syndrome the 'motoric–cognitive risk' (MCR) syndrome. The authors used data from the Einstein Aging Study,[3] a prospective cohort study aimed to identify risk factors for dementia. In this study, usual pace walking speed was assessed by the GAITRite

system, a computerized walkway with embedded pressure sensors, while cognition was evaluated by a neuropsychological test battery validated in older persons, and final definition of cognitive impairment was established by the Clinical Dementia Rating scale. Prevalence of this syndrome is almost 10% of older persons, enrolled in worldwide population-based study, and this huge amount of cognitive and motoric frail older persons should be clearly evaluated for avoiding future disability (*Table* 1). In details, the prevalence of MCR in Europe is around 8.0%, 7.0% in USA,[4] and 6.3% in Japan.[5] The incidence of the MCR syndrome is estimated to be 65.2 per 1000 person years in adult aged >60 years. Many studies reported negative outcomes of the syndrome in older persons, emphasizing its clinical impact.[6] In particular, in almost all longitudinal studies, MCR produces a three-time increased risk of future dementia. In Europe, data from the InCHIANTI study report an increased risk of 2.74 [1.54–4.86],[7] which is 3.27 [1.55–6.90][3]in the United States according to the Einstein Aging Study[3] and 2.49 [1.52–4.10] in Japan based on the NCGGSGS study.[5] The studies of different continents are also consistent in showing an increased risk of all-cause mortality, which is 1.50 [1.04–2.16] in the European SHARE study,[4] 1.87 [1.54–2.28] in the HRS study,[4] and 1.69 [1.08–2.02] increased risk for incident disability in Japan according to the NCGGSGS study.[5]

After the proposed definition of the syndrome made its entrance in the literature in 2013, 31 papers including this definition were published with a total amount of more than 200 citations during the time period ranging from 2013 (January 1st) to 2019 (April 10th).

This condition has been studied and validated in many worldwide population-based studies of older persons, including 26 802 adults without dementia and motoric disability aged 60 years and older from 22 cohorts of 17 countries.[7] Of note, procedures and tests used for the definition of MCR syndrome were different among studies. However, milestones of this syndrome were the simultaneous presence of motoric and cognitive impairment in older persons, free of established criteria of neurodegenerative diseases. In details, motoric dysfunction was established by using objectives tests, such as instrumented walkway (GAITRite), 4 m timed walk and 6 meter timed walk, while cognitive impairment was ascertained by using self-report cognitive questionnaire, part of the Geriatric Depression Scale and part of the WHO Disability Scale.[7]

By considering this common approach of capturing cognitive and motoric frailty in older persons, our group has identified in the *T.R.I.P study*, a study aimed to identify risk factors of falling in older outpatients setting, 114 of 263 (43%) showed both low muscle strength and cognitive impairment and almost all participants (91%) had balance deficit, defined as an inability to maintain *tandem position* (one foot in front of the other) for at least 10 s.[8]

Even in the '*Gait and Brain study*',[9] conducted in 252 older adults free of dementia at baseline, the authors showed that those subjects displaying the combination of reduced walking speed and cognitive impairment (n = 65, 26%) had the highest risk for progression to dementia (HR: 35.9, 95% CI: 4.0–319.2; P = 0.001, incident rate: 130/1000 person years).

To overcome the difficulty of selecting different procedures, recently, the Canadian Consortium on Neurodegeneration in Aging proposed a 'Minimum-battery' of tests to identify persons at risk of cognitive and motoric frailty.[10] In details, from 17 tests appraised, 10 tests fulfilled pre-specified criteria and were selected as part of the 'core-battery' (*Table* 2). The final selection included gait speed, dual-task gait speed, the Montreal Cognitive Assessment and Trail Making Test A and B. This combination captures shared characteristics of mobility and cognition observed during aging process and neurodegeneration and is able to identify older persons at risk of negative outcomes such as dementia, falls, and aging-related disabilities.

Future studies should be perspectival performed with the specific plan to identify the relationship and potential common mechanisms underlying cognitive impairment and muscle dysfunction.[11,12]

Table 2 Proposed 'Minimum-battery' of tests to identify older persons with cognitive–motoric risk syndrome

Mobility tests	Cognitive tests
Gait speed (usual pace)	MoCA
Dual task (speed)	Trail Making Test A and B

MoCA, Montreal Cognitive Assessment.

Table 1 Prevalence, incidence, and clinical impact of the motoric–cognitive risk syndrome (MCRS) in Europe, USA, and Japan

Country or/and name of the study	Prevalence of the MCRS	Incidence of the MCRS	Incident dementia	Mortality/disability risk
Europe, SHARE study/InCHIANTI study	8.0%, 319/3977	65.2 per 1000 person years in adults aged >60 years	2.74 [1.54–4.86], 0.001	1.50 [1.04–2.16], P = 0.030
USA, HRS study/EAS study	7.0%, 142/2025		3.27 [1.55–6.90], $P < 0.001$	1.87 [1.54–2.28], $P < 0.001$
Japan, NCGGSGS study	6.3%, 265/4235		2.49 [1.52–4.10], $P < 0.001$	1.69 [1.08–2.02], $P < 0.001$

EAS, Einstein Aging Study; HRS, Health and Retirement Study; NCGGSGS study, National Center for Geriatrics and Gerontology Study of Geriatric Syndrome; SHARE study: Survey of Health, Ageing and Retirement in Europe.

DOI: 10.1002/jcsm.12476

Acknowledgement

The authors of this manuscript certify that they comply with the ethical guidelines for authorship and publishing in the Journal of Cachexia, Sarcopenia, and Muscle.[13]

Conflict of interest

None declared.

References

1. Lauretani F, Ticinesi A, Meschi T, Teresi G, Ceda GP, Maggio M. Randomized controlled trials for Alzheimer disease and Parkinson disease. *Front Biosci (Elite Ed)* 2016;**8**:378–389.
2. Lauretani F, Meschi T, Ticinesi A, Maggio M. "Brain-muscle loop" in the fragility of older persons: from pathophysiology to new organizing models. *Aging Clin Exp Res* 2017;**29**:1305–1311.
3. Verghese J, Wang C, Lipton RB, Holtzer R. Motoric cognitive risk syndrome and the risk of dementia. *J Gerontol A Biol Sci Med Sci* 2013;**68**:412–418.
4. Ayers E, Verghese J. Motoric cognitive risk syndrome and risk of mortality in older adults. *Alzheimers Dement* 2016;**12**:556–564.
5. Doi T, Shimada H, Makizako H, Tsutsumimoto K, Verghese J, Suzuki T. Motoric cognitive risk syndrome: association with incident dementia and disability. *J Alzheimers Dis* 2017;**59**:77–84.
6. Chhetri JK, Chan P, Vellas B, Cesari M. Motoric cognitive risk syndrome: predictor of dementia and age-related negative outcomes. *Front Med (Lausanne)* 2017;**4**:166.
7. Verghese J, Annweiler C, Ayers E, Barzilai N, Beauchet O, Bennett DA, et al. Motoric cognitive risk syndrome: multicountry prevalence and dementia risk. *Neurology* 2014;**83**:718–726.
8. Lauretani F, Maggio M, Ticinesi A, Tana C, Prati B, Gionti L, et al. Muscle weakness, cognitive impairment and their interaction on altered balance in elderly outpatients: results from the TRIP observational study. *Clin Interv Aging* 2018;**13**:1437–1443.
9. Montero-Odasso MM, Barnes B, Speechley M, Muir Hunter SW, Doherty TJ, Duque G, et al. Disentangling cognitive-frailty: results from the gait and brain study. *J Gerontol A Biol Sci Med Sci* 2016;**71**:1476–1482.
10. Montero-Odasso M, Almeida QJ, Bherer L, Burhan AM, Camicioli R, Doyon J, et al. Canadian Gait and Cognition Network. Consensus on shared measures of mobility and cognition: from the Canadian Consortium on Neurodegeneration in Aging (CCNA). *J Gerontol A Biol Sci Med Sci* 2019;**74**:897–909. (2 citations)
11. van Kan GA, Cesari M, Gillette-Guyonnet S, Dupuy C, Vellas B, Rolland Y. Association of a 7-year percent change in fat mass and muscle mass with subsequent cognitive dysfunction: the EPIDOS-Toulouse cohort. *J Cachexia Sarcopenia Muscle* 2013;**4**:225–229.
12. Kohara K, Okada Y, Ochi M, Ohara M, Nagai T, Tabara Y, et al. Muscle mass decline, arterial stiffness, white matter hyperintensity, and cognitive impairment: Japan Shimanami Health Promoting Program study. *J Cachexia Sarcopenia Muscle* 2017;**8**:557–566.
13. von Haehling S, Morley JE, Coats AJS, Anker SD. Ethical guidelines for publishing in the Journal of Cachexia, Sarcopenia and Muscle: update 2017. *J Cachexia Sarcopenia Muscle* 2017;**8**:1081–1083.